SecondLook Digital

Sensitivity of a Computer-Aided Detection System Applied to Full-Field Digital Mammography (FFDM) According to Histopathology and Tumor Size

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Purpose

Mammography remains as the gold standard for breast cancer screening, with a sensitivity of 85-90%. Computer-aided detection (CAD) systems are designed to help radiologists in the detection of suspicious masses and microcalcifications earlier and more accurately during screening mammography.

Since the **histopathologic findings** and **size** of a cancerous lesion influence radiologist sensitivity, they may also influence the tumor detection rate of a CAD system. The evaluation of the performance of CAD based on this two features may have prognostic implications as well; for small invasive tumors, masses have better prognosis than microcalcifications, and smaller tumors have a better prognosis than larger ones.

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 histopathologic findings and tumor size.**

Materials and Methods

PATIENT SELECTION

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.

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

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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. Cancers **sizes** were based on pathologic size and were grouped into size intervals of 1-10mm, 11-20 mm, 21-30 mm and greater than 30 mm. CAD sensitivity correlated by cancer size was evaluated for all cancers, as well as for cancers that manifested mammographically as masses, as microcalcifications, and as masses with microcalcifications.

Tumor **histopathology** was based on pathologic findings. Tumors were classified as invasive ductal carcinoma, invasive lobular carcinoma, ductal carcinoma in situ (DCIS), tubular carcinoma and other types of invasive carcinoma.

Results

Statistical analysis of CAD sensitivity based was on tumor size shows a statistically significant difference ($p<0.05$), although CAD performed consistently with small lesions as well as with large lesions.

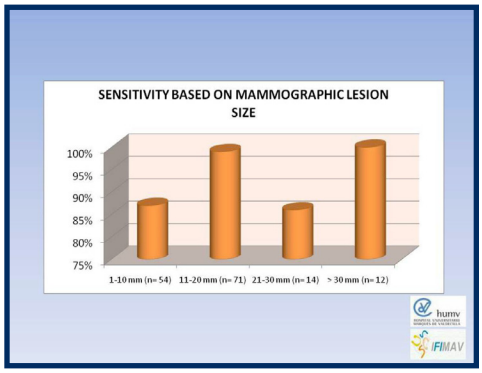

Fig 2.Sensitivity based on lesion size

The CAD system detected 47/54 (87%)of the cancers that measured 1-10mm, 70/71 (98.6%) of the cancers that measured 11-20mm, 12/14 (86%) of the cancers that measured 21-30mm and 12/12 (100%) of the cancers that were greater than 30mm.

Statistical analysis of CAD sensitivity correlated by size and mammographic appearance was statistically significant only for masses. The CAD system detected 26/34 (76.5%) of the 1 to 10 mm sized masses vs 60/62 (96.8%)of the masses greater than 10mm.

CAD detected 73/79 (92%) of the invasive ductal carcinomas, 8/9 (89%) of the invasive lobular carcinomas, 46/48 (96%) of DCIS and 11/12 (92%) of tubular carcinomas.

95 out of 103 invasive carcinomas were correctly marked by the CAD system (sensitivity=92%).

No significant differences according to histopathology were found.

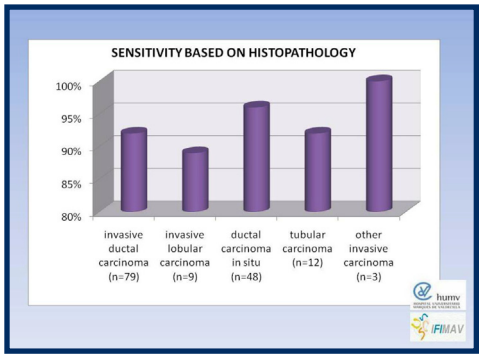

Fig 4.Sensitivity based on histopathology

Conclusion

1. Sensitivity for masses was dependent on tumor size ($p<0.05$).
2. Sensitivity of the CAD system for ductal in situ carcinomas was 96%, and for invasive carcinomas 92%.
3. CAD could play an important role in depicting traditionally "difficult to detect" lesions, such as invasive lobular carcinoma.

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