Frequency of Recurrent CT Examinations among Patients with High Cumulative Dose and/or Number of CT Examinations

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Purpose

• With the help of dose management software:
  • What are some cumulative effective doses patients with multiple CT studies are exposed to?
  • Does high number of CT examinations result in highest cumulative dose?
  • Patients’ demographics – What procedures result in high cumulative doses?
  • Opportunities to reduce dose?
  • Flag potentially redundant CT scans?

Introduction

• Motivations behind the study:
  • Based on AAPM position statement on radiation from medical imaging procedure: Possible risks from cumulative effective doses of above 100 mSv
    • What are typical cumulative doses for patients with multiple CT studies?
    • Are they above 100 mSv?
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  • The Joint Commission Diagnostic Imaging Requirements
Introduction

A 12. For organizations that provide diagnostic computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), or nuclear medicine (NM) services: The organization considers the patient’s age and recent imaging exams when deciding on the most appropriate type of imaging exam.

Note 1: Knowledge of a patient’s recent imaging exams can help to prevent unnecessary duplication of these examinations.
Methods

- Query UCLA CT dose database from Jan 2015 to Jan 2016
- Sort patients using a threshold of 100 mSv cumulative effective dose
  - Further sort patients using # of CT examinations
- Collect patient imaging history for
  - Top 10 patients in the “highest cumulative effective dose” category
  - Top 10 patients in the “highest number of examinations” category

Methods

- Imaging histories of top 20 patients were reviewed and investigated by 3 radiologists for:
  - Appropriateness of recurrent studies
  - Potential opportunities for reducing # of exams and dose
- Timed review process
Results

• A total of 34672 patients from Jan 2015 to Jan 2016
• 927 (2.7%) were identified with a cumulative effective dose of 100 mSv and above, from which 1/3 were trauma patients
• Top 10 highest cumulative effective dose: 376 to 842 mSv
  • Predominantly patients with IR/ablative procedures
  • 842 mSv – patient with 2 DX scans and 9 interventional ablative CT guided procedures

Results

• Top 10 highest # of CT examinations: 25 to 56 exams
  • Predominantly head trauma patients
  • 56 exams – 17 year old head trauma patient (deceased)
• 442 total reviewed individual CT scans
  • One possible CT scan that could have been avoided
    • scan was performed to assess liver transplant to look for flow and could have possibly been done with ultrasound as per reviewing radiologist
  • Review process of an average of 20 min per patient
Results

• There was no overlap between patients from each category,
• Top five most frequently performed examinations in a year
  • Abdomen/Pelvis w/ contrast
  • Chest w/ contrast
  • Oncology chest w/ contrast and Abd/Pel w/o contrast
  • Brain w/ contrast
  • Chest w/o contrast

Conclusion

• Cumulative doses can be surprisingly high
  • Academic medical center performing complex, unusual interventional procedures
  • #1 trauma center in the area
• Most exams appear to be warranted and necessary
  • Limited number of patients were reviewed as compared to the number of patients received cumulative effective doses of above 100 mSv
Conclusion

• Patients with highest dose and highest # of exams are not necessarily the ones who are getting needless scans
  • The most critically ill patients
    • Trauma patients – cannot be evaluated with physical exam due to intubation and sedation
    • Cancer patients – advanced stage cancers, requiring periodic restaging CT studies or ablation studies to improve quality of life

Lessons Learned

• Track doses – without data, can't see the problems
• Appropriateness of procedure/ Mortality morbidity review
  • Good documentation necessary to determine appropriateness

• Protocol modification… and protocol adherence
Lessons Learned

• Who determines exam necessity?
  • Referring physician?
  • Radiologist?
• Review Implementation?
  • Requires cross-disciplinary discussion and participation
  • Participants’ roles
    • Referring physician
    • Radiologists
    • Physicists
    • Administration?

Future Studies

• Focus on specific patient cohorts…
  • ED and oncologic patients – dose a priority in light of critical illness?
  • Peds
  • ED patients with minor injuries
  • Interventional patients
Thank you!
Questions…?

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