Initial Image Quality and Clinical Experience with New CR Digital Mammography System: A Phantom and Clinical Study

Enrique Gaona*, Beatriz Y. Álvarez Alfonso¶, Gustavo Casian Castellanos¶, Jesús Gabriel Franco Enríquez*

*Universidad Autónoma Metropolitana-Xochimilco, Calz. del Hueso 1100, 04960 México, D.F.
¶Hospital Juárez de México, Av. Instituto Politécnico Nacional No. 5160, 07760 México, D.F.

Abstract. The goal of the study was to evaluate the first CR digital mammography system (® Konica-Minolta) in Mexico in clinical routine for cancer detection in a screening population and to determine if high resolution CR digital imaging is equivalent to state-of-the-art screen-film imaging. The mammograms were evaluated by two observers with cytological or histological confirmation for BIRADS 3, 4 and 5. Contrast, exposure and artifacts of the images were evaluated. Different details like skin, retromamillary space and parenchymal structures were judged. The detectability of microcalcifications and lesions were compared and correlated to histology. The difference in sensitivity of CR Mammography (CRM) and Screen Film Mammography (SFM) was not statistically significant. However, CRM had a significantly lower recall rate, and the lesion detection was equal or superior to conventional images. There is no significant difference in the number of microcalcifications and highly suspicious calcifications were equally detected on both film-screen and digital images. Different anatomical regions were better detectable in digital than in conventional mammography.

Keywords: CR mammography, Quality imaging, Clinical experience.
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INTRODUCTION

The goal of the study was to evaluate the first CR digital mammography system (® Konica-Minolta) [1] in Mexico in clinical routine for cancer detection in a screening population and to determine if high resolution CR digital imaging is equivalent to state-of-the-art screen-film imaging. This study compares the new CR digital technique with screen-film mammography regarding image quality and lesion detectability by using images of the same patient from both systems with medical physicist mammography systems evaluation.

MATERIAL AND METHODS

In the first stage two mammography systems were used, one with a photostimulable fluorescent plate digital detector with 43.75 μm pixel pitch (® Regius 190, Konica-Minolta) and the other one with a screen-film system (with same Elscinttec mammography unit) and both systems with quality control programs [2]. Images of a

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ACR-phantom were made with conventional and digital technique and contrast, system resolution, average mean glandular dose and artifacts of the images were evaluated as part of the quality control programs. Digital and conventional mammograms were performed of 25 patients with cytological or histological proven tumors on the same day.

In the second stage 77 digital mammograms and their corresponding screen-film mammograms not older than 1.5 years were reviewed in a random order (of 1228 cases) and the mammograms were evaluated by two observers with cytological or histological confirmation for BIRADS 3, 4 and 5. Contrast, exposure and artifacts of the images were evaluated. Different details like skin, retromamillary space and parenchymal structures were judged. The detectability of microcalcifications and lesions were compared and correlated to histology.

The following tests were made to ensure CR digital systems performance acceptable: CR reader sensitivity ("S" number), CR reader shading correction, Imaging plate fogging test, verification of AEC with CR cassettes on mammography unit and Regius laser processor QC.

The CR digital mammography system is using a frequency processing based on decomposition into multiresolution space-hybrid processing with five image processing capabilities: automatic gradation processing (G processing), frequency processing (F processing), equalization processing (E processing), and hybrid processing (H-F processing or H-E processing) [3]. The parameters of the different types of processing of the image were optimized to improve the image quality. The quality control tests of the CR images solved problems of flat field uniformity, lack spatial resolution, ghosts in the image, artifacts and other problems.

RESULTS AND DISCUSSION

Different anatomical regions were better detectable in digital than in conventional mammography (figure 1).

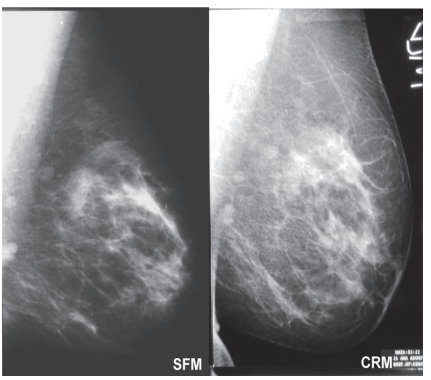

FIGURE 1. Comparison of Screen-Film Mammography (SFM) and CR Digital Mammography (CRM) images.

The scoring phantom images with more frequency were 4 and 5 largest fibers, 3 and 4 largest speck groups, and the 4 largest masses and the average glandular doses delivered during a single cranio-caudal view of an ACR-phantom not exceed 2.5 mGy per exposure in clinical conditions for CR digital mammography [4]. There is no significant difference in the number of microcalcifications and highly suspicious calcifications were equally detected on both film-screen and digital images. There was a high degree of correlation between cytological or histological confirmation and BIRADS 3, 4 and 5 for CR digital mammography images.

CONCLUSIONS

The difference in sensitivity of CRM and SFM was not statistically significant. However, CRM had a significantly lower recall rate, and the lesion detection was equal or superior to conventional images. The CR digital mammography image was superior to the film-screen system allowing for improved detection of low contrast objects. Even though the limiting spatial resolution of the CR digital system is less than that of the film-screen system, the CR digital system allows improved object detection. CR digital mammography with a quality control program offers a consistent high image quality without artifacts.

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