ORIGINAL RESEARCH

Ultrasogram vs Mammogram in Breast Lump Evaluation

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ABSTRACT

Introduction: With the advent of imaging modalities, the breast lesions are detected and characterized, there by reduces the mortality and has a excellent prognosis to the patient, making its role crucial. In case of malignancy, staging of tumor is used to decide optimal management. Aims and objectives_of the study was evaluate breast masses with ultrasound and mammography and subsequent FNAC for histological diagnosis, to explore the role of imaging modalities in characterization of lesion and differentiate benign from malignancy.

Materials and Methods: Ultrasonogram lesions were charecterised based on shape, margins, echotexture, shadowing, pseudocapsule and and calcifications,.On mammography lesions are charecterised by shape, margins, calcifications,and architextural distortion. In suspected cases of malignancy FNAC was performed.

Results: Forty patients between 21 to 70 years of age with lumps in breast were included in the study.Ultrasonogram and Mammography were performed in 40 and 36 patients respectively and correlated with BiRads system. On Birads there were Probably benign(Birads 3) findings in 7 cases, Suspecious of abnormality (Birads 4) in 9 cases and Highly suspicious of malignancy (BIrads 5) in 10 casesses. In another Ten cases Mammogram could not be charecterised due to dense breasts (Birads - 0) which were evaluated by Ultrasonogram. Birads system of classication and supecious of malignant lesions on ultrasonogram were confirmed / excluded by tissue diagnosis by FNAC.

Conclusion: Sonography has definite role to differentiate benign from malignant solid masses. The sensitivity and specificity of ultrasound is more compared to mammogram in detection of solid from cystic mass lesions. Our study conclude that ultrasound can be used as primary method of investigation for all palpable breast masses and mammography is more useful as a screening method to detect early breast malignancy.

Keywords: Sonography, Mammogram, Breast Lump

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INTRODUCTION

A breast lump is defined as palpable mass in the breast; it may be either painful or painless. Age of patient may be useful to suspect a BENIGN or MALIGNANT breast mass as younger age group are more prone for benign and older age group are more prone for malignant lesions. Majority of breast lump patients may present with or without pain and discharge.[1,2] The role of imaging is crucial for the detection of lesion and its characterization. In case of malignancy, staging of tumor is crucial to decide optimal management. With the advent of recent imaging modalities like ultrasonogram and mammography, characterization and management of breast lesions is possible which in turn reduces the mortality and mortality to the patient.[3-5] The purpose of out study was to evaluate breast lumps on ultrasonogram and mammography and subsequent FNAC for histological diagnosis to explore the role of imaging modalities in characterization of lesion and differentiate benign from malignant lesions.

MATERIALS AND METHODS

A prospective study was conducted on 40 female patients of age range from 21 – 70 years who presented to the department of surgery in King George Hospital, with symptom of lump in the breast with or without pain and discharge from nipple. In all the patients Breast lump was detected on clinical examination. Informed consent was obtained from the all patients prior to imaging modalities and interventional procedures.

Ultrasonography of breast

Ultrasonogram is routinely performed for palpable masses as an initial imaging examination in women younger than 30 years of age and to identify breast lumps not visible on mammograms of patients of any age. Ultrasonogram is also performed for mammographically detected masses to rule out cysts and to determine whether the mass in amenable for US – guided tissue sampling or not.

All examination are performed with Toshiba Just Vision 400 Ultrasound machine with a 5 – 10 MHz linear – array Transducer. The scanning protocol included both transverse and longitudinal real – time imaging with representative hard – copy images acquired in each plane. No further imaging or tissue sampling is done for all simple cysts found on Ultrasonogram. In case of solid masses, two reviewers are asked to asses the lesions based on the following criteria from the literature[1-3] shape (oval, around, lobulated, or irregular) margins (circumscribed, ill defined, Spiculated or microlobulated), width to anterior posterior (AP) dimension ratio, posterior echoes (enhanced, unaffected, or decreased) echogenicity (intensity of internal echoes), echotexture (homogeneity of internal echoes) presence of calcifications and presence of the pseudocapsules.[7-9]

Mammography

Mammography was performed on Mammomet Digital Mammography Machine belonging to Siemens. In all patients standard Mediolateral – oblique and Craniocaudal views are obtained. The reviewers are instructed to assess the mammograms using the standard criteria such as size, shape, margins, presence of microcalcifications and presence of architectural distortion. On the basis of their evaluation, a BI-RADS final assessment category was assigned by each reader.[10-14]

The reviewers evaluated the cases in which both Ultrasonogram and mammography are performed and assigned a final assessment category that took into account the findings of each.

Finally two radiologists experienced in breast imaging reviewed the hard copy of US images and the mammograms. The two reviewers are not from the faculty where the images were obtained and interpreted and had no previous knowledge of any of the cases or the original interpretations. The patients clinical histories, previous imaging results and tissue sampling results were not available to them. Each of the radiologists is requested to review the cases independently in three different phases: In phase 1, evaluation of Ultrasonograms only; In phase 2, evaluation of available mammograms only; In Phase 3, evaluation of ultrasonograms in conjunction with the mammograms.

RESULTS

A total of 40 female patients of breast masses between 21 to 70 years age were evaluated by Ultrasonogram and Mammography in the present study. A maximum number of 12 lumps were identified in 41-50 years age group.

The most common presenting feature in all 40 patients (100%) was lump in breast. Pain was the second most common feature in 9 patients (22.5 %). Other clinical features in order were Retraction of nipple in 4 cases (10 %) and discharge from the nipple in 2 cases (5 %).

On ultrasonogram 36 / 40 lumps could be identifiable and in 4 cases no lumps could be identifiable due to dense breasts. Again on ultrasonogram 4/36 cases were identified as simple cysts and the remaining 32/36 were solid lesions. On Mammogram only 26/40 lumps could be identifiable. This shows that ultrasonogram is more sensitive in detecting mass lesion in 36 cases (90%) compared to mammography where only 26 cases (65%) are detected. The ultrasonogram features of 32 solid lesions are depicted in Table -1.

Criteria for characterization of lesion in 32 patients on the basis of ultrasonography are: 1. Shape, 2. Margins, 3. Width to A.P. dimension ratio, 4. Echotexture. 5. Shadowing 6. Pseudocapsule. 7. Calcification.

Criteria for characterization of lesion in 26 patients on the basis of mammography. are: 1. Shape 2. Margins 3. Calcification 4. Architectural distortion.

There were 10 benign, 9 indeterminate and 13 malignant lesions based on utrasonogram charecters. Finally the ultrasonogram findings are correlated with tissue diagnosis by performing ultrasound guided FNAC. In 4/40 cases of dense breasts and 4/40 cases of simple cysts FNAC was not performed. The FNAC finding are correlated and depicted in Table-1.

On mammographs only 26/40 cases lesions were identifiable. In 10 cases, the breasts images were too dense

		Tissue diagnosis	
Disease	**No. of Patients**	**Benign**	**Malignant**
Dense breast	4	Nil	Nil
Cystic lesion	4	Nil	Nil
Benign	10	8	2
Indeterminate	9	4	5
Malignancy	13	2	11

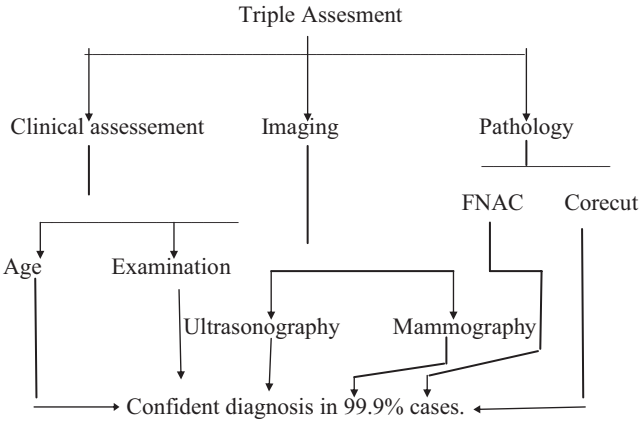
Table–1: Final Tissue diagnosis of mass lesions on US features (n=32)

			Tissue diagnosis	
BI-RADS Category	**Assessment**	**No. of cases (n=36)**	**Benign**	**Malignant**
1	Negative	Nil	Nil	Nil
2	Benign finding	Nil	Nil	Nil
3	Probably benign finding	07 (26.9)	05 (71.4)	02 (28.5%)
0	Need additional imaging evaluation	10 Dense breast	Nil	Nil
4	Suspicious abnormality	09 (34.6)	01 (11 %)	08 (88.8 %)
5	Highly suggestive of Malignancy	10 (38.4)	02 (20%)	08 (80 %)

Table–2: Final Tissue diagnosis vs BIRADS (mammography) **(N=32)**

Imaging findings	**(N = 40)**	**Percentage (%)**
Negative	4/40	10
Benign	16/40	40
Suspicious	20/40	50

Table–3: Combined mammographic and sonographic evaluation (n= 40).



Graph-1: Triple assessment protocol for evaluation of Breast masses

on mammograms and they required additional imaging evaluation. The lesions in 26 cases were again characterized based on mammographic features.

Out of 40 cases, there were 10 dense breasts cases and 26 lesions cases on mammogram. These 36 cases were incorporated in BIRADS systems and correlated with tissue diagnosis.

In table '2' there were 10 cases of dense breasts on mammogram, where no obvious mass lesion could be made out clearly; there cases were subjected further evaluation by ultra sonogram. On ultrasongram, there were again 4 dense breasts, where no lesion could be made out; In the remaining 5/6 cases probably benign and 1/6 cases probably malignant featured focal lesions were found. On tissue diagnosis all the 5/6 benign and 1/6 malignant character lesions on ultrasonogram were histologically proven as Benign lesions on FNAC.

On the final assessment after combined mammographic and sonographic evaluation of palpable abnormalities in 40 patients studied, 4 abnormalities (10%) had negative imaging findings (Dense Breasts). 16 abnormalities (40%) had benign findings. Benign causes of palpable abnormalities include cyst (n = 4); fibro adenoma (n = 11); phylloides tumor (n = 1). Out of 16 benign palpable abnormalities 6 lesion were mammogaphically occult and were described at sonographic evaluation. All the 20 lesions (50 %) categorized as suspicious lesion on combined imaging underwent FNAC. Among these lesions there were 18 cases of malignancies, one case of abscess and another one was fibroadenosis.

DISCUSSION

While evaluating a patient with palpable breast mass the main aim of the radiological investigation is to characterize mass lesion, to accurately define its course, in case of malignancy delineation of the extent of the disease and assessment of tumor resectability. Such information is crucial to plan the appropriate treatment option.[15-17]

For palpable breast mass "TRIPLE ASSESSMENT" should be involved to characterize lesion, which include clinical examination, imaging and FNAC for histological correlation. The positive predictive value for "Triple Assessment" exceeds 99%.

The role of mammography in patients with palpable breast lumps is to know the cause for the palpable abnormality, to support earlier intervention with malignant features, to screen the reminder of ipsilateral and contralateral breasts for additional lesions and to asses the extent of malignancy when cancer is diagnosed.[6] Multiple studies have shown that the false negative rate for a combined mammographic and sonographic evaluation varying from 0-2.6%.[2-5] however, in our series the false negative rate of mammography for breast cancer in patient with palpable abnormality of the breast has been reported to be high so that additional imaging with sonography is appropriate in most instance to reduces false negative rates.

In our series 5 (12.5%) of 40 palpable breast lumps

were categorized as benign after a combined mammographic and sonographic evaluation, clearly showing that the value of imaging to avoid unnecessary biopsies. Sonography is also able to characterize palpable lesions obscured by dense tissue on mammograms. Moss et al[14] reported that sonography increased cancer detection by 14% in symptomatic patients who were evaluated with both mammography and sonography. Our series reported that sonography increases cancer detection by 11.11% in symptomatic patients who were evaluated with both mammography and sonography.

In retroseptive analysis of 20 palpable suspicious malignant lesions the sonography detected malignancy in 13 cases (65%), compared with Georgian-Simith D et al[16] retrospective analysis of 293 palpable malignant lesion, sonography detected all cancers, this is mainly due to inter and intra observer variability in characterization of lesion as explained by Bakers et al.[15]

Further more sonography has been shown to be accurate in characterizing solid masses and on the basis of published criteria eight of the 32 lesions in our series which were considered as high probability of benign nature all the lesion that under went FNAC had benign histologic findings.

The role of US in breast imaging had evolved over the years. In most clinical practices, the use of breast US has been restricted to differentiation of cysts versus solid masses. To day, US also plays an important role in guiding interventional procedures such as needle aspiration, core – needle biopsy and pre biopsy needle localization.

It is important that the criteria for differentiating benign from malignant mass lesion should be strictly applied as emphasized by stavros et at.[11]

Our series observed as in the table (1) showing the frequency of specific US features observed by the two reviewers and the correlation between the specific feature and the tissue diagnosis. The US features most predictive of a benign tissue diagnosis were oval or round shape (83.3% of masses with this feature were benign), circumscribed margins (76.9 % were benign), and width-to-AP dimension ratio > 1.4. This study is compared with GUITA RAHBER et al[24] study – round shaped (94%) circumscribed margins (91%) and width-to-AP dimension ratio > 1.4 (89% lesions were benign. The features more predictive of malignant tissue diagnosis are irregular shape (91.6 %) ill defined margins (81.25%) and width-to-AP dimension ratio < 1.4 (75%), in respect to study of GUITA RAHBER et al[8] irregular shape (61%) and ill defined margins (50%) width-to-AP dimension ratio of < 1.4; our analysis showed that when two readers determined the presence of these features in a specific case, the probability of benignity was 100%.

Our retrospective analysis had shown the use of these features alone, when agreed by two observers, to identify mass that did not requires biopsy could have improved the overall positive predicitive value.

The readers assigned benign in 2 cases on ultrasonogram findings and in 3 cases on mammography findings which on tissue diagnosis proven to be malignant. So our analysis conclude that solid lesion either benign on US or mammography should undergo histological diagnosis for final assessment.

In our series among 20 suspicious lesions one case classified as benign by mammography but malignant on sonography compared with result of stavors et al among 125 lesions 64 were classified as benign at mammography but malignant by sonography.

In our series some features were not reliable in differentiating benign from malignant- for example hyperechoic lesion was very reliable as a predictive of benignity but it was present in only 4 / 9 (44 %) benign cases. Most of benign solid lesions presented as hypoechoic lesions this is mainly due to inter and intra observer variability.

The readers agreement was calculated from the k statistics was studied by Bakers et al.[15] They reported moderate interobserver and substantial intra observer aggrement for most categories. In our study high inter observer agreement (k = 0.8) for the shape, margin and width-to-AP dimension ratio and least (k = 0.2-0.4) for mass echotexture and echogenicity were noted. It is likely that the interobserver variability would be even higher if real time imaging were incorporated into the analysis. In our series of 32 solid nodules 18 were malignant and 14 were benign. The sonographic classification had a sensitivity of 88% (16 of 18) specificity 57 % (8 of 14) and positive predictive value of 72 % (16 of 22) and negative predictive value 80 % (8 of 10).

In our series the risk of malignancy correlated with sonographic features in 20 suspicious lesion. The shape feature was most predictive of malignancy, with PPV of 91% for irregular, 62 % for lobular, 16% for round shape masses. The posterior attenuation feature most predictive of malignancy was shadowing which was present in half the malignant lesions; Malignancy was present in 71 % (5 of 7) of lesions that had heterogeneous echotexture without cysts, 55 % (11 of 20) of homogeneous lesions and 28% (2 of 7) of heterogeneous lesions with cysts. Echogenicity did not discriminate between benign and malignant lesions, with PPV of 50

% (10 of 20) and 55% (5 of 9), for hypoechoic and hyperechoic lesions respectively, in comparision with Berg et al study. Diagnostic Mammography was perfomed to further asses solid masses with complex cyst detected on US. Diagnostic Mammography usually performed after FNAC and US because mammography can not distinguish cyst from solid mass, so performing US before diagnostic mammography will eliminate the need of mammography in cases of palpable breast lumps. In our analysis mammography was not done on 10 % of cases (4/40) due to presence of simple cysts on ultrasonogram. So in our series 36 cases were subjected to diagnostic mammography with palpable lumps, of which 10/36 cases are dense breast on mammo and 26/36 have palpable lumps detected on mammography. According to BIRADS assessment the lesion should be categorized for final assessment. as in the table 4.

On mammographic images the shape, margins and calcification are the important feature to determine the category of the lesion. In our series positive predictive value for masses was irregular shape 92.8% (13 of 14 cases) and speculated margins 100 % (10 of 10 cases). For calcification the PPV was 100 % in 3 + 3 cases where the calcification wgere pleomorphic linear(3) or clusters(3) bases of these findings the above lesion were designated as category 5 with positive predictive value of 80% for malignant lesions as explained by Libermen et al.[10]

In our series probably benign findings, categorized as BIRADS 3 were seen in 7 of 26 cases with well defined round margins. On tissue diagnosis (5 of 7) 71.4 % were benign and 2/7 cases were malignant 28.5 %. One was medullary carcinoma and the other one was duct cell carcinoma which where compared with study of varas et al. Suspicious abnormality categorized as BIRADS 4 with ill defined magins and asymmetric density of breast seen in 9 cases (34.6%) of which one case turned out as benign (abscess) and 8 cases were malignant on tissue diagnosis.

In ten cases of dense breasts on mammography, no obvious mass lesions were clearly made out (n= 10). These patients when subjected to other imaging modalities like US 6/10 mass lesions were detected (60 %) in our series and 4/10 remained as Dense breasts even on ultrasonogram. Sonography therefore is complimentary and superior to mammography in patient with palpable abnormalities; where lesions are obscured by dense breast- Shetty MK et al.[12] Variable mammogra-

	Clinical	US	Mammogram	FNAC
Sensitivity	83	88	81	90
Specificity	87.5	85.7	75	95
Positive Predictive value	91	88	86	98

Table-4: Palpable breast lumps: Results of triage of investigation:

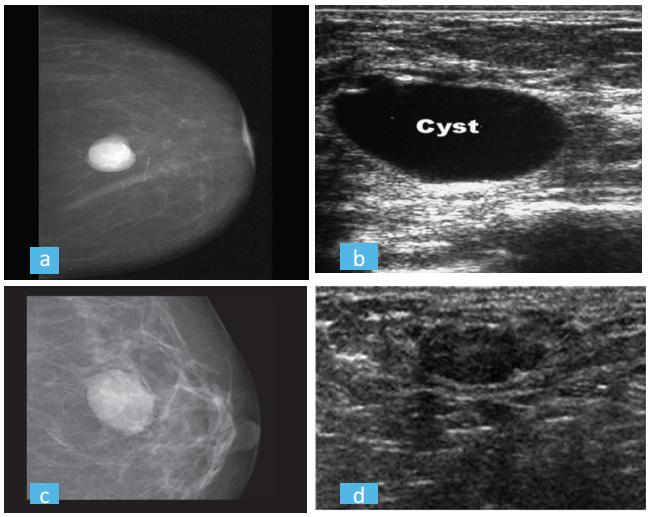


Figure-1: Benign Lesions: a &b represent simple cyst and c & d represent Fibroadenoma; a) Mammmogram revealing well defined oval lesion with smooth margins; b) Ultrasonogram revealing well defined cyst with post acoustic enhancement; c) Mammmogram revealing well defined oval lesion with lobulated margins; d) Ultrasonogram revealing hypoechoic lesion with lobulated margins

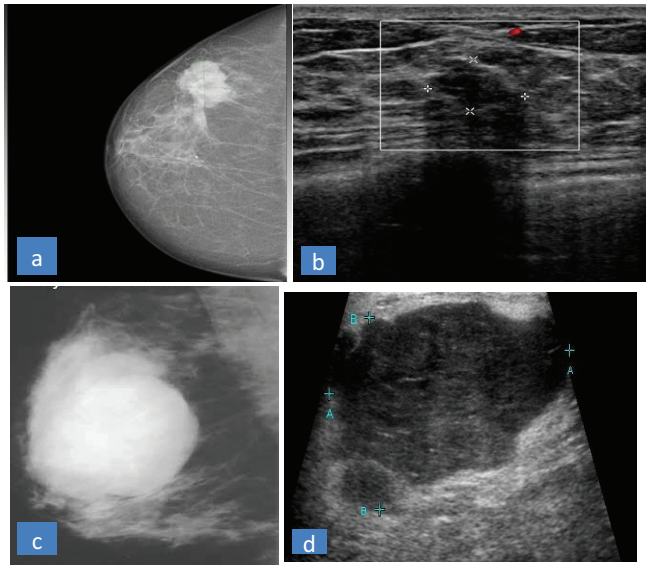


Figure -2: a&b Malignant breast lesion and c&d phyllodes tumor; a) Mammmogram revealing lesion with speculated margins; b) Ultrasonogram revealing irregular hypoechoic lesion with post acoustic shadowing; c) Mammmogram revealing large oval dense lesion with lobulated margins; d) Ultrasonogram revealing hypoechoic lesion with lobulated margins

phy interpretation between two observers notified were in the description of mass shape, margins, calcification and architextural distortion. When palpable lesions that had high probability of being benign on the basis of sonographic appearance were excluded, the positive predictive value of combined imaging for breast cancer in patients with palpable breast lumps who underwent biopsy was 40% in comparison.[17-22]

In a review article, Donegan[13] stated that most breast cancers appear as palpable masses, usually found by the patients. However, not all palpable abnormalities represent discrete masses; this is especially true in women younger than 40 years, in whom normal glandular nodularity may be mistaken for dominant mass. They also said small number of palpable masses detected on physical examination unfortunately turned out malignant in our series, 5% of the palpable lesions that underwent combined mammographic and sonographic imaging were malignant as comparision with MK. Shetty et al[12] series -there were 3.4 % of the palpable lesions that underwent combined mammographic and sonographic imaging turned out malignant. In our series, we included patient of all ages whom the clinician was concerned about the palpable abnormalities.

In our series the sensitivity and specificity of mammography alone was 81% and 75% and that of US alone was 88%, 85.7 % respectively. The sensitivity and specificity of mammography and ultrasound in combination was 88% and 50% which were compared with moss et al[14] and MK shetty el al.[12] The sensitivity and negative predictive value for combined mammographic and sonographuic assessement were 100 % with specificity of 80.1 % by MK shetty et al.[12] In Moss et al[14] series, the sensitivity and specificity of mammography alone was 78.9 % and 82.7 % respectively; of ultrasound alone were 88.9% and 77.9% respectively; and in combination were 94.2% and 67.9% respectively

The sensitivity of breast FNAC on palpable masses is 80 – 90 % (mean – 90%). The specificity and predictive value of breast FNAC is close to 100 % as false positive results are exceptionally rate. The efficiency of the test ranges from 75 % to 98%.[17 – 20]

CONCLUSION

Imaging plays a crucial role in investigating for any palapable breast mass. It is ideal to do "Triple assessment" which includes clinical examination, imaging and FNAC to assign benignity or malignancy to a breast lump. The efficiency of triple assessment ranges from 75 – 98 % in our study.

In the present study sonography has definite role in differentiating benign from malignant solid masses, but we found interobserver variability in final assessment which leads to false negative interpretation. Ultrasonogram is the imaging modality to diagnosis simple breast cysts and if found no further imaging or FNAC are required. Mammogram could not identify solid mass in a dense breast where sonography can be used as additional imaging modality to detect and characterized mass lesion which is cost effective.

Negative findings on combined ultrasound and mammography has a very high specificity and reassuring to the patient. The specificity, sensitivity and positive predictive value is high for FNAC as compared to the above said imaging modalities and hence, any solid lesion on ultrasonogram or mammogram should be followed up with FNAC. The sensitivity and specificity of ultrasonogram is more than that of mammogram in detection of solid mass lesion and hence, our study conclude that ultrasound can be used as a primary method of investigation for all breast masses.

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