



SecondLook Digital

Performance of a Computer-Aided Detection System Applied to Full-Field Digital Mammography (FFDM) According to Breast Density

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Purpose

Although mammography remains the mainstay for breast cancer screening, it is an imperfect examination with a sensitivity of 85-90% for breast cancer. Computer - aided detection (CAD) has been developed to improve mammographic detection of breast cancer. CAD systems for full-field digital mammography (FFDM) are now commercially available and they have high breast cancer sensitivity in retrospective published studies.

A significant factor limiting the sensitivity of mammography is increased breast density. Analysis of characteristics of cancers missed on screening mammography show that greater breast density is associated with missed breast cancers. Therefore, additional methods to improve the detection, particularly in mammographically dense breasts, are needed.

The aim of this study is to **evaluate the performance of a computer-aided detection (CAD) system applied to full-field digital mammography (FFDM) for the detection of breast cancer based on breast density.**

Materials and Methods

CANCER PATIENTS

We selected **151 women** (mean age , 52 years; range, 30-83 years) with **151** histologically proven **nonpalpable breast cancers** originating from the Cantabria Screening Mammography Program (n=106) and the Marques de Valdecilla University Hospital (n= 45) from January 2005 to July 2008. All cases were retrospectively evaluated using **CAD** (SecondLook, version 7.2, iCAD, Inc.) with FFDM (Senographe 2000D, GE Healthcare), and had visible mammographic signs of malignancy on both craniocaudal (CC) and mediolateral oblique (MLO) views.

All mammograms were evaluated for **breast density** and assigned a BI-RADS breast density score of 1 through 4. Mammograms with BI-RADS 1 density (entirely fat) or BI-RADS 2 density (scattered fibroglandular tissue) were categorized as non-dense. Mammograms with BI-RADS 3 density (heterogeneously dense) or BI-RADS 4 density (extremely dense) were categorized as dense.

ANALYSIS OF MAMMOGRAMS BY THE CAD SYSTEM

CAD system marks are ellipses and rectangles highlighting potential areas of concern overlaid on the digital images. The ellipses mark potential masses (nodule, architectural distortion or asymmetric density), and the rectangles mark potential microcalcification clusters.

The locations of CAD marks that correspond to mammographically detected and histologically confirmed cancerous lesions were analyzed to determine whether the CAD system had correctly marked the lesions. The cases were considered **true positive** if, on at least one view, the CAD mark correctly identified the corresponding mammographic lesion location. In addition, the type of mark had to agree with the mammographic characteristic of the lesion. If both mass and microcalcification features were noted (mixed lesion), either mark type was considered correct and each component was considered separately.

The **sensitivity** of the CAD system was calculated as the number of lesions correctly marked divided by the total number of lesions. We analyzed global sensitivity and **sensitivity for masses** (including nodules, asymmetries and distortions) **and microcalcifications according to the breast glandular composition**.

Results

CAD **sensitivity** in **non-dense breast group** (BI-RADS 1 and 2) was **94.8%** (109/115) and in **dense breast group** (BI-RADS 3 and 4) was **88.9%** (32/36). This difference was not significant ($p=0.3$).

The sensitivity values of the CAD system for detection of microcalcifications, nodules, asymmetric densities and distortions in non-dense breast group were 98% (50/51), 93% (51/55), 89% (8/9) and 90% (9/10), respectively, and the CAD sensitivity values in dense breast group were 100% (17/17), 85% (11/13) and 78% (7/9), respectively (in this breast group there were no asymmetric density cases). Therefore, CAD **sensitivity for detection of nodules and distortions was higher in non-dense breasts than in dense breasts**, and this difference was significant ($p<0.008$). **Sensitivity for mixed lesions** (mass with microcalcifications) was **100%** in the two groups.

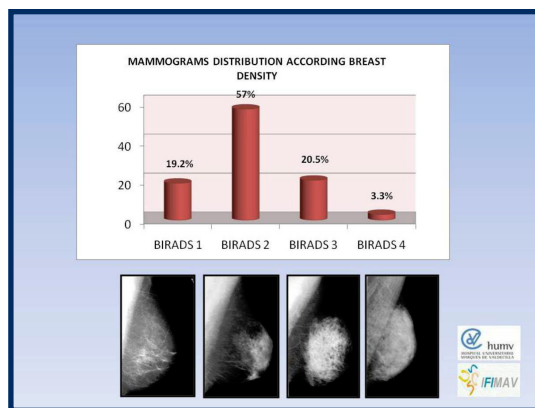


Fig 1. Sensitivity based on breast density

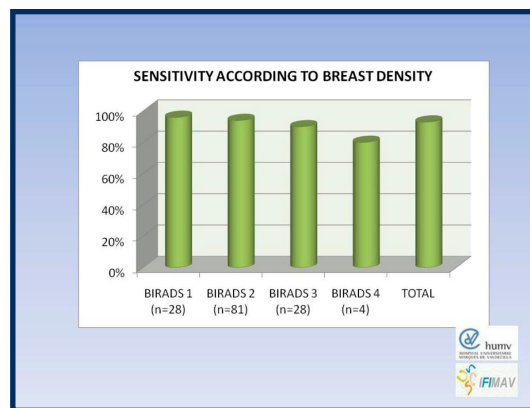


Fig 2. Sensitivity based on breast density

Conclusion

1. Sensitivity for masses was statistically significant higher in non-dense vs dense group. The sensitivity for detection nodules and distortions was higher in non-dense than in dense breasts ($p<0.008$).
2. Sensitivity for mixed lesions was 100% regardless of breast density.

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