Original article:

Role of high-frequency ultrasonography and mammography in the evaluation of breast lesions

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ABSTRACT:

BACKGROUND: Mammography and ultrasonography have got good accuracy rate in diagnosing breast lesion. This study has examined the improvement in accuracy of mammography and ultrasonography of the breast when combined in the evaluation of breast lesions with histopathological/cytological correlation.

Methods: A prospective study evaluated 49 women referred from the Department of General Surgery and Department of Obstetrics and Gynaecology to Department of Radiodiagnosis of Dr Somervell Memorial CSI Medical College, Karakonam, Kerala, for high-frequency ultrasonography with mammography and who have a final histopathological / cytology diagnosis. The equipment used were Siemens Mammomat 3000 Nova and Siemens Sonoline G 50.

Results: In our study ultrasonography in the evaluation of breast lesions, the sensitivity was 92.3%, the specificity 97.2% and an accuracy of 95.9%. In the evaluation of benign breast lesions with mammography, the sensitivity was 80.6%, the specificity 100% and an accuracy of 85.7% and the sensitivity of mammography in the evaluation of malignant breast lesions was 92.3%, the specificity 97.2% and an accuracy of 95.9%.By combining both modalities in the evaluation of breast lesions we found the sensitivity was 100%, the specificity 97.2% and an accuracy of 98%. A false negative value of 0% and false positive value of 2.8%. A positive predictive value of 92.9%, a negative predictive value of 100%, a positive likelihood ratio of 36 and a negative likelihood ratio of 0 were found.

Conclusion: Breast cancer is one of the most prevalent cancers in the world among women. Breast masses are usually benign, but effective evaluation and diagnosis can rule out malignancy. In this study, we found that combined use of mammogram and ultrasound showed higher sensitivity and diagnosis accuracy than observed for a single modality.

Key words: Biopsy; Breast; Mammography; Palpable lumps; Ultrasonography.

INTRODUCTION

Both women and men develop breast from the same embryological tissues. However, for females at puberty the female sex hormones like oestrogen promote breast development which does not take place in men due to the higher amount of testosterone. As a result of it, women's breasts become far more prominent than that of men. Breast cancer is one among the leading causes of death in women. Postmenopausal women and younger women with a genetic predisposition are more prone to develop breast cancer. Palpable breast masses are very common and are usually benign, but needs efficient evaluation to rule out malignancy. [1] Ultrasonography and mammography of the breast are routinely used for the evaluation of breast lesions. Ultrasonography of breast is used to evaluate

abnormalities detected on mammography. It is especially useful in the evaluation of dense breasts which is a limitation of mammography.[2]

Mammography and ultrasonography have got good accuracy rate in diagnosing breast lesion but we find sensitivity and specificity in detection of breast lesions seem to increase by using both the imaging modalities together. Histopathological examination helps us to confirm the findings of mammography and ultrasonography of the breast.[3] For any suspicious lesion in the breast, biopsy / FNAC is generally performed. And so a systematic approach to breast lesions identified on mammography and ultrasonography, to characterize a lesion will help to reduce the need for the painful unnecessary biopsy.[4] The purpose of this study is to find the improvement in accuracy of mammography and ultrasonography of the breast when combined in the evaluation of breast lesions with histopathological/cytological correlation.

AIMS AND OBJECTIVES

1. To find the sensitivity, specificity and accuracy of high-frequency ultrasonography in diagnosis of breast lesions.
2. To find the sensitivity, specificity and accuracy of mammography in the diagnosis of breast lesions.
3. To assess the improvement in diagnostic accuracy while combining both modalities in females who have undergone both modalities, compared with the gold standard histopathology/cytology.

MATERIALS AND METHODS

STUDY DESIGN

A prospective study methodology was followed. It was approved by the institutional and university ethics board before its execution. It was conducted from December 2013 to December 2015.

STUDY SETTING

The study was conducted at Dr Somervell Memorial CSI Medical College, Karakonam, Kerala.

STUDY POPULATION

Women referred from the Department of General Surgery and Department of Obstetrics and Gynaecology to Department of Radiodiagnosis, for high frequency ultrasonography with mammography whenever applicable and who have a final histopathological/cytology diagnosis are included in this study.

EQUIPMENT

1. **Siemens Mammomat 3000 Nova**. mammography unit will be used for mammography of the breast. Both breasts or unilateral study in post unilateral mastectomy patients will be evaluated by standard lateral oblique and craniocaudal views. Additional compression views will be done whenever required.
2. **Siemens Sonoline G 50** Ultrasound unit will be used for ultrasound examination of both breasts with linear 10 MHz high-frequency probe.

PROCEDURE FOR DATA COLLECTION

A direct interview has been done in the Department of Radiology with the patient for a brief history and clinical examination. Details of the procedure have been explained in non-medical terms and written consent obtained from the patient. The study requested by the referring physician has been done in detail and findings of the study have

been documented in the proforma. The images have been analysed independently under the guidance of the guide and a radiological opinion had been made. The FNAC (Fine needle aspiration cytology) / excision biopsy reports of the patients included in the study were obtained from the Department of Pathology.

STATISTICAL ANALYSIS

Data collected has been entered into MS excel spreadsheet and analysis conducted using a statistical package, SPSS (Statistical Package for Social Sciences). Percentage and proportions have been applied to assess the outcome of the study.

RESULTS

During this study period, 49 patients who have undergone mammography and ultrasonography of the breast followed by cytological/histopathological correlation were assessed.

Table 1: Percentage distribution of the sample according to diagnosis

Diagnosis	Normal		Malignant		Benign	
	Count	Percent	Count	Percent	Count	Percent
Mammography	7	14.3	13	26.5	29	59.2
Ultrasonography	0	0.0	13	26.5	36	73.5
Combined	0	0.0	14	28.6	35	71.4
Biopsy	0	0.0	13	26.5	36	73.5

Table 2: Diagnostic accuracy of mammography when biopsy is gold standard

	Normal	Malignant	Benign
Sensitivity	-	92.3	80.6
Specificity	85.7	97.2	100.0
False Negative	-	7.7	19.4
False positive	14.3	2.8	0.0
Positive Predictive value	0.0	92.3	100.0
Negative Predictive value	100.0	97.2	65.0
Positive Likelihood ratio	-	33.23	-
Negative Likelihood ratio	-	0.08	0.19
Accuracy	85.7	95.9	85.7

Table 3: Diagnostic accuracy of ultrasonography when biopsy is gold standard

Sensitivity	92.3
Specificity	97.2
False Negative	7.7
False positive	2.8
Positive Predictive value	92.3
Negative Predictive value	97.2
Positive Likelihood ratio	33.23
Negative Likelihood ratio	0.08
Accuracy	95.9

Table 4: Diagnostic accuracy of combined when biopsy is gold standard

Sensitivity	100.0
Specificity	97.2
False Negative	0.0
False positive	2.8
Positive Predictive value	92.9
Negative Predictive value	100.0
Positive Likelihood ratio	36.00
Negative Likelihood ratio	0.00
Accuracy	98.0

DISCUSSION

Breast cancer is the one of the most common malignancies among women worldwide [5]. Breast diseases cause considerable morbidity and palpable breast mass potentially poses serious concerns prompting immediate evaluation especially in the diagnosis of breast cancer. In the absence of a known preventable cause of breast cancer, the single most important factor in reducing death from breast cancer and the extent of treatment required is early detection through screening. Thus, mammography and ultrasonography play a major role.

This study was conducted in a rural part of South India. The patients who were clinically suspected to have breast pathology referred from Department of General Surgery and Department of Obstetrics and Gynaecology, undergoing mammography and ultrasonography of the breast followed by cytological/histopathological correlation. In our study half of the patients were aged above 50 and more than half had a history of pain or discharge from the breast. ¾ of the patients presented with lump and less than ¼ had a history of carcinoma breast. Breast ultrasonography has become a popular imaging modality for the evaluation of breast diseases including clinically palpable lumps.
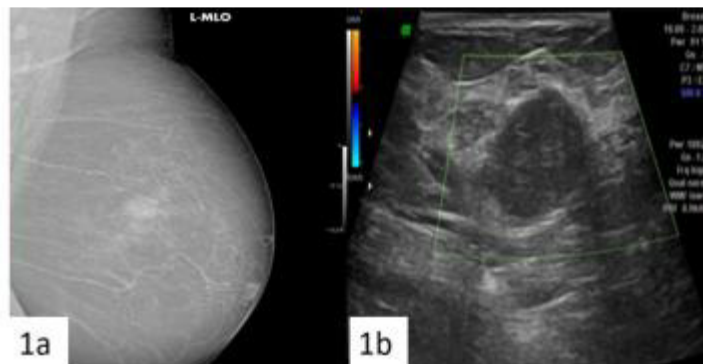

FIG (1a, b): Mammogram of left breast -Mediolateral oblique view(a) shows small well-defined smooth marginated mass lesion which on USG (b)appears well defined hypoechoic lesionwith edge shadowing and no significant colour uptake on doppler study

In our study, the sensitivity of ultrasound in the evaluation of breast lesion was 92.3%, the specificity 97.2% and an accuracy of 95.9%. A false negative value of 7.7% and false positive value of 2.8%. A positive predictive value of 92.3%, a negative predictive value of 97.2%, a positive likelihood ratio of 33.2 and a negative likelihood ratio of 0.08 were found.

In a similar study by Duijm et al, they found the sensitivity for breast cancer detection was 92.0% and the specificity 97.7%. A positive predictive value of 68.0%, a negative predictive value of 99.6%, a positive likelihood ratio of 40 and a negative likelihood ratio of 0.08 [6], which is similar to our study

Mammography is the preferred screening examination for breast cancer. It is widely available, well-tolerated and inexpensive.
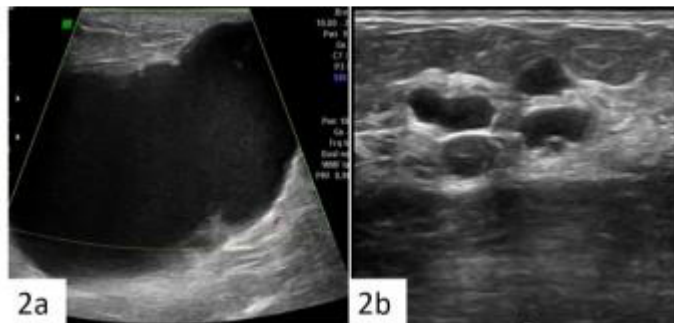
FIG (2a, b): USG(a)shows a well-definedanechoic lesion with posterior acoustic enhancement, edge shadowing and no significant colour uptake on doppler study suggesting Benign cyst. USG (b) shows multiple small cystic lesions suggesting fibrocystic disease

 In our study, the sensitivity of mammography in the evaluation of benign breast lesions was 80.6%, the specificity 100% and an accuracy of 85.7%. A false negative value of 19.4% and false positive value of 0%. A positive predictive value of 100%, a negative predictive value of 65%, negative likelihood ratios of 0.19 were found. And the sensitivity of mammography in the evaluation of malignant breast lesions was 92.3%, the specificity 97.2% and an accuracy of 95.9%. A false negative value of 7.7% and false positive value of 2.8%. A positive predictive value of 92.3%, a negative predictive value of 97.2%, a positive likelihood ratio of 33.2 and a negative likelihood ratio of 0.08 were found.

In a similar study done by G. Gurung et al,out of 100 patients, 65% had mammographic features of a benign lesion and 35% had features of malignancy. Pathology revealed 64% of lesions to be benign and 36% of lesions to be malignant. There was four false negative (6.2%) and three false positive (8.6%) cases. The sensitivity and specificity of mammography were 88.9% and 95.53% respectively [7]

In our study, we found the sensitivity by combining both modalities in the evaluation of breast lesion was 100%, the specificity 97.2% and an accuracy of 98%. A false negative value of 0% and false positive value of 2.8%. A positive predictive value of 92.9%, a negative predictive value of 100%, a positive likelihood ratio of 36 and a negative likelihood ratio of 0 were found. Thus,the combined use of mammogram and ultrasound shows improvement in diagnostic accuracy than individual techniques. Shetty MK and Shah YP reported in their study a sensitivity of 100% and specificity of 80.1%. Barlow et al reported a sensitivity of 87% and specificity of 88% and positive predictive value of 22% [8].
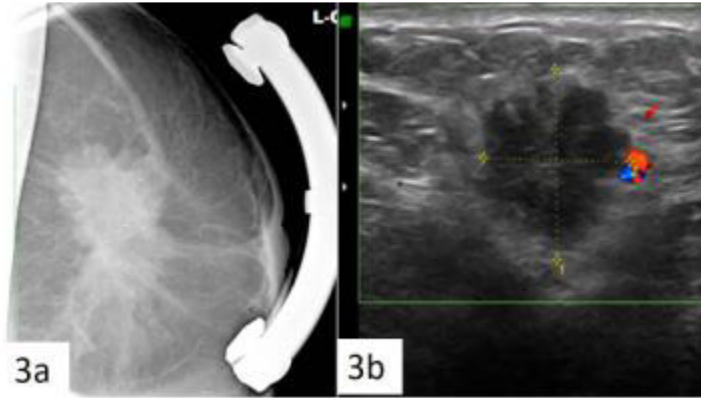
FIG(3a, b): Mammogram of left breast – compressed craniocaudal view (a) shows an ill-defined mass lesion with speculated boarder and multiple microcalcifications which on USG (b) appears ill-defined hypoechoic lesion with speculated boarder.

According to Prasad SN in his study mammography showed an efficiency of 81.8 % compared to 95.5 % for ultrasonography in detecting fibrocystic mastitis. However, their combined approach resulted in 100 %. In the case of fibroadenomas, mammography showed 75 % efficiency and ultrasonography only 35 % and the combination resulting in 93.7 %. For carcinomas, mammography had an efficiency of 77.8 % and ultrasonography 55.6 %, but the combination had an efficiency of 98.1 %. Overall, the histopathological results when correlated with each modality finding showed that mammography had an efficiency of only 77.4 % and ultrasonography only 69.8 % when used alone in detecting these lesions of the breast compared to an efficiency of 98.1 % obtained by their combined approach [1].

Fig 4: Diagnostic accuracy of combined when biopsy is gold standard
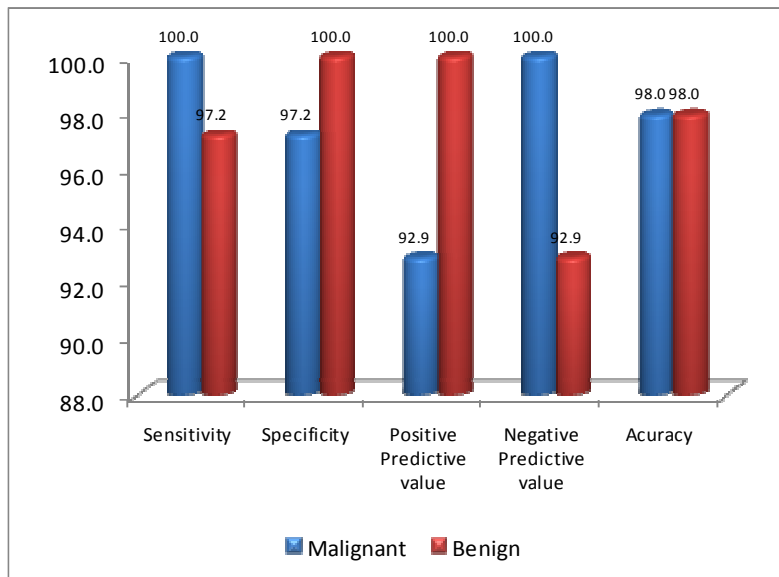
CONCLUSION

Breast cancer is one of the prevalent cancers in the world among women. Breast masses are common and usually benign, but effective evaluation and prompt diagnosis can rule out malignancy. Mammography and ultrasonography have got good accuracy rate in diagnosing breast lesion but we find sensitivity and specificity in detection of breast lesions seem to increase by using both the imaging modalities together. Histopathological examination helps us to confirm the findings of mammography and ultrasonography of the breast.

This study confirms that mammography and ultrasonography when combined had higher sensitivity than the sensitivity observed for a single modality. The diagnostic accuracy of carcinomas of the breast appears to improve when mammography was combined with ultrasonography. Thus, a combined mammography and ultrasonography approach to detect breast diseases is significantly more helpful in the accurate evaluation of breast pathologies than the use of either modality alone.

REFERENCES

1. PrasadSN, Houserkora D. Comparison of mammography and ultrasonography in the evaluation of breast masses. Biomed Pap med far univ palacky olomouc czech repub.2007; 151 (2): 315-322.

2. Stein L, Chellman J M. The Radiologic Workup of a Palpable Breast Mass. CCJM 2009 March; 76: 175-180.

3. Berg. Diagnostic Imaging of Breast. 1st ed. Saltlake city, Utah, USA: Amirsys Publications. 2006; 28-32.

4. Kailash S, Tariq A, Ghanshyam DG. The accuracy of ultrasound in diagnosis of palpable breast lumps.JK Science. 2008; 10:4.

5. Kiguli ME, Mubuuke AG, Businge F, Kawooya GM, Nakatudde R, Byanyima KR, Muyinda Z. Pan African Medical Journal. Current knowledge, attitudes and practices of women on breast cancer and mammography at Mulago Hospital. 2010; 5:1–9.

6. Duijm LE, Guit GL,Zaat JO,Koomen AR, Willebrand D. Sensitivity, specificity and predictive values of breast imaging in the detection of cancer. Br J Cancer. 1997; 76(3): 377–381.

7. Gurung G, Ghimire RK, Lohani B."Mammographic Evaluation of Palpable Breast Masses with Pathological Correlation: A Tertiary Care Centre Study in Nepal. Journal of Institute of Medicine. 2010; 32(2): 21-25.

8. Shetty MK, Shah YP, Sharman RS. Prospective Evaluation of the Value of Combined Mammographic and Sonographic Assessment in Patients with Palpable Abnormalities of the Breast. Journal of Ultrasound in Medicine. 2003; 22(3): 263-268.