DOI: 10.21276/sjams.2016.4.11.58

Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(11D):4157-4160 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com

Original Research Article

Diagnostic Accuracy of Mammography and Sonomammography in Evaluation of Symptomatic Women

Dr. Annapurna Srirambhatla[1], Dr. Prashanth Kumar KS[2], Dr. Sireesha Chinta[3]

[1,2]Assistant Professor, Department of Radio Diagnosis, Kamineni Academy of Medical Sciences and Research Institute, LB Nagar, Hyderabad, Telangana, India

[3]Senior Resident, Department of Radio Diagnosis, Kamineni Academy of Medical Sciences and Research Institute, LB Nagar, Hyderabad, Telangana, India

***Corresponding author**
Dr. Annapurna Srirambhatla
Email: prunasrirambhat@gmail.com

Abstract: Mammography and sonomammography are two widely used modalities for evaluation of breast masses. The relative risk of malignancy in breast masses and prognostication is assessed by using the BIRADS lexicon proposed by the American college of radiology (ACR). The aim of our study was to determine the efficacy of mammography and sonomammography in evaluation of women presenting with breast lump. Our study included 147 women presenting to our institute with complaints of breast lump. X-ray mammography and sonomammography evaluation of these patients yielded 155 masses. Histopathological confirmation of diagnosis by biopsy / excision of the mass was done. Mammography had a sensitivity of 89%, specificity of 80 % and a PPV of 69%. Sonomammography evaluation had 95 % sensitivity, 79% specificity with PPV and NPV being 68% and 97 % respectively. In conclusion, the sensitivity of mammography is higher in symptomatic women than screening mammography. Sonomammography performed better than mammography in lesion characterization in symptomatic women. It helped in differentiation of solid from cystic lesions thus eliminating the necessity of follow up. Sonomammography is a useful adjunct to mammography in evaluation of dense breasts.

Keywords: mammography, sonomammography, breast lump

INTRODUCTION

Mammography is the modality of choice and a gold standard in breast cancer screening. The sensitivity of mammography as a screening modality ranges from 60-90% with a specificity of 90-95%. Diagnostic mammography on the other hand is used in evaluation of symptomatic women with signs and symptoms of breast cancer.

Sonomammmography is being used increasingly to evaluate women with increased parenchymal density on mammography, further characterization of a mammographic mass, symptomatic pregnant /lactating women and young women (<30yrs) with breast symptoms. Women presenting with a palpable breast lump, bloody nipple discharge, skin dimpling /retraction undergo mammography and sonomammography as a diagnostic workup. Diagnostic mammography includes additional views and spot magnification to reach a final diagnosis. The purpose of our study was to determine the diagnostic accuracy of mammography and sonomammography in evaluation of women with signs and symptoms of breast cancer.

MATERIALS AND METHODS

For this study, women presenting with complaints of breast lump over a period of twenty seven months were evaluated using mammography and sonomammography.

Of the two hundred symptomatic patients, 155patients had a full diagnostic work up of mammography, sonomammography and histopathological diagnosis. Hence statistical analysis which included sensitivity, specificity, positive predictive value and negative predictive value of mammographic and asonomammographic findings of 155 patients was performed.

Mammography machine used was “GE MEDICAL SYSTEM SA” with molybdenum target and

filter . Patients were imaged with two basic projections i.e. cranio – caudal & medio – lateral oblique views. Supplementary views were taken where necessary, which included exaggerated lateral craniocaudal views (for lesions in posteriorlateral aspect), lateromedial (for lesions in medial aspect), axillary tail view (for lesions in axillary tail region, lateral aspect), rolled craniocaudal views(for removing superimposed tissues in dense breast), spot view(for pseudomasses) and magnification views (for analysing calcifications). Mammography images were interpreted by an experienced radiologist for the presence of any lesions or abnormal density. The mammography findings were classified according to BI-RADS lexicon. Patients with a mammographic report of BIRADS categories of 3, 4 and 5 were taken as positive.

Sonomammography was performed in all these patients using a 7-10MHz linear array, 3-6 MHz curved array (in large breast) transducers on PHILIPS ENVISOR HD11.

The entire breast was examined, with particular attention paid to the region of mammographic or clinical abnormality. The breasts were examined in radial and anti radial planes. Each lesion was analyzed in real time and classified according the sonographic BI-RADS lexicon using sonographic descriptors for shape, orientation, margins, echo pattern, posterior acoustic features, and surrounding tissue alterations. On the basis of these descriptors, each lesion was assigned a final category.

Final Assessment Categories
Assessment incomplete
Category 0: need additional imaging evaluation
Assessment complete (final categories)
Category 1: negative
Category 2: benign finding
Category 3: probably benign finding; short-interval follow-up suggested
Category 4: suggestive abnormality; biopsy should be considered
Category 5: highly suggestive of malignancy; appropriate action should be taken
Category 6: known biopsy-proved malignancy

RESULTS

A total of 155 patients were evaluated in this study. The mean age of the patients' in our study was 50 years with most of our patients in the 40-49 year category. The number of malignant lesions in our study were 44 and benign were 111(cysts included).

Mammography

The distribution of mammographic breast density in our study was as follows: 8 (5%) women had fibrofatty parenchyma, 55(35%) had fibrofatty parenchyma with few glandular elements, 51(32 %) had heterogeneous glandular parenchyma and 41(26%) had dense glandular parenchyma. Out of the 155 mammograms, no lump / asymmetry could be identified in 12 cases. In the remaining 143 lesions, 85 were classified as BIRADS 3 and 58 lesions were classified as suspicious / highly suspicious of malignancy. Out of the 85 mammographic benign lesions, 5 lesions were diagnosed as malignant in pathology (false negatives).Of the 58 lesions diagnosed as malignant / suspicious of malignancy, 19 were diagnosed as benign (false positive) (Table -1).

Table 1: Diagnostic Accuracy of Mammography

Mammography	HPE Malignancy	HPE Benign	Total
Positive	39 (TP)	19 (FP)	58
Negative	5 (FN)	80 (TN)	85
Total	44	99	143

Positive (Birads 3,4,5); Negative (Birads 1,2); TP-True Positive, FP – False Positive, FN – False Negative, TN – True Negative

Table 2: Diagnostic Accuracy of Sonomammography

Sonomammography	HPE Malignancy	HPE Benign	Total
Positive	42 (TP)	19 (FP)	61
Negative	2(FN)	75(TN)	77
Total	44	94	138

Positive (Category 3,4,5); Negative (Category 1,2); TP-True Positive, FP – False Positive, FN – False Negative, TN – True Negative

The sensitivity of mammography in detecting malignancy was 88%, specificity of 80%, positive predictive value of 67% and a negative predictive value of 94%. Including the mammography negative cases (n=12) in the analysis would decrease the sensitivity of the study to 69%. These women had dense glandular parenchyma (type D). The number of women with dense parenchyma(types 3 and 4) in our study was 92, of which 80 cases were positive. So the abnormal

mammogram rate in dense parenchyma was 86%. The sensitivity of mammography in these cases was 90%.

Sonomammography

On sonomammography, lesions were detected in all the 155 cases. Of these, 17 were cystic and 138 were solid lesions. Statistical analysis was therefore performed for 138 solid lesions. The minimum size of the tumor detected was 5mm and the largest size was 4cm.Of these, 87 lesions were categorized as benign and 51 lesions were categorized as suspicious / highly suspicious of malignancy. Two lesions were wrongly categorized as benign (false negative) and 9 lesions were wrongly categorized as malignant (false positive). Sonomammographyhad a sensitivity of 95%, specificity of 79%, positive predictive value of 68% and negative predictive value of 97% (table-2).

DISCUSSION

Mammography

The performance of mammography, whether screening or diagnostic, depends on multiple factors which include age of the patient, breast density, hormonal status and the size/stage of the breast tumor [1].

The sensitivity and specificity of screening mammography in various studies was 77.6 % and 98.8% [1], 79.9% and 90.5% [2] and 72.4%, 97.3% [3].

This study evaluated the diagnostic accuracy of mammography and sonomammography in symptomatic women. The presence of a self reported lump increased the sensitivity of mammography as compared to screening tests. In our study, the sensitivity of mammography was 88%. In a studyconducted by Barlow, the sensitivity of DMG was 85% [4] and by Moskowitz showed a sensitivity of 80-85% [5].

The study conducted by Barlow *et al* [4] was a retrospective study wherein BI RADS categories of 0, 3,4 and 5 were taken as positive irrespective of the BI RADS 3 recommendations. We had considered BI RADS 3, 4 and 5 as positive in our analysis. Addition of BI RADS 0 (mammographically occult cases in our study, n=12) resulted in a sensitivity of 69% in our study as compared to 81% in the study by Barlow [4]. The distribution of the dense fibro glandular elements in the breast as a whole and also adjacent to the tumor influences the detection of tumor [6]. In our study dense breast patterns of 3 and 4 were noted in 92 cases with an abnormal mammogram in 80 cases. Therefore the sensitivity of detecting a mass in dense parenchyma (abnormal mammogram rate) was 86%. The sensitivity in detecting malignancy was 92%. The study conducted by Barlow [4] reported a sensitivity of mass detection of 78-86% for category 3 and 73-86% for category 4 breast density. When compared to the sensitivity of screening mammograms in dense breasts (50-65%), there is an increase in sensitivity of mass detection in DMG. The specificity of DMG in our study was 80% with a positive predictive value of 67% and a negative predictive value of 94%. There is a decrease in the specificity and positive predictive value of DMG compared to screening because a symptomatic woman is more likely to have a mammographic examination with a finding that warrants biopsy. Also a palpable lump could be due to a malignancy or benign lesion such as fibroadenomas or complex cysts. The decreased specificity of mammograms in women with reported breast lumps could also be a result of radiologists being more likely to recommend biopsy of a palpable lump, regardless of the mammographic findings [7]. The specificity of DMG in other studies was 87% by Barlow *et al*, 89% by Paplack *et al* and 87% by Moskowitz *et al*.

Sonomammography

ACR practice parameter for the performance of a breast ultrasound examination in its Resolution 39 (2014 amendment) advocates use of sonomammography as an additional imaging for screening in mammographically dense breasts, diagnosis of breast lumps in pregnant and lactating women and women <30years of age. The addition of SMG to mammography, be it screening or diagnostic, has been shown to increase the sensitivity cancer detection.

In their study, comparing the performance of mammography, physical examination and sonomammography, Kolb *et al*, SMG alone enabled detection of nonpalpable invasive cancer in 42% (30 of 71) of women in whom no other cancers were detected with any other screening modality [8]. The sensitivity and specificity of SMG in characterizing a lesion as benign or malignant in symptomatic women were 88.9 and 77.9% in a study by Moss *et al* [9]. Stavros *et al* demonstrated a sensitivity of 99.8% and a specificity of 30.5% of SMG in characterization of solid breast nodules as benign or malignant. The positive predictive value was 42.1% and negative predictive value was 99.6% [10]. In our study**,** SMG had a sensitivity of 95%, specificity of 79%, positive predictive value of 68% and negative predictive value of 97% in lesion characterization. SMG had the benefit of differentiating solid from cystic lesions in a symptomatic woman, thus downgrading the mammographic BI RADS score and obviating a follow up / biopsy. One malignancy which was missed (occult)on mammography could be detected on SMG.

CONCLUSIONS

Diagnostic mammography is highly sensitive in detecting breast lumps in symptomatic women. The

performance of diagnostic mammography is determined by breast density however self reported lumps increase the sensitivity of mammography in dense breasts. Sonomammographyplays an important role in further characterizing breast lumps and as an additional imaging modality for women with mammographically dense breasts.

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