

Accuracy of Breast Cancer Screening Using Film Mammography in Comparison to Digital Mammography

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ABSTRACT

Aim of the work: digital mammography may achieve better images than does film mammography in young women, especially those who are less than 50 years old, where breast is characterized by dense breast tissue. This review aimed to compare the accuracy of screening using film mammography versus digital mammography in detection of breast cancer. **Methods:** an electronic search was conducted in MEDLINE and EMBASE by using PubMed search engine. The search resulted in 48 relevant studies, then after exclusion of duplicated and studies with different outcomes only 4 studies found eligible to be included in this review. The data were extracted using data extraction tables.

Results: the search resulted in four potentially relevant studies that reported clinical trials on a comparison between breast cancer screenings using film mammography versus digital mammography. **Conclusions:** the digital mammography offers advantages over film mammography namely, easier access to images and computer assisted diagnosis, improved means of transmission, retrieval and storage of images; and the use of a lower average dose of radiation without a compromise in diagnostic accuracy

Keywords: mammography, digital, film, accuracy, breast, cancer.

INTRODUCTION

Mammography is the most effective modality to early detection of breast cancer ⁽¹⁾. The use of screening mammography is associated with the detection of breast cancer at an earlier stage and smaller size ⁽²⁾. There is a current consensus that screening mammography decreases the mortality rate related to breast cancer in females 40 years old or older ⁽³⁾.

However, the positive predictive value of mammographic diagnosis is only about 15%–30% ⁽³⁾. As the number of patients undergoing mammography increases, it will be increasingly important to improve the positive predictive value of this procedure in order to decrease patient discomfort and costs ⁽⁴⁾. A study showed that mammography is sensitive in diagnosis and screening of breast cancer, but with a high false-positive rate ⁽⁵⁾. So far, conventional screen-film mammography with high spatial resolution has been the modality of choice for screening programs ⁽⁶⁾. Digital mammography has been developed to overcome the drawbacks of film mammography in terms of separation the stage of image taking and display which optimize the outcomes of both stages ⁽⁷⁾. Digitally processed image allows the control of contrast, thus, this contrast can be elevated in the dense parts of the breast with the lowest contrast ⁽⁸⁾.

A study showed that digital mammography may achieve better images than does film mammography in young women, especially those who are less than 50 years old, where breast is characterized by dense breast tissue ⁽⁹⁾. High density of breast tissues decreases the ability of mammography to detect breast lumps ⁽¹⁰⁾ and elevates the risk of breast cancer ⁽¹¹⁾. This review aimed to compare the accuracy of screening using film mammography versus digital mammography in detection of breast cancer.

METHODS

An electronic search was conducted in MEDLINE and EMBASE using PubMed search engine with this search strategy (Breast cancer OR breast tumor OR breast malignancy), film mammography OR conventional OR film-screen), digital mammography and accuracy OR specificity OR sensitivity. The search resulted in 48 relevant studies, then after exclusion of duplicated and studies with different outcomes only 4 studies found eligible to be included in this review. The data were extracted using data extraction tables for the items demonstrated in table 1.

The study was done after approval of ethical board of Umm Al-Qura university.

RESULTS

This search resulted in four potentially relevant studies that reported clinical trials on a comparison between breast cancer screenings using film mammography versus digital mammography. Only one study was excluded because it was not consistent outcome. The sample size was ranged between 200 (12) to 49528 (13), aged over 40 years old. The stage of breast cancer was not reported in three studies, only one study reported that the stage was between T1- T4.

The comparison between film mammography and digital mammography was done by estimation of sensitivity and specificity of each in a cohort study in which the sensitivity was ranged between 35% - 38% when using film mammography and between 38%- 49% when using digital mammography. While, the specificity was 97%-98% in film mammography and 79% for digital mammography. The technique used for film mammography was not reported, while five digital-mammography systems were used in digital mammography: the Seno Scan (Fischer Medical), the computed radiography system for mammography (Fuji Medical), the Senographe 2000D (General Electric Medical Systems), the digital mammography system (Hologic) and the Selenia full field digital mammography system (Hologic) (13). In this study, the mean age was 54 years old, the stage of breast cancer was T1- T4 . The overall diagnostic accuracy of digital and film mammography as a means of screening for breast cancer was similar, but digital mammography was more accurate in women under the age of 50 years, women with radiographically dense breasts, and premenopausal or perimenopausal women.

Cancer detection rate was evaluated in two studies. The first study was a prospective study done on 43,429 women, aged between 45–69 years. Cancer detection rate was 41% when using film mammography, it was performed using one of three mammography units (Mammomat 300; Siemens Medical Systems, Erlangen, Germany) with Min-R 2000 film and Min-R 2190 screens (Eastman Kodak, Rochester, NY) in both standard and large formats. A molybdenum anode, molybdenum filter and 29 kV

were used for all examinations. While, cancer detection rate was 59% when using digital radiography; it was acquired by using one of two available FFDM units (Senographe 2000D; GE Medical Systems, Milwaukee, Wis) equipped with an automatic mode (automatic optimization of parameters, or (AOP) in which an anode track-filter combination and kV were selected automatically after analysis of pre-mammographic data obtained with a brief exposure. FFDM allowed a higher cancer detection rate than did SFM in the group aged 50–69(9).

The second study was a randomized trial done on 23929 women aged between 45– 69 years. The cancer detection rate was 38% using film mammography which was performed with one of two units (Mammom at 300; Siemens Medical Systems, Erlangen, Germany) with Min-R 2000 film and Min-R 2190 screens (Eastman Kodak, Rochester, NY) in both standard and large formats. While, cancer detection rate using digital mammography was 59%, the image of which were acquired with another unit (Senographe 2000D; GE Medical Systems, Milwaukee, Wis). Mammograms from both imaging modalities (SFM and FFDM) included the two standard views (craniocaudal and mediolateral oblique) of each breast. FFDM resulted in a significantly higher cancer detection rate than did SFM.

Image quality was reported in a study was carried on 200 women above 40 years old. Image quality was excellent for digital mammography which was performed using the GE Senographe 2000D. Comparison was made on hardcopies, printed on a Kodak DryView 8610 laser-printer. Printout parameters were set in standard mode. While image quality was decreased when using film mammography which was performed using a GE Senographe DMR+ with Kodak MinR 2000 film–screen system (Kodak, Rochester, NY) and developed using a Kodak Xomat M35 developer with RP. Digital mammography demonstrated improved image quality compared with film–screen mammography.

Table 1: the accuracy of film mammography versus digital mammography in the included studies

Study	Sample size	Age of patients	Stage of breast cancer	Digital mammography (technique and specifications)	Film mammography (technique and specifications)	Accuracy, sensitivity, specificity of digital mammography	Accuracy, sensitivity, specificity of film mammography	Which is better in the screening of breast cancer
<i>Pisano et al.</i> ⁽⁸⁾	49,528	Mean 54 years	T1-T4	Five digital-mammography systems were used: the SenoScan (Fischer Medical), the CT System for Mammography (Fuji Medical), the Senographe 2000D (General Electric Medical Systems), the Digital Mammography System (Hologic), and the Selenia Full Field Digital Mammography System (Hologic)	Not reported	Sensitivity= 38_49% Specificity= 97%	Sensitivity= 35_38% Specificity= 97_98%	The overall diagnostic accuracy of digital and film mammography is similar, but digital mammography is more accurate in women under the age of 50 years, women with radiographically dense breasts, and premenopausal or perimenopausal women
<i>Skaane P and Skjennald</i> ⁽⁹⁾	43,429	45–69 years	Non-reported	FFDM images were acquired by using one of two available FFDM units (Senographe 2000D; GE Medical Systems, Milwaukee, Wis) equipped with an automatic mode	Three mammography units (Mammomat 300; Siemens Medical Systems, Erlangen, Germany) with Min-R 2000 film and Min-R 2190 screens (Eastman Kodak, Rochester, NY)	Cancer detection rate= 59%	Cancer detection rate= 41%	FFDM allowed a higher cancer detection rate than did SFM in the group aged 50–69
<i>Fischmann et al.</i> ⁽¹²⁾	200	Above 40 years	Non-reported	FFDM was used (GE Senographe 2000D. Comparison was made on hardcopies, printed on a	FSM was used (GE Senographe DMR+ with Kodak MinR 2000 film–screen system	Image quality was rated by reader A/B/C as excellent for FFDM in 153/155/167 cases	for FSM in 139/116/114 cases	FFDM demonstrated improved image quality compared with film–screen mammography.

Accuracy of Breast Cancer Screening

Study	Sample size	Age of patients	Stage of breast cancer	Digital mammography (technique and specifications)	Film mammography (technique and specifications)	Accuracy, sensitivity, specificity of digital mammography	Accuracy, sensitivity, specificity of film mammography	Which is better in the screening of breast cancer
				Kodak DryView 8610 laser-printer.				
Skaane <i>et al.</i> ⁽¹⁴⁾	23929	45– 69 years		Mammograms from two imaging modalities (SFM and FFDM) included the two standard views (craniocaudal and mediolateral oblique) of each breast	SFM examinations were performed with one of two units (Mammomat 300; Siemens Medical Systems, Erlangen, Germany) with Min-R 2000 film and Min-R 2190 screens (Eastman Kodak, Rochester, NY)	Cancer detection rate was 0.59% Sensitivity was 77.4% at FFDM ; specificity was 96.5%	Cancer detection rate 0.38% and 61.5% at SFM 97.9%	FFDM resulted in a significantly higher cancer detection rate than did SFM

DISCUSSION

Mammography is the primary tool for the early detection of breast cancer. The use of screening mammography is associated with the detection of breast cancer at an earlier stage and smaller size and, thus, with a reduction in mortality from breast cancer in women aged 40–69 years, as has been shown in randomized trials⁽¹⁵⁾.

Conventional screen-film mammography (SFM) with high spatial resolution has been the modality of choice for screening programs⁽⁶⁾. digital mammography was significantly better than conventional film mammography at detecting breast cancer in young women, premenopausal and perimenopausal women, and women with dense breast⁽¹³⁾, it allowed a higher cancer detection rate than did SFM in the group aged 50–69 years⁽⁹⁾.

Digital mammography also demonstrated improved image quality compared with film–screen mammography⁽¹²⁾. In a digital image, the x-ray transmission can be manipulated to enhance visualization of subtle structural changes in tissue over the entire breast. For mammograms, the most problematic areas are those in which cancers can be hidden by adjacent dense tissue owing to small differences in contrast between lesions and the fibroglandular background⁽¹³⁾. Screening mammography reduces the rate of death from breast cancer and that if digital mammography

detects cancers at a rate that equals or exceeds that of film mammography, its use in screening is likely to reduce the risk of death by as much as or more than that conferred by film mammography. The cancers are detected by digital mammography and missed by film mammography in women under the age of 50 years, women with heterogeneously dense or extremely dense breasts and premenopausal and perimenopausal women included many invasive and high-grade in situ cases. These are precisely the lesions that must be detected early to save lives through screening. Neither digital nor film mammography found all the breast cancers in the population. Palpable findings and symptoms that develop after screening should be evaluated even if a woman has negative findings on digital mammography⁽¹³⁾.

CONCLUSION

The digital mammography offers advantages over film mammography namely, easier access to images and computer-assisted diagnosis; improved means of transmission, retrieval, and storage of images; and the use of a lower average dose of radiation without a compromise in diagnostic accuracy. Also it has some limitations, a further limitation is the subjective character of the parameters examined. As the radiologist is one of the major limiting factors in breast imaging, the

non-objective parameters play an important role in the diagnostic process.

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