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A Comparative Study of Mammography and Sonomammography with Histopathology in Evaluating Palpable Breast Masses

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ABSTRACT

Breast cancer is a leading cause of cancer mortality among women. Women have a 12.5% lifetime risk for developing breast cancer by 85 years of age.¹ Sensitivity, and specificity of sonography or mammography is higher if sonography and mammography are combined. The aim of this study is to evaluate the mammographic features and sonomammographic findings of the clinically palpable breast masses and characterize them into benign and malignant. The objectives being to compare categorized imaging findings of clinically palpable breast masses with histopathology as gold standard.

A prospective comparative study was conducted over a period of one and a half years (April 2016 to September 2017) on 89 patients with clinically palpable breast masses in MGM hospital , Navi mumbai . The data was correlated with histopathological findings and analysed using appropriate statistical tests. Out of 89 patients, 34 showed no evidence of mass lesion on mammography and sonography. 55 patients had findings on mammography , 20 patients had benign characteristics on both mammography and sonography. Out of 20, 7 lesions were mammographically occult and visualized on ultrasound of breast and 1 lesion was sonographically occult and seen on mammography. 7 patients had suspicious findings on combined evaluation and biopsy was advised and of these only 2 patients showed malignancy. To conclude benign pathologies of the breast are much more common than malignant ones. Combined mammographic, sonomammographic evaluation of breast masses was more accurate than either method alone which plays important role in diagnosing.

KEYWORDS: mammography, sonomammography, palpable breast lesions, breast cancer, breast pathologies

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INTRODUCTION

Breast cancer is a leading cause of cancer mortality among women. Women have a 12.5% lifetime risk for developing breast cancer by 85 years of age.¹ Great strides in early detection and improved treatment have decreased breast cancer related deaths. A palpable mass in a woman's breast represents a potentially serious lesion and requires evaluation by history taking, physical examination and mammography. Physical examination, imaging studies and FNAC or core biopsy are the essential management of palpable breast lesions as triple assessment². Mammography is a well-defined and widely accepted technique to evaluate clinically suspected breast lesions and screening for breast cancer. In the patient with dense breast, ultrasonography is a helpful modality; which helps in characterizing a mammographically detected palpable abnormality³. Sensitivity, and specificity of sonography or mammography is higher if sonography and mammography are combined.

The aim of breast imaging is to assess the probability of a lesion either being benign or malignant. Recently film screen x-ray mammography, real time ultrasonography, color doppler and MRI are used in combination for detection of breast cancer.

Screen Film Mammography:

Mammography is a specific type of radiological imaging which uses low dose x-rays for breast examination. It has importance due to its ability to detect earliest sign of malignancy, which often present as micro calcifications. It is the standard investigation for routine screening of the patients for breast diseases. It has high specificity in detecting invasive breast carcinomas.

Breast Ultrasound:

Ultrasound is real time imaging modality and has important role in characterizing a mass as solid or cystic. It is the preferred modality when compression of breast is not desired during pregnancy and lactation and in painful conditions. It is also valuable for evaluation of post surgical and irradiated breasts. Ultrasound is also used for the evaluation of lumps that are difficult to see on mammogram. At times, ultrasound is used as part of diagnostic procedures, such as needle biopsy or aspiration.

MATERIALS AND METHODS

Study Design

Prospective comparative study.

Study Place

Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai.

Study period and duration

The study was conducted for the period of one and half year from April 2016 to September 2017.

Sample size

A total of 89 patients with palpable breast lump were studied.

Source of Data

All female patients with clinically palpable abnormalities of breast during a period of 18 months who underwent a combined mammographic and sonographic evaluation of breast at Department of Radio-diagnosis, Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai were studied.

Selection Criteria

Inclusion

- Women above 18 years of age with palpable masses of breast who gave consent to the imaging modalities.

Exclusion

- Previously diagnosed case of breast carcinoma.
- Women with fungating mass in breast and mass adherent to chest wall where performing mammography is difficult.
- Pregnant and lactating women.
- Post-traumatic and post inflammatory breast swellings.

Ethical Clearance

Prior to the commencement, the study was approved from the Ethical and Research Committee, Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai .

Informed consent

The patients fulfilling selection criteria were informed about the nature of the study and a written consent is obtained from the patients before enrollment.

Method of collection of data

A structured pre-prepared case proforma was used to enter the patient details, detailed clinical history including menstrual history, history of mastalgia, lactation history, past and family history of any breast problems, and physical examination of patients who meet the inclusion criteria.

All patients underwent diagnostic mammography, which included standard cranio-caudal, and medial-lateral oblique views. Later all the patients were subjected to ultrasound of breast.

- Mammography was performed with Siemens Mammomat 3000 Nova equipment in two views (i.e., cranio-caudal & medio-lateral oblique views).
- Sonographic examination was performed with High resolution, 3– 12 MHz, linear array transducer of Philips HD-11XE & HD-15 USG machine.

The features of Mammography was then characterized into benign and malignant lesion considering the following:

- Mass shape
Oval/Round/Irregular.
- Mass margin
Circumscribed/Micro lobulated/Spiculated / Ill-defined .
- Calcification
Punctate/Coarse/Micro/Granular/pleomorphic
- Architectural distortion
- Nipple retraction

The features of Sonomammography will be then characterized into benign and malignant lesion according to the BIRADS LEXICON considering the following gray scale findings:

- Mass shape - Oval / Round / Irregular.
- Mass margin - Circumscribed / Micro-lobulated / Spiculated / Ill-defined .
- Mass orientation - Parallel / Non parallel
- Posterior acoustic shadow - No features / Enhancement / Shadowing / Combined
- Lesion boundary - Abrupt interface / Echogenic halo
- Echo pattern - Hyperechoic / Isoechoic / Hypoechoic / Complex / Anechoic

A standardized final assessment based on American College of Radiology Breast imaging reporting and Data system shall be made. Thus the lesions will be categorized as benign, malignant, probably benign or probably malignant.

Table 1. Final Assessment of BI-RADS

	Category Description
0	Incomplete assessment-Needs additional imaging evaluation
1	Normal-No abnormality detected
2	Benign finding
3	Probably benign finding-Short interval follow up suggested
4	Suspicious Abnormality-Biopsy Should be Considered
5	Highly Suggestive of Malignancy-Appropriate Action Should be Taken (Almost certainly malignant)
6	Known biopsy proven malignancy

Histopathology / Cytology report

- Histopathology was done in the form of fine needle aspiration cytology or biopsy. Non-diagnostic smears to be repeated.
- The mammographic and sonomammographic findings will be correlated with histopathology findings to consider the lesion as malignant or benign.

Statistical analysis

The data obtained was coded and entered in Microsoft Excel Spreadsheet. The categorical data was expressed as rates, ratios and percentages and comparison was done using chi-square test. Continuous data was expressed as mean $\pm$ standard deviation. The diagnostic accuracy of

mammography in predicting breast lumps was determined by sensitivity, specificity, positive predictive value and negative predictive value. Kappa agreement was used to correlate the agreements between diagnosis. A 'p' value of less than or equal to 0.05 was considered as statistically significant.

RESULTS

This 18 months comparative study was conducted from April 2016 to September 2017. A total of 89 patients with palpable abnormalities of the breast who underwent combined study of sonography and mammography evaluation in Department of Radio-diagnosis, Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai were studied. The data obtained was analysed and the final results were tabulated. Out of 89 patients, 34 showed no evidence of mass lesion on mammography and sonography. 55 patients had findings on mammography, 20 patients had benign characteristics on both mammography and sonography. Out of 20, 7 lesions were mammographically occult and visualized on ultrasound of breast and 1 lesion was sonographically occult and seen on mammography. 7 patients had suspicious findings on combined evaluation and biopsy was advised and of these only 2 patients showed malignancy.

Table 2: **Description of palpable abnormalities**

Description	Frequency
Lump	49
Thickening	18
Not Specific	22
Total	89

Table 3: **Distribution of Breast lesions according to the side of involvement**

Side	Frequency
Left	25
Right	30
Bilateral	34
Total	89

Table 4: **Distribution of shape of masses on sonography**

Shape	Frequency
Oval	33
Lobulated	14
Tubular	1
Ill-defined	7
Total	55

Table 5: **Distribution of mammographic Descriptions of margins of palpable breast masses**

Margins	Frequency	Percentage
Well-defined	38	70.4%
Spiculated	17	29.6%
Total	55	100.0%

Table 6: **Distribution of density of palpable breast masses on mammography**

Density	Frequency
Hyperechoic	30
Hypoechoic	10
Mixed	15
Total	55

Table 7: **Distribution of density of palpable breast masses in ultrasound.**

Echogenicity	Frequency
Hyperechoic	45
Anechoic	8
Isoechoic	2
Total	55

Table 8: **Assessment of mammographic evaluation of palpable abnormalities in 89 patients**

Mammography	Frequency
Normal	35
Benign	36
Suspicious	16
Malignant	2
Total	89

Table 9. **Assessment of sonographic evaluation of palpable abnormalities in 89 patients**

Sonography	Frequency
Normal	35
Benign	36
Suspicious	16
Malignant	2
Total	89

Table 10: **Distribution of Cases of combined sono-mammographic evaluation**

Combined	Frequency
Normal	24
Benign (Cyst)	9
Benign (FCC)	9
Benign (FA)	16
Benign (FA+FCC)	5
Benign (Galactoceles)	2
Benign (Abscess)	6
Duct ectasia	1
Malignant	11
Total	89

Table 12: **Accuracy of combined evaluation with histopathological evaluation of palpable breast masses**

Pathology	Frequency	Percentage
Benign	43	79.63%
Malignant	12	20.37%
Total	55	100.00%

Table 13: **Test Characteristics for combined Mammographic & Sonographic evaluation in 89 patients with palpable abnormalities of breast**

Sensitivity	Specificity	PPV	NPV
0.0%	81.8%	0.0%	17.6%
2.4%	27.3%	11.1%	6.8%
2.3%	9.1%	9.1%	2.3%

Table 14: **Parameters depicting comparison of benign and malignant lesions by combined evaluation**

		Pathology			
		Malignant	Benign	Statistics	P-Value
		Count	Count		
Description	Lump	38	11	Chi-square	1
	Thickening	5	0	df	1
	Not Specific	0	0	Sig.	.235 ^a
	Total	43	11		
Side	Left	17	4	Chi-square	3
	Right	17	7	df	2
	B/L	9	0	Sig.	.176 ^a
	Total	43	11		

Shape	Oval	31	1	Chi-square	33
	Lobulated	11	3	df	3
	Tubular	1	0	Sig.	.000 ^{a,*c}
	Ill-defined	0	7		
	Total	43	11		
Margins	Well-defined	35	2	Chi-square	18
	Spiculated	7	9	df	1
	Total	42	11	Sig.	.000 ^{a,*}
Density	Hyperechoic	25	5	Chi-square	6
	Hypoechoic	9	0	df	2
	Mixed	9	6	Sig.	.047 ^{a,*}
	Total	43	11		
Echogenicity	Hyperechoic	34	11	Chi-square	3
	Anechoic	7	0	df	2
	Isoechoic	2	0	Sig.	.251 ^{a,c}
	Total	43	11		
Mammography	Malignant	0	2	Chi-square	8
	Benign	42	9	df	1
	Total	42	11	Sig.	.005 ^{a,*c}
Sonography	Malignant	1	8	Chi-square	31
	Benign	41	3	df	1
	Total	42	11	Sig.	.000 ^{a,*}
Combined	Malignant	1	10	Chi-square	42
	Benign	42	1	df	1
	Total	43	11	Sig.	.000 ^{a,*}

FIGURES

CASE 1: 43-year-old woman presents with a palpable mass in the right breast Findings

- Mammogram: There is a lobulated, well-circumscribed, high-density mass in the center of the breast. This could be a complex cyst or solid mass.
- Ultrasound: Macro lobulated homogeneously hypoechoic solid mass with a thin echogenic margin that is wider than tall.
- ACR BI-RADS 2
- Diagnosis: **Benign Fibroadenoma**, confirmed on pathology.

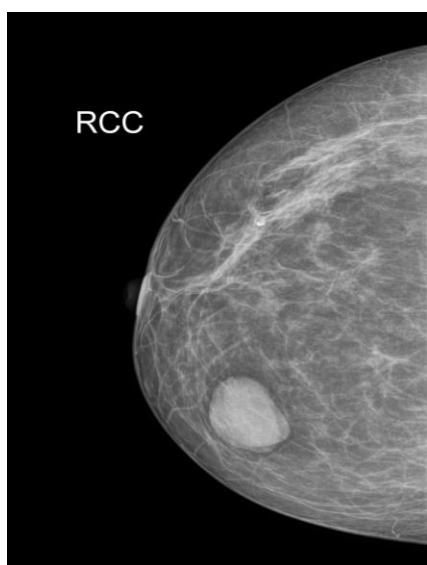


Figure 1.A. Fibroadenoma.
Right cranial caudal view

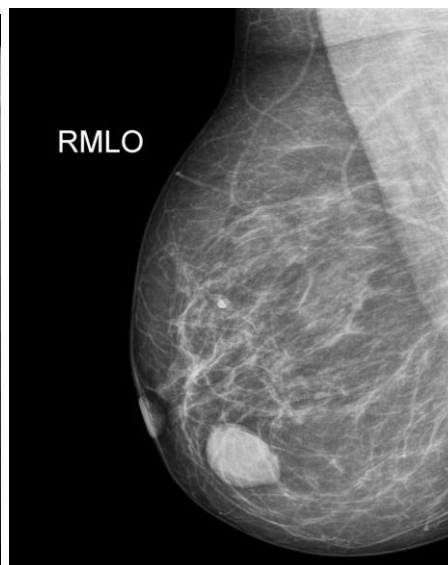


Figure 1.B. Fibroadenoma.
Right mediolateral-
oblique view mammogram

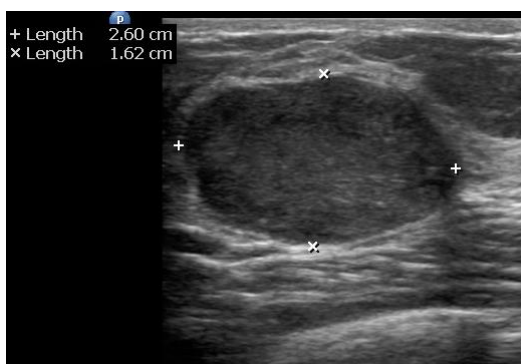


Figure 1.C. Fibroadenoma. USG
image (wider than taller)

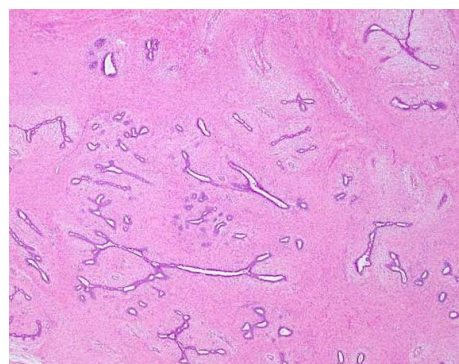


Figure 1.D. Fibroadenoma
(H & E)

CASE 2

42 years old female

Mammography findings:

Both breasts display extremely dense parenchyma which limits mammographic evaluation falling under ACR Category D.

No mass lesion, microcalcification, asymmetric areas or architectural distortion is seen.

Skin, subcutaneous tissue and nipple areolar appear normal.

No significant axillary lymphadenopathy seen

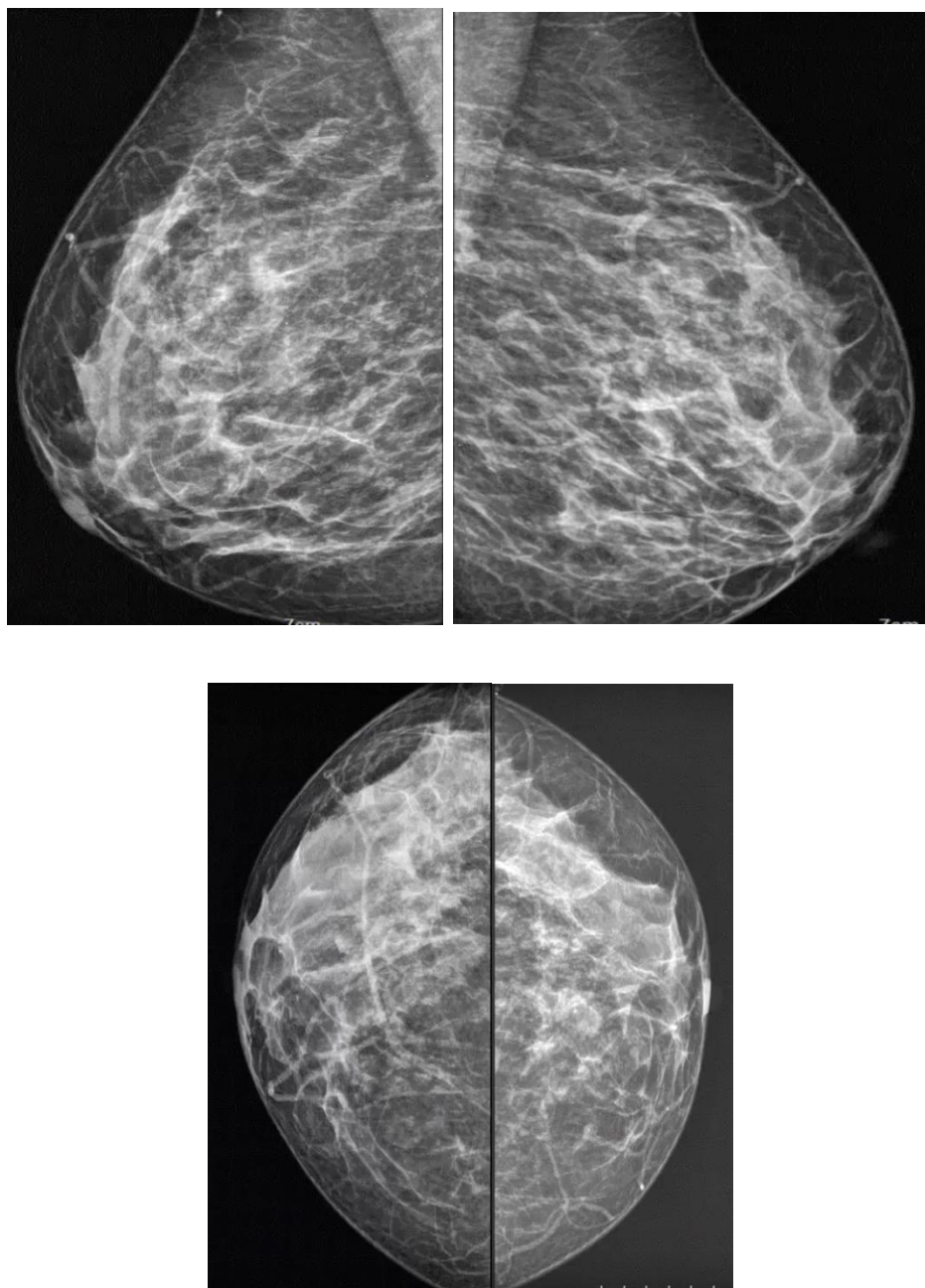


Figure2. Dense breast parenchyma in FCC. A. Mediolateral oblique view mammogram. B.. Cranio-caudal view mammogram

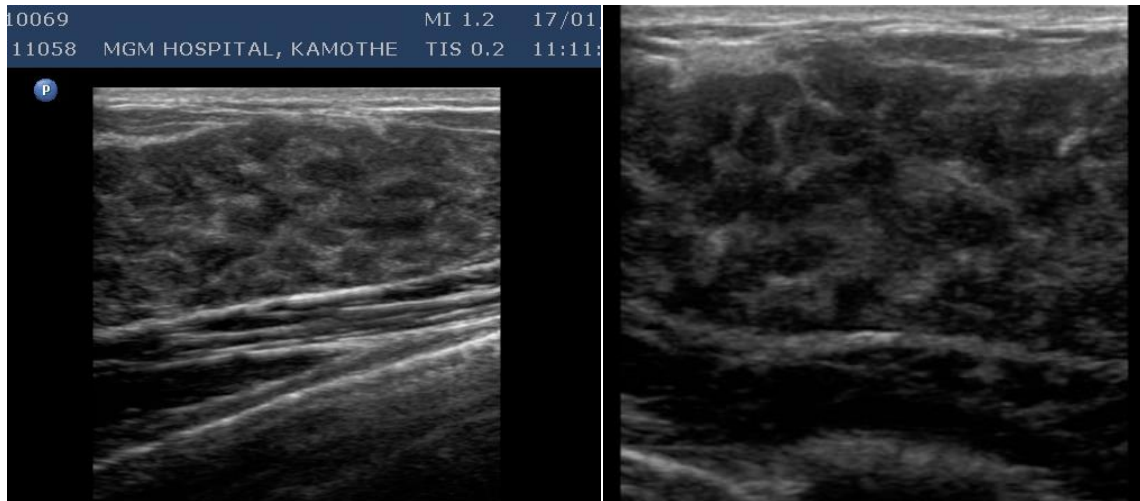


Figure 2C. FCC. USG of dense fibro glandular tissue with cystic changes, however no evidence of any mass. Figure 2.D. FCC (zoomed in image)

Ultrasound findings :

Prominent fibro-glandular architecture noted bilaterally ,however no discernible mass noted.

No evidence of any calcification ,nipple retraction or skin thickening.

Diagnosis: Fibrocystic changes (FCC) / fibroadenosis

ACR BI-RADS Category 3

CASE 3

55-year-old woman with a rapidly enlarging palpable mass in the left breast

Findings

- Mammogram: Round, equal-density, non-calcified mass with partially obscured margins .Ultrasound: Round, heterogeneously hypoechoic mass with relatively circumscribed margins and associated posterior acoustic enhancement .
- Diagnosis – **Phyllodes Tumor** (Pathology confirmed)
- **ACR BI-RADS Category 4**

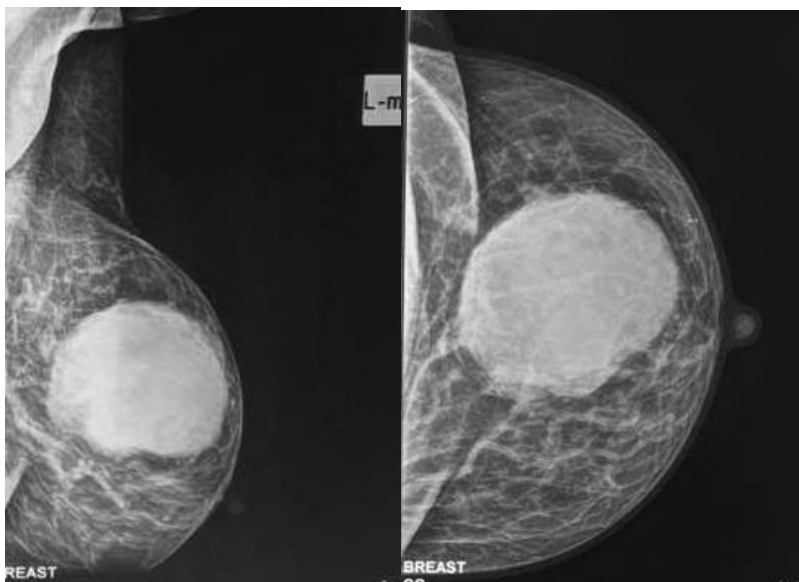


Figure 3.A. Phyllodes tumor. Left mediolateral-oblique & cranio-caudal views mammogram

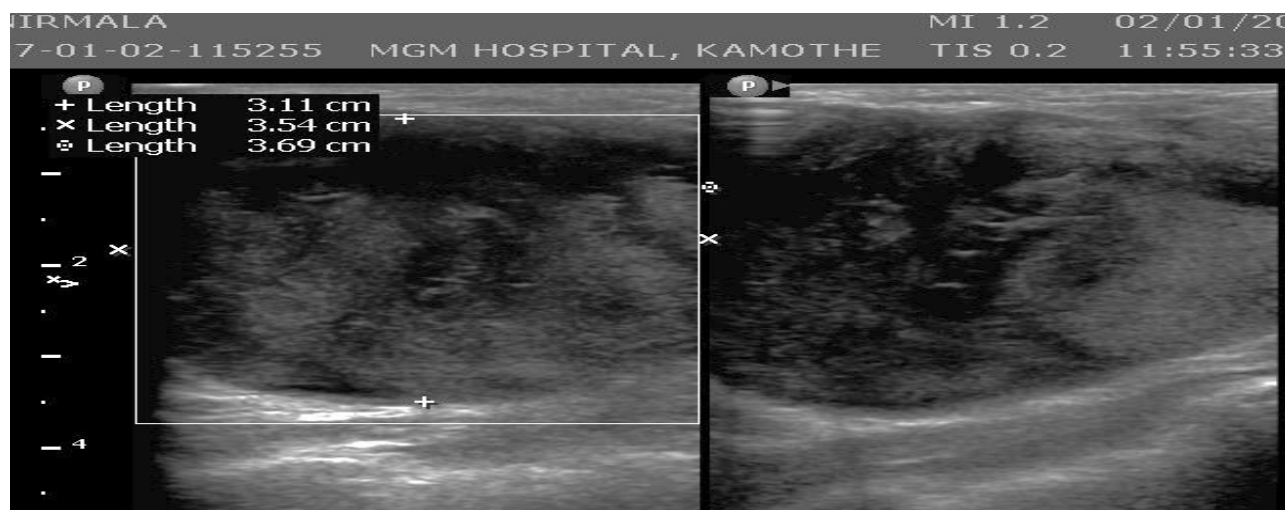


Figure 3.B. Phyllodes tumour. Ultrasound image showing heterogeneously hypoechoic mass.

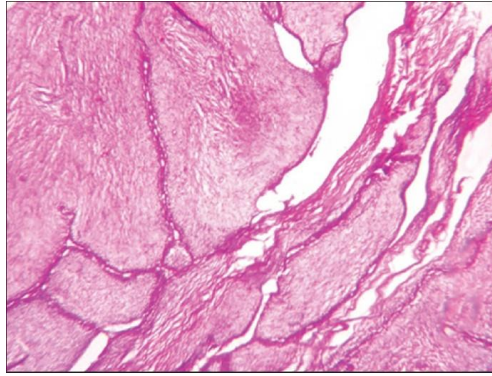


Figure 3.C. Histology of Phyllodes tumor.

CASE 4

33-year-old woman with complaint of lump in the left breast with nipple discharge.

Findings

- Mammogram: Well defined double density opacities noted.
- Ultrasound: Cystic structure with internal solid mural mass.
- Diagnosis: Aspirated fluid was bloody and pathology confirmed,
Intracystic papillary carcinoma.

ACR BI-RADS category 5

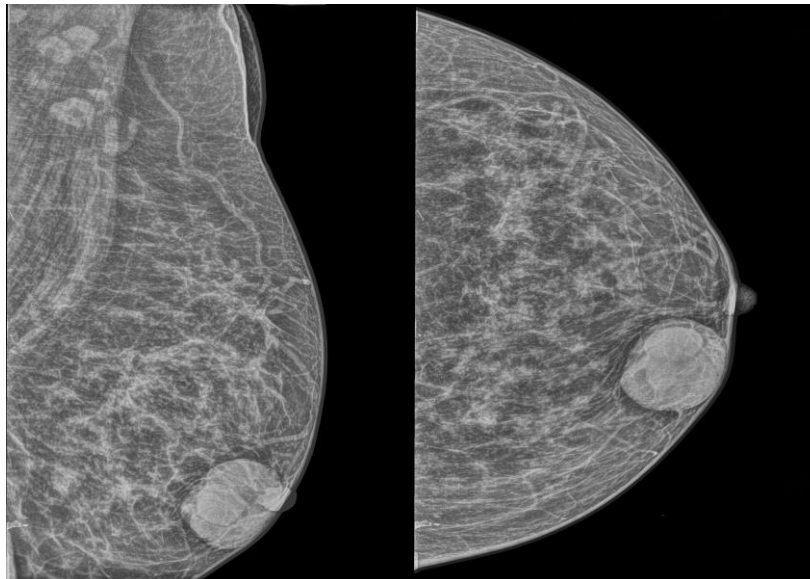


Figure 4.A. Intracystic papillary carcinoma. Left mediolateral oblique view mammogram Figure 4.B.

Intracystic papillary carcinoma. Left cranio-caudal view mammogram

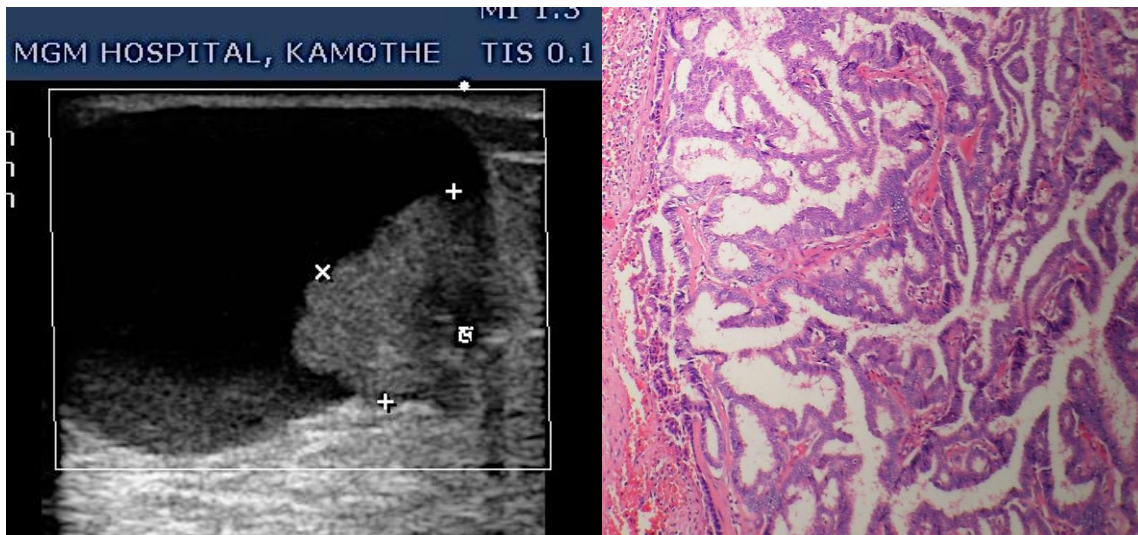


Figure 4.C. Intracystic papillary carcinoma. USG shows solid component within cystic structure. Figure 4.D. Intracystic papillary carcinoma from the solid component.

CASE 5

47-year-old woman with a palpable mass in the left breast.

Findings

- Mammogram: Light density, lobular, circumscribed mass in the deep central breast.
- Ultrasound: Heterogeneous predominantly hypoechoic mass with micro lobulated margins. **ACR BI-RADS Category 5**
- Pathology confirmed – **Invasive Mucinous carcinoma**

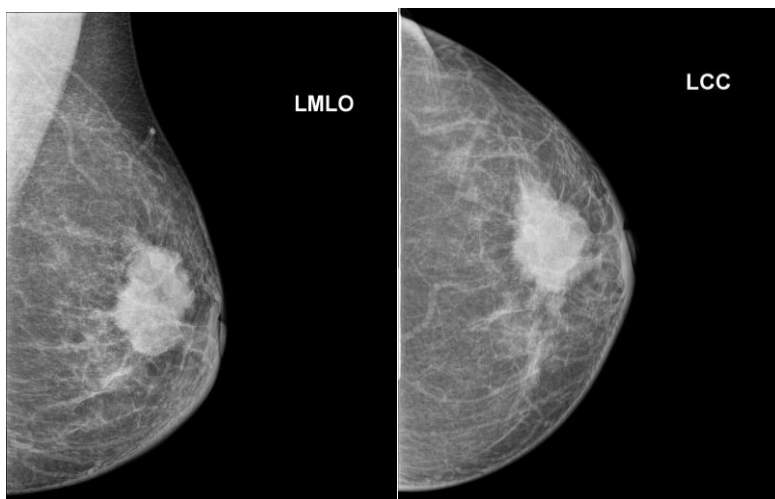


Figure 5.A. Invasive Mucinous Carcinoma, Left mediolateral-oblique view mammogram

Figure 5.B. Invasive Mucinous Carcinoma, Left cranio-caudal view mammogram

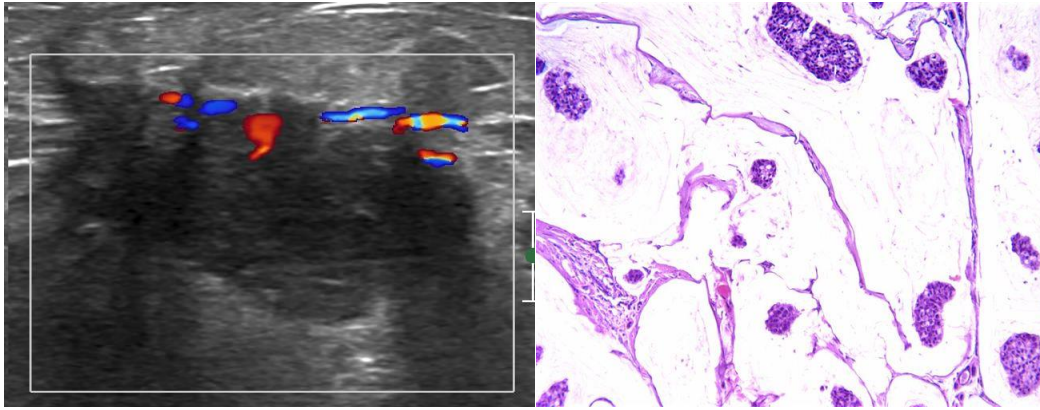


Figure 5.C. Ultrasound of Invasive carcinoma. Figure 5.D. Invasive Mucinous carcinoma(histopath image.)

DISCUSSION

Although various radiographic modalities are readily available to identify lesions that are suspicious for breast cancer, mammography remains the mainstay of breast cancer screening. The role of mammography in patients with palpable breast lumps is to show a benign cause for palpable abnormality and to avoid further intervention, to support earlier intervention for a mass with malignant features, screen the remainder of the ipsilateral and contralateral breast for additional lesions, and to assess the extent of malignancy when cancer is diagnosed. However the false negative rate of mammography for breast cancer in patients with palpable abnormalities of the breasts has been reported to be as high as 16.5 %⁵. Multiple studies have shown that the false negative rate for a combined mammographic and sonographic evaluation varies from 0% to 2.6%^{3,4,5}. Additional imaging with sonography is appropriate in most instances, with the exception of lesions that are mammographically benign as noted above or lesions that are highly indicative of malignancy, in which sonographic imaging would not add any additional information. Sonography may obviate the need for intervention by showing benign causes of palpable abnormalities such as cysts, benign intra mammary lymphnodes, extravasated silicon and superficial thrombophlebitis or Mondor disease of the breast. In this study, 43 (48%) of the 89 lesions were categorized as benign after a combined mammographic and sonographic evaluation, clearly showing the value of imaging in helping avoid unnecessary biopsies. In these patients sonography was able to categorize palpable lesions obscured by dense tissue on mammograms. In this study 1 lesion (fat necrosis) was sonographically occult and was visualized only on mammography. 7(14%) of the 50 lesions were mammographically occult and were seen only on ultrasound. Of these 6

were benign cysts and 1 was duct ectasia. Sonography therefore is complimentary to mammography in patients with palpable abnormalities; its superiority over mammography is in being able to show lesions obscured by dense breast tissue and in characterizing palpable lesions that are mammographically visible or occult. Mammography is complimentary to sonography because of its ability to screen the remainder of the ipsilateral and contra lateral breast for clinically occult lesions. It has been reported that the accuracy of sonography is comparable with that of mammography as a screening modality for breast cancer. In this study only 7 of the 50 palpable abnormalities underwent biopsy on the basis of imaging findings and only 2 (4%) showed malignancy. A small number of palpable masses detected on physical examination are malignant; in this study 4 % of the palpable lesions that underwent combined mammographic and sonographic imaging were cancer. Their findings are comparable with present findings of sensitivity of 100 % and specificity of 84.3% in patients with palpable breast lumps.

CONCLUSION

Benign pathologies of the breast are much more common than malignant ones. Combined mammographic, sonomammographic evaluation of breast masses was more accurate than either method alone which plays important role in diagnosing. It also helps to characterize the palpable mass lesions and avoid unnecessary interventions in which imaging findings are unequivocally benign. Negative findings on combined mammographic and sonomammographic evaluation have very high specificity and are reassuring to the patient. This study was undertaken to evaluate the role of mammography and sonography in characterizing the palpable breast masses. The study includes 89 patients with palpable breast abnormalities. Out of 89 patients, 34 showed no evidence of mass lesion on mammography and sonography. 55 patients had findings on mammography , 20 patients had benign characteristics on both mammography and sonography. Out of 20, 7 lesions were mammographically occult and visualized on ultrasound of breast and 1 lesion was sonographically occult and seen on mammography. 7 patients had suspicious findings on combined evaluation and biopsy was advised and of these only 2 patients showed malignancy. 4% of patients showed malignancy in this particular study. The positive predictive value for cancer lesions undergoing biopsy that showed questionable findings on combined mammographic and sonographic evaluation was 28.5%

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