RSNA Press Release

MRI Technique Differentiates Benign Breast Lesions from Malignancies

Released: February 20, 2018

At A Glance

- An MRI imaging technique may reduce unnecessary breast biopsies in women with BI-RADS 4 lesions.
- Diffusion kurtosis imaging combined with a radiomics model allows radiologists to distinguish benign from malignant breast lesions with high sensitivity.
- This advanced MRI technique requires no contrast agent.

download full-size photo

Sebastian Bickelhaupt, M.D.

OAK BROOK, Ill. — An MRI breast imaging technique that requires no contrast agent, combined with sophisticated data analysis, could reduce the number of unnecessary breast biopsies, according to a new study appearing online in the journal *Radiology*.

Breast MRI currently is used to screen women at high risk of breast cancer and as a diagnostic adjunct to mammography. The examination relies on gadolinium-based contrast agents that need to be injected intravenously.

Researchers recently studied an alternative approach that eliminates the need for contrast agents in some cases by using diffusion-weighted imaging (DWI) measurements derived from MRI. The technique, known as diffusion kurtosis imaging, provides a picture of breast tissue on a microstructural level.

"Diffusion kurtosis imaging has been introduced in DWI to provide important information on tissue structures at a microscopic level," said study lead author Sebastian Bickelhaupt, M.D., from the German Cancer Research Center in Heidelberg, Germany. "Since malignant lesions disrupt the tissue structures at this level, diffusion kurtosis might serve as a relevant marker of changes."

download full-size photo

Paul Jaeger, M.Sc.

Dr. Bickelhaupt, co-lead author Paul Jaeger, M.Sc., and colleagues evaluated a retrospective analysis of data collected from 222 women at two independent study sites. The women had suspicious findings on mammography that were classified under the Breast Imaging Reporting and Data System (BI-RADS) as BI-RADS 4 and 5 breast lesions. A BI-RADS 4 lesion is considered a suspicious abnormality, while a 5 is considered highly suspicious of malignancy. The women underwent DWI followed by biopsy.

For the analysis, a software algorithm was developed for lesion characterization, and imaging features were extracted using a kurtosis-based radiomics model. Radiomics is a rapidly growing field that enables the extraction of a large amount of quantifiable data from images.

In an independent test set of 127 women, the radiomics analysis reduced false-positive findings by 70 percent, while detecting 60 of 61 malignant lesions, or 98 percent.

"The model might help to lower the number of BI-RADS 4 lesions suspected of being cancer on the basis of screening mammography while retaining a high sensitivity similar to the sensitivity reported for biopsies themselves," Jaeger said.

Should the results hold in larger trials, the model has potential advantages in the clinic beyond its ability to reduce unnecessary biopsies in women with BI-RADS 4 lesions. The software algorithm makes the assessment reader-independent, ensuring that its accuracy is maintained across different imaging facilities.

The new approach is not intended to replace current contrast-enhanced breast MRI protocols in general, Dr. Bickelhaupt emphasized, but to expand the spectrum of options available for answering specific clinical questions.

"This might also improve the efficiency of reporting," he said.

"Radiomics Based on Adapted Diffusion Kurtosis Imaging Helps to Clarify Most Mammographic Findings Suspicious for Cancer." Collaborating with Dr. Bickelhaupt and Jaeger were Frederik Bernd Laun, Prof. Dr., Wolfgang Lederer, M.D., Heidi Daniel, M.D., Tristan Anselm Kuder, Dr. rer nat, Lorenz Wuesthof, Daniel Paech, M.D., David Bonekamp, M.D., Alexander Radbruch, M.D., Stefan Delorme, Prof. Dr., Heinz-Peter Schlemmer, Prof. Dr., Franziska Steudle, and Klaus H. Maier-Hein, Ph.D.

Radiology is edited by David A. Bluemke, M.D., Ph.D., University of Wisconsin School of Medicine and Public Health, Madison, Wis., and owned and published by the Radiological Society of North America, Inc. (*http://radiology.rsna.org/*)

RSNA is an association of over 54,200 radiologists, radiation oncologists, medical physicists and related scientists, promoting excellence in patient care and health care delivery through education, research and technologic innovation. The Society is based in Oak Brook, Ill. (*RSNA.org*)

For patient-friendly information on breast MRI, visit *RadiologyInfo.org*.

Images (JPG, TIF):

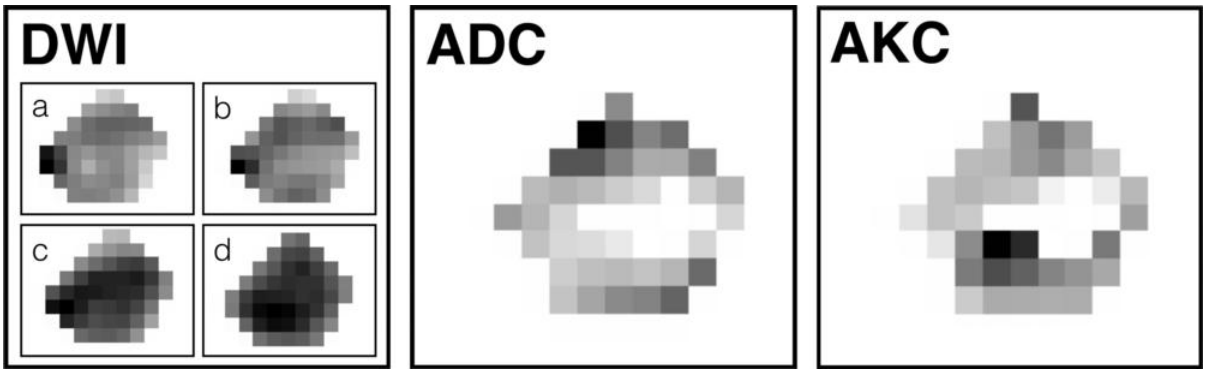


Figure 1. Two-dimensional sections of a three-dimensional acquisition of images of a malignant tumor. Diffusion weighted imaging (DWI) with b values of (a) 0, (b) 100, (c) 750, and (d) 1500 sec/mm^2. Apparent diffusion coefficient (ADC) map and apparent kurtosis coefficient (AKC) map show the resulting pixel values after Kurtosis fitting. Notably, white pixels inside lesion constitute background after exclusion for not matching the fit criteria.

High-res (TIF) version

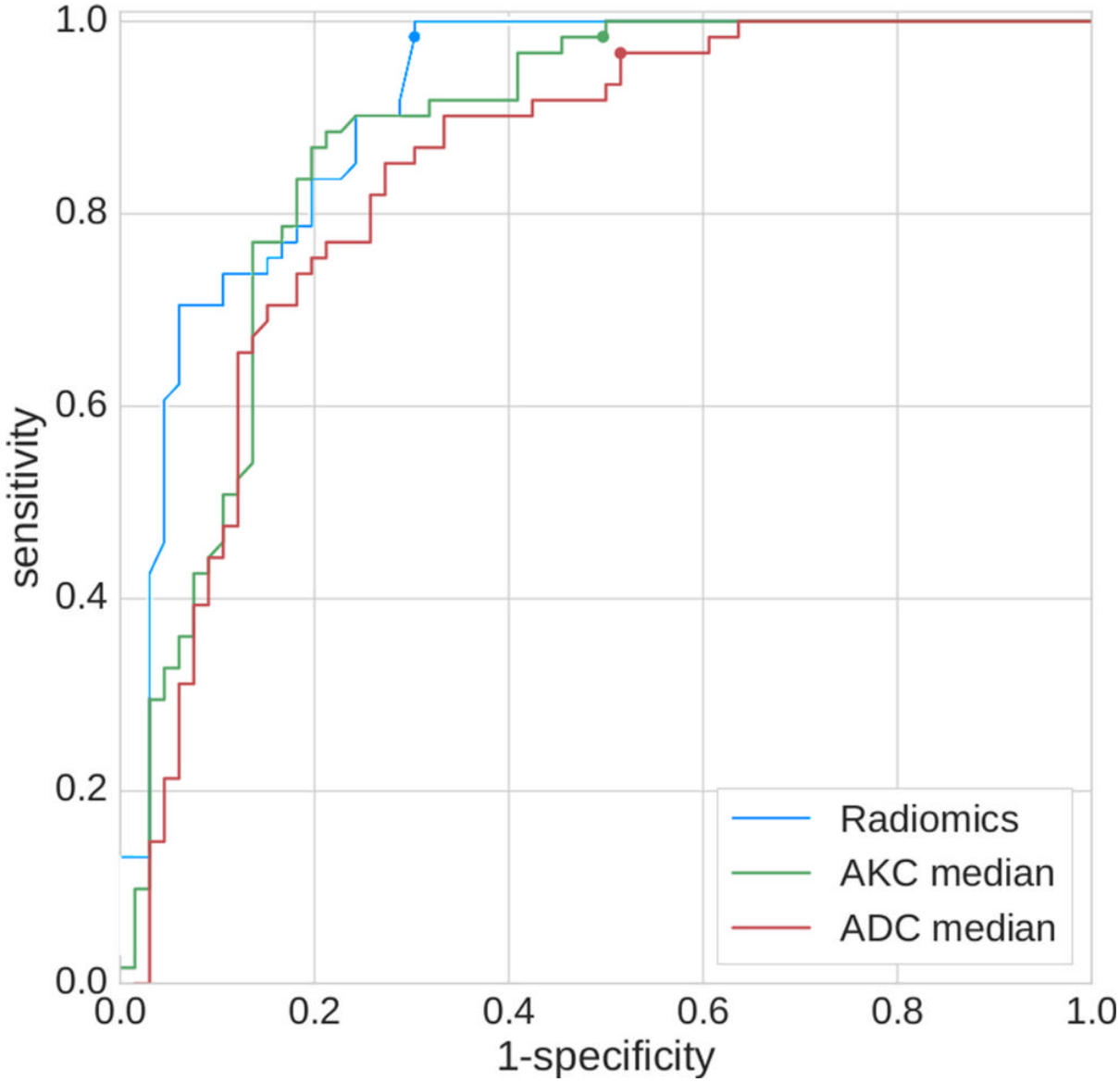
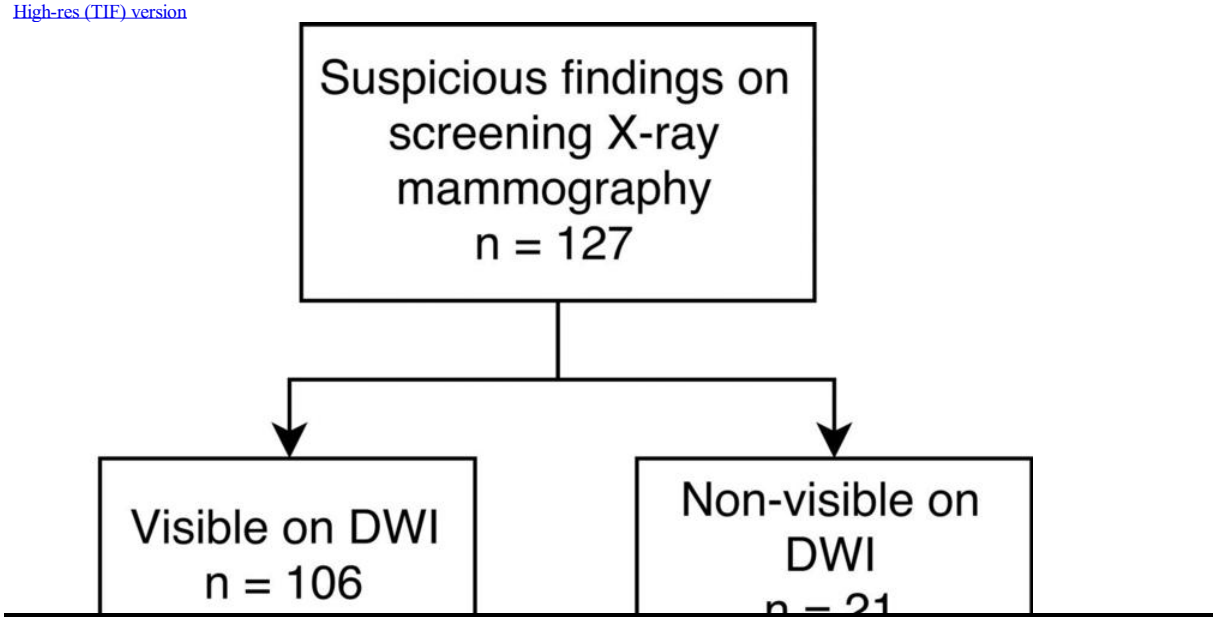


Figure 2. Receiver operating characteristic plot for the radiomics model, apparent kurtosis coefficient (AKC) median and apparent diffusion coefficient (ADC) median. Dots illustrate the resulting thresholds.

High-res (TIF) version



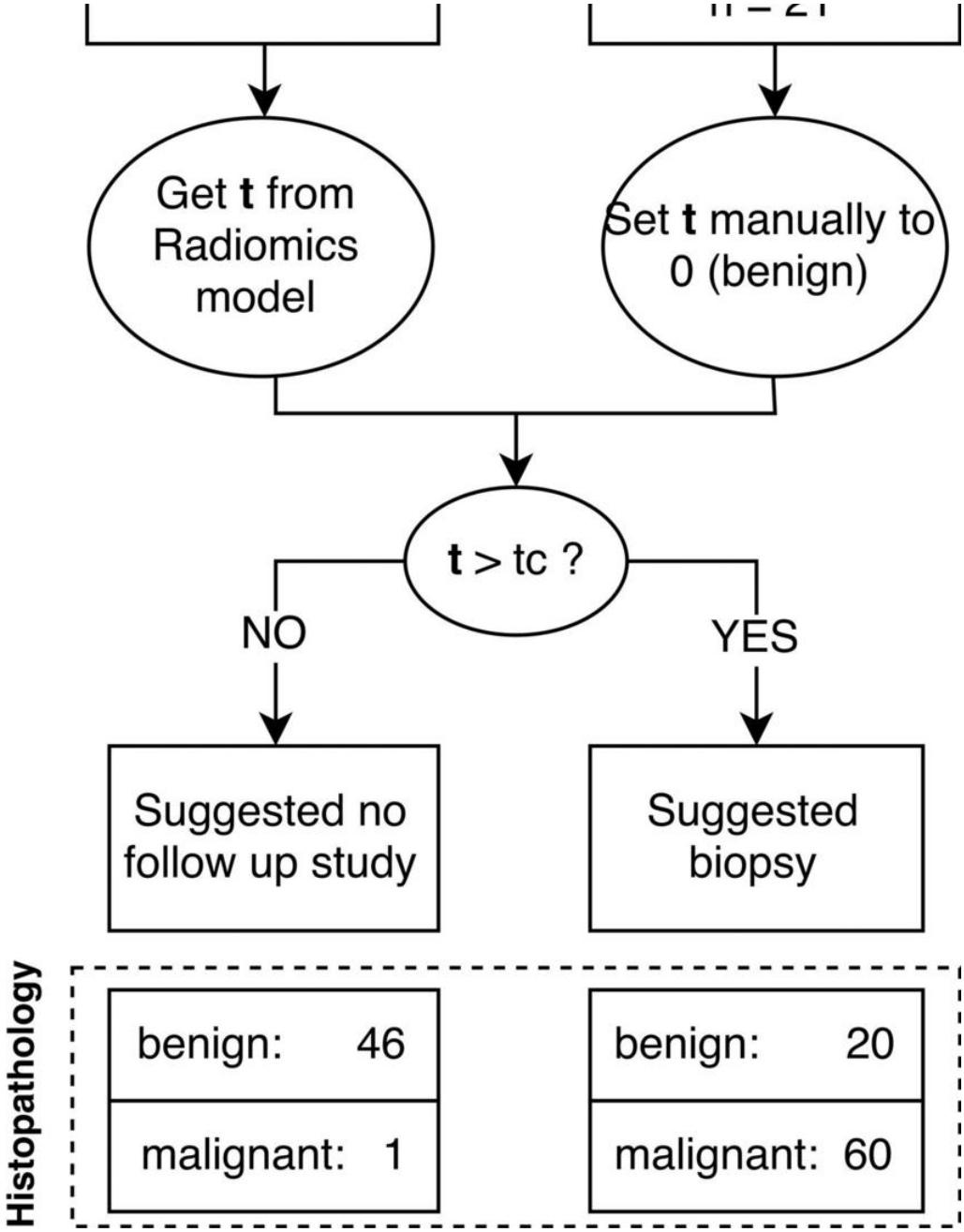


Figure 3. Flow diagram shows patient selection in the independent test set. DWI = Diffusion weighted imaging, t = result of the threshold calculation; tc = cut-off threshold to differentiate between benign and malignant lesions.

High-res (TIF) version

Resources:

Study abstract