Impact of Breast Density on Enhanced Computer-Aided Detection for Breast Cancer

Rachel F Brem, MD, Jeffrey W Hoffmeister, MD, MSEE Jocelyn A Rapelyea, MD, Jason Knapp, MSEE, Steven W Worrell, MSEE

Primary contact for abstract/poster:
Rachel F. Brem, MD email: rbrem@mfa.gwu.edu
Director, Breast Imaging and Interventional Center phone: 202-741-3031
Professor of Radiology fax: 202-741-3029
Vice Chair, Research and Faculty Development administrative ass't: 202-741-3003
The George Washington University Medical Center 2150 Pennsylvania Avenue; Washington, DC 20037

NCBC Poster/Abstract Category II – Clinical Care, Treatments and Processing
Subcategory A. Radiology; 3. Breast Radiology

Purpose
To evaluate performance enhancements of a computer-aided detection (CAD) system in detecting breast cancer and the impact of breast density.

Methods and Materials
Eight hundred ninety-nine sequential mammographically detected breast cancers and 147 normal screening mammograms from 18 facilities were classified by mammographic density. Breast Imaging Reporting and Data System (BI-RADS®) 1 and 2 density cases were classified as nondense breasts; BI-RADS 3 and 4 density cases were classified as dense breasts. Cancers were classified as either masses or microcalcifications. All mammograms from cancer and normal cases were evaluated by an enhanced CAD system (iCAD SecondLook®, version 6.0) and a prior CAD system (iCAD SecondLook®, version 4.0). Sensitivity and false-positive rate of both CAD systems in dense and nondense breasts were evaluated and compared.

Results
Overall, 809 (90%) of 899 cancer cases were detected by the enhanced CAD system; 459/501 (92%) cancers in nondense breasts and 350/398 (88%) cancers in dense breasts were detected. CAD sensitivity was not affected by breast density (p=0.07). The prior CAD system detected 90% (807/899) overall, with 91% (454/501) and 89% (353/398) in nondense and dense breasts (p=0.34). False-positive rate was 2.0 marks per normal case with enhanced CAD and 3.0 per case with prior CAD. Prior CAD had more false-positive marks on dense versus nondense mammograms (p=0.04); false-positive rate of enhanced CAD was not affected by breast density (p=0.23). There was no difference in enhanced CAD detection of microcalcifications in nondense (111/121, 92%) and dense breasts (160/170, 94%) (p=0.43); prior CAD detected 94% (114/121) and 97% (165/170) in nondense and dense breasts (p=0.23). Sensitivity of enhanced CAD to masses was affected by breast density, with detection of 348 (92%) of 380 masses in nondense breasts and 190 (83%) of 228 masses in dense breasts (p=0.002); prior CAD detected 89% (340/380) and 82% (188/228) in nondense and dense breasts (p=0.01).

Conclusions
The impact of breast density on the sensitivity of enhanced and prior CAD systems remains similar – breast density does not impact overall CAD detection of breast cancer; however, the detection of breast cancer manifesting as masses is impacted by breast density. Enhanced CAD maintains an overall 90% sensitivity, with a 30% reduction in false-positive rate that is not affected by breast density. CAD may be particularly advantageous in patients with dense breasts, in which mammography is most challenging.