Diagnostic Accuracy of Mammography in Characterization of Palpable Breast Lumps in Benign and Malignant: Keeping Histopathology as a Gold Standard

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ABSTRACT

Objective: To evaluate the diagnostic accuracy of mammography in characterization of palpable breast lumps in benign and malignant; keeping histopathology as a gold standard.

Study Design: Observational / analytic study.

Place and Duration of Study: The study was conducted in Department of Radiology, Ittefaq Hospital (Trust) Lahore in six months duration from July 2013 to January 2014.

Patients and Methods: 300 female patients with palpable breast masses were included in the study. All patients had mammography done to establish diagnosis as benign or malignant, followed by histopathology of the mass (as gold standard) to detect the lesion as benign or malignant. Diagnostic accuracy of mammography was detected by determining sensitivity, specificity and accuracy.

Results: Sensitivity, specificity, and accuracy of mammography were 95.3% 95.4% and 95.3%, respectively.

Conclusion: The sensitivity, specificity and accuracy of mammography is high for characterization of palpable breast masses as benign or malignant.

Key Words: Diagnostic accuracy, Benign, Malignant, Characterization, Palpable breast mass

INTRODUCTION

Breast cancer is the most common malignancy in women and the second most common cause of cancer-related mortality. According to WHO approximates more than 1.2 million new cases are diagnosed worldwide every year.[1] More recently there has been increase in incidence of breast cancer in developing countries. In fact, Pakistan's population boasts the highest rate of breast cancer amongst all Asian countries as; over 90,000 women suffer from breast cancer.[2] The Karachi Cancer Registry suggests that the age-standardized annual rate of breast cancer in Pakistan is 69.1 per 100,000.[3]

Albert Soloman for the first time, after the invention of X rays, studied the breast under X rays and suggested that X rays can be used for diagnostic purpose for breast pathologies.[4] Mammography was used primarily for early detection of malignancies in their curable stages, to decrease the malignancy related mortality. It is screening tool which is easily available, cheap and fairly accurate with minimal radiation to detect micro

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calcifications, spiculated masses and small lymph nodes seen in malignancies. Incidence of breast cancer can be reduced by 30% by routine mammographic screening of healthy women.[5,6] Women who present with breast symptoms or who have palpable findings on clinical examination are usually investigated with breast imaging, which generally consists of mammography or breast Sonography or both,[7] but the mammography can demonstrate breast lesion earlier than they can be diagnosed by physical examination. It also screens the rest of ipsilateral breast and the contralateral breast for unsuspected cancer. Mammography is less sensitive in detecting breast cancer in young patients (less than 35years) due to increased density of breast parenchyma.[8] As compared to screening mammography; the diagnostic mammography is a more comprehensive examination and consists of multiple specialized views like magnification or spot compression view. Because of higher prevalence of signs and symptoms in the population diagnostic mammography has been shown to have higher sensitivity and lower specificity than screening mammography.[9] The prevalence of malignancy is 24%.[10]

The rationale of study was to evaluate mammographic accuracy in characterization of palpable breast lesion in our population as Yankaskas et al[11] showed the sensitivity of diagnostic mammography 91% and

specificity 86% in black women; while according to BCSC[12] (Breast Cancer Surveillance Consortium) data for 2009 sensitivity and specificity of diagnostic mammography for all examinations in white race women is 84.1% and 92% respectively. Study is carried out to see whether the sensitivity in our population matches the above figures. The positive predictive value changes with the change of prevalence of disease so the results of this study will be different as mentioned in the literature. There is one local study which was carried out in 2003 in Peshawar that is 10 year old, as the prevalence of cancer has changes over the time so this study will also reveal the new prevalence of disease in our population. This will help to segregate patients with high risk characters. It will also help to reduce unnecessary interventions thus reducing morbidity. This modality is cost effective and easily available so early diagnosis is assured.

PATIENTS AND METHODS

This study was conducted in Department of Radiology, Ittefaq Hospital (Trust) Lahore in six months duration from July 2013 to January 2014. In this study 300 female patients more than 35 years of age with palpable breast masses were included after taking verbal informed consent, while already diagnosed cases were excluded. Data was collected on a structured Proforma. As a part of triple assessment, proper history and thorough examination by mammographic consultant was done in each case. Female patients underwent mammography which was performed with Planned Sophie Classic RFH 40822 by mammographic consultant. All the mammograms were reported according to BIRADS system by mammographic consultant having 5 years experience in mammography. Patients also under went biopsy by consultant radiologist and specimen were sent for histopathology. Mammographic diagnosis was then compared with the histopathological diagnosis by consultant. The collected data was analyzed on SPSS 10.0 software. Quantitative data like age of the patient was presented in the form of mean±SD. Quantitative data like density, shape, margins, calcifications, skin thickening and axillary lymph nodes for benign and malignant palpable breast lumps were presented in the form of frequency and percentages. A 2x2 contingency table was generated to calculate the sensitivity, specificity, PPV, NPV and accuracy of mammography in characterization of palpable breast lump by taking histopathology as gold standard.

RESULTS

In the study, the mean age of the patients was 45.83±11.32 years [range 35–83]. There were 125 (41.7%) patients of age 35–40 years, 79 (26.3%) patients of age range of 41–50 years, 55 (18.3%) patients of age range of 51–60 years, 26 (8.7%) patients

of age range of 61–70 years, 12 (4 %) patients of age range of 71–80 years and 3 (1%) patients of age range of > 80 years (Table 1). Upon distribution of patients by density, low density lesions were present in 125 (41.7%) patients and high density lesion in 175 (58.3%) patients. (Table 2).

Table No.1: Distribution of patients by age (n=300)

Age (years)	No.	%age
35 – 40	125	41.7
41 – 50	79	26.3
51 – 60	55	18.3
61 – 70	26	8.7
71 – 80	12	4
> 80	3	1

Table No.2: Distribution of patients by characterization of breast masses on mammography (n=300)

Mamographic characterization	No.	%age
Density		
Low	125	41.7
High	175	58.3
Shape		
Oval	40	13.3
Rounded	35	11.7
Lobular	70	23.3
Irregular	160	53.3
Margins		
Circumcised	150	50
Obscured	79	26.3
Microlobulated	50	16.7
Spiculated	21	7
Surrounding architecture distortion		
Absent	132	44
Present	168	56
Overlying skin thickening		
Present	36	12
Absent	264	88
Axillary lymph node		
No cortical thickening	185	61.7
Well preserved hilum	185	61.7
Cortical thickening present	115	38.3
Loss of fatty hilum	115	38.3
Nipple retraction		
Yes	36	12
No	264	88
Number of lesions		
< 1	233	77.7
> 1	77	22.3

The shape of breast lesions on mammography of 40 (13.3%) patients was oval, 35 (11.7%) patients were rounded, 70 (23.3%) patients were lobular, and 160 (53.3%) patients were irregular. (Table 2).The margins of breast lesions on mammography was circumcised in 150 (50%) patients, obscured in 79 (26.3%),

microlobulated in 50 (16.7%) and spiculated in 21 (7%) patients. (Table2). Surrounding architectural distortion was absent in 264 (88%) patients, and was present in 36 (12%) patients (Table 2). On distribution of mammorgraphic findings of axillary lymph node status it was observed that no cortical thickening and well preserved hilum was seen in 185 (61.7%) patients. However, cortical thickening and loss of fatty hilum was present in 115 (38.3%) patients. (Table 2).Nipple retraction was observed in 36 (12%) patients while it was not seen in 264 (88%) patients. (Table 2).There were 233 (77.7%) patients who had single lesions on mammography findings, while in 77 (22.3%) patients; there were more than one lesion (Table 2). Out of 300 patients included in the study, the mammography was detected to be malignant in 168 patients. Of these, 162 were proved on histopathology, so were labelled as true positive, while rest of the 6 patients were labeled as false positive. Mammography findings were benign in total 132 patients. Out of these 124 were proved benign on histopathology. So, they were labeled as true negative and 8 were proven malignant on histopathology, so were labeled as false negative. (Table 3) The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of mammography for characterization of breast masses as benign or malignant lesion was 95.3%, 95.4%, 96.4%, 93.9% and 95.3%, respectively.

Table No.3: Comparison of mammography findings with histopathology of palpable breast masses (n=300)

Mammography finding	Histopathological findings (Gold standard)		Total
	Maligant	Benign	
Malignant	162 (TP)	6 (FP)	168
Benign	8 (FN)	124 (TN)	132
Total	170	130	300

$$\text{Sensitivity Rate} = \frac{162}{170} \times 100 = 95.3\%$$

$$\text{Specificity Rate} = \frac{124}{130} \times 100 = 95.4\%$$

$$\text{Positive predictive value} = \frac{162}{168} \times 100 = 96.4\%$$

$$\text{Negative predictive value} = \frac{124}{132} \times 100 = 93.9\%$$

$$\text{Diagnostic accuracy} = \frac{286}{300} \times 100 = 95.3\%$$

DISCUSSION

Breast masses are psychological and social trauma for the female. These can even be malignant. The single most widely used investigation for the detection of breast masses is mammography. However, most of the time, it is not specific and the patients may have to undergo biopsy for the correct diagnosis. In this study, we evaluated the diagnostic accuracy of mammography for the detection of malignant or benign disease on mammography of the breast masses. The results of the study were in favor of mammography with high values of sensitivity (95.3%), specificity (95.4%), and diagnostic accuracy (95.3%).

The mean age of the patients in our study was 45.83+11.32 years. In a study by Devoli-Disha et al[13] the mean age of the patient was 56 years, ranging from 33 to 77 years. This study included 546 patients with palpable breast masses. The mean age of the patients as described in study by Nascimento et al[14] was 49±12 years. The patients' ages ranged from 37 to 61 years. We observed that 41.7% women were in the age range of 35–40 years. This represents that in our population, the women with younger age may be affected more with breast masses and need screening for the problem.

In our study, we observed that 168 (56%) patients were shown to have malignant disease in our study. This figure was higher than other studies. In study by Michell et al[15] frequency of malignant breast masses was 26.8%. However, they included all the patients who presented with screening and in their study; the normal mammography was observed in 35.4% patients. Nascimento et al[14] observed 58.3% were benign and 41.7% were malignant. In study by Devoli-Disha et al[13] the frequency of malignant lesions was 47.4%. All these diagnosis of malignancy was based on histopathology findings.

Our study showed a high sensitivity (95.3%), specificity (95.4%) and diagnostic accuracy (95.3%). Some other studies in world have also evaluated the diagnostic accuracy of mammography for detection of malignant diseases.

In a study by Devoli-Disha et al[13] the sensitivity of mammography was 52.1% and specificity was 73.9% for detection of malignant breast disease. This was a low sensitivity and they declared mammography as a non reliable investigation. Nascimento et al[14] determined that the sensitivity of mammography was 68%, specificity 76% and accuracy 75%. Michel et al[15] conducted a study to detect the diagnostic accuracy of mammography for detection of malignant masses. They also observed a very high sensitivity of mammography i.e. 97.5%, specificity 51% and high NPV of 98.3%. Yankaskas et al[11] conducted a study to determine the diagnostic accuracy of mammography and showed that the sensitivity of diagnostic mammography was 91% and specificity 86%. According to BCSC[12] (Breast Cancer Surveillance Consortium) data for 2009 sensitivity and specificity of diagnostic mammography for all examinations in white race women was 84.1%

and 92% respectively.

We also stratified our data according to the mammography characteristics of the patients. We observed a higher frequency of patients with high density i.e. 58.3%. The density of the lesion may help in characterizing the tissue. It is a known fact that there is a direct association between the increased mammographic density and an increase in the risk for development of breast cancer. However, Nascimento[14] observed that the PPV for heterogeneously dense breasts was 43.8%.

A variation in shape of the lesions was observed. However, the most common shape found in our study was irregular, which was observed in 53.3% patients. With regards to round and oval shapes, these were associated to a high NPV, between 75% and 71%. Microlobulated and lobular shapes also presented a high PPV, between 90% and 70%. Surrounding architecture distortion was seen frequently among both malignant and benign cases. With regard to margins, the NPV for circumscribed margins was 84.2%, while the PPVs for indistinct and spiculated margins were 24.5% and 90%, respectively.[14] Overlying skin thickening was seen in only 12% cases. Axillary nodal cortical thickening and the loss of fatty hilum was also detected in 38.3% cases. This is also suggestive of malignancy, but not seen frequently in our study. There were few limitations of the study. This was a single center study with a limited population size. All the mammography reports were interpreted by an expert radiologist who had at least 5 years experience of interpreting the radiographs. The reproducibility of the results in hands of inexperienced is not known.

CONCLUSION

This study concludes a very high sensitivity, specificity and diagnostic accuracy of mammogram for characterization of malignant and benign diseases. However, there are few false negative and false positive which merit that evaluation of palpable breast masses should be conducted with addition of some other modalities like USG & histopathology in highly suspected cases.

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