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Role of B Mode in Evaluating Malignant Breast Masses

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ABSTRACT

Background: *Breast cancer now represents the most common female malignancy in developing and developed world, and is the second leading cause of cancer death among women. USG is an ideal imaging modality due to its cost effectiveness and no ionizing radiation. Sonography has proved a useful adjunct to mammography, offering heightened discrimination of palpable lesions, notably in the more radiodense premenopausal breast. Accurate differentiation between benign and malignant breast nodules could result in improved care and reduction of patient discomfort, morbidity and health care cost. The purpose of the study is to help in establishing the role of sonography in differentiating malignant and benign breast lumps.*

Aim: *1. To determine whether real-time B-Mode ultrasound is reliable in differentiating benign from malignant breast nodules.*
2. Compare and correlate the ultrasound findings with biopsy results.
3. Assess the risk of malignancy for each type of ultrasound features in breast nodules.

Materials and Methods: *This is an observational study with diagnostic test evaluation. Study was conducted at Dept of Radiodiagnosis in our hospital, a tertiary care centre with advanced services and one of the major referral centres in central Kerala. Breast ultrasound studies were performed for 64 women. Confirmation of ultrasound results was made by histopathology done by pathologist. Later the tissue diagnosis results were correlated with sonological findings by statistical analysis.*

Results: *In our study sonography showed a sensitivity of 95.3%, specificity of 85.7% and PPV of 93.2%. The accuracy of sonological evaluation was 92.2% with NPV of 90%.*

Conclusion: *Our study shows that a combination of B-Mode and Doppler ultrasound should continued to be used as an adjunct to mammography. The value is greatest when mammographic findings are indeterminate and the decision to biopsy or follow-up can be enhanced by the addition of ultrasound.*

Keywords: *Ultrasound scan, malignancy, benign.*

INTRODUCTION

A lump in the breast is a cause of great concern. Breast cancer now is the second leading cause of cancer death among women.[1] Currently, India reports roughly 100000 new cases annually.[2] USG is an ideal imaging modality due to its cost effectiveness and no ionizing radiation. Sonography has proved a useful adjunct to

mammography, offering heightened discrimination of palpable lesions, notably in the more radiodense premenopausal breast. It is believed that the progress in the understanding of the predictive value of the different criteria utilized either in isolation, or in combination for categorizing breast nodules detected by multiple imaging methods, is a significant step towards reducing the number of biopsies with benign results.[3]

Sonographic findings suspicious for benign nodule: Pure and intensely hyperechoic texture, Elliptical shape, wider than tall, complete thin, echogenic capsule, Gently lobulated (less than four) shape, complete thin capsule

Sonographic findings suspicious for malignancy in solid nodules

Spiculation and Thick, Echogenic Halo: Spiculation consists of alternating hypoechoic and relatively hyperechoic straight lines radiating out perpendicularly from the surface of the nodule indicating the presence of invasion of the lesion into the surrounding tissues. In invasive nodules that are surrounded by fat, only hyperechoic spiculations are visible, whereas in lesions surrounded by hyperechoic fibrous tissues, only hypoechoic spiculations are seen, the thick, echogenic halo represents hyperechoic spicules that are too small to resolve sonographically. Occasionally, a thick, ill-defined, echogenic halo is the result of peritumoral edema rather than unresolved spiculations. Spiculation has a very good positive predictive value but a low sensitivity.[4,5,6]

Angular Margins: The presence of angular margins is especially valuable because it can occur in both spiculated and circumscribed malignant nodules. The angles on the surface of the solid nodule may be very acute, 90 degrees, or even obtuse. As the nodule enlarges horizontally along the undersurface of the anterior mammary fascia, it encounters the base of a Cooper's ligament, where the anterior mammary fascia is absent and where the resistance to invasion is low. Tumor grows into the base of Cooper's ligament, assuming the angular shape of the base of the ligament.

Microlobulations: are much smaller (1 or 2 mm), more numerous, and closer together. Microlobulations that have angular configurations or are associated with a thick, echo genie lesion suggest the presence of a micronodular invasive tumoral.[4] Microlobulations that are rounded and thinly encapsulated suggest the presence Ductal carcinoma in-situ. Cancerized lobules can become abnormally enlarged, and the presence of multiple enlarged cancerized lobules may contribute to microlobulation.

Taller-than-Wide Shape: Taller-than-wide shape is unique to sonography. Taller-than-wide indicates that the lesion's anteroposterior (AP) dimension is larger than either of its horizontal dimensions. Fornage et al. showed that having a larger AP dimension was primarily a feature of small malignant nodules that had a volume of less than 1 Ml. Benign lesions remain confined within and grow parallel to the tissue planes and therefore are wider than tall.[7] Malignant lesions, on the other hand, can invade across normal tissue planes and grow in an axis that lies perpendicular to the axis of the tissue planes. The taller-than wide shape in small, but not large, cancers reflects the shape of the underlying lobule in which the carcinoma arose. Most cancers are thought to arise at the level of the terminal ductolobular unit (TDLU), at the junction of the extralobular terminal duct with the lobule. The DCIS then grows proximally in the terminal duct toward the large ducts and peripherally into the lobule, cancerizing the intralobular ductules.

Acoustic Shadowing: Acoustic shadowing is an internal characteristic that is unique to sonographic evaluation of solid breast nodules. It reflects the desmoplasia induced by malignant nodules that lie primarily at the speculated end of the spectrum. Many circumscribed breast carcinomas contain relatively little or even no desmoplasia. The degree of acoustic shadowing caused by a malignant nodule depends on the frequency of the ultrasound beam with which it is

scanned. Thus, lesions scanned at 12 MHz will cause more acoustic shadowing than those scanned with a 7-MHz beam. Not all spiculated lesions that cause acoustic shadowing are low-grade invasive ductal carcinomas and that not all lesions associated with enhanced through transmission are high grade invasive ductal carcinomas. There is a differential diagnosis for malignant-appearing solid nodules that have enhanced through transmission that includes the rare special-type tumors in addition to high grade invasive ductal carcinomas. Thus, the differential diagnosis for malignant-appearing nodules that demonstrate enhanced through-transmission, in order of prevalence, includes: high-grade invasive ductal carcinoma, colloid (mucinous) carcinoma larger than 1.5 cm, medullary carcinoma, metaplastic carcinoma, and invasive papillary carcinoma. Likewise, some special-type tumors and lobular carcinoma must be considered in the differential of malignant-appearing nodules that cause acoustic shadowing.[4]

The differential diagnosis for lesions that cause acoustic shadowing, in order of prevalence, includes: low-grade invasive ductal carcinoma, invasive lobular carcinoma, tubular carcinomas 1.5 cm or larger, and tubulolobular carcinoma. The differential diagnosis for lesions with normal through-transmission, in order of prevalence, includes: intermediate-grade invasive ductal carcinoma, small tubular carcinomas less than 1.5 cm, small colloid carcinomas less than 1.5 cm, and small tubulolobular carcinomas less than 1.5 cm in maximum diameter.

Hypoechogenicity: The echogenicity of solid nodules must be compared with the echogenicity of fat, not with that of hyperechoic fibrous tissues. Hypoechogenicity is a finding unique to sonography. It is a mixed finding that can be seen in both invasive carcinomas and pure DCIS lesions. It has a propensity to occur in high-grade invasive ductal carcinomas and high-nucleargrade DCIS lesions. On the otherhand hyperechoic lesion is almost a sure sign of benignity.[8]

Heterogeneity of Breast Cancer: The gross morphologic features of malignant nodules span a spectrum from circumscribed to spiculated. Additionally, there are heterogeneous lesions in the middle of the spectrum that have mixed features.

Incompressibility and absent echogenic capsule

Incompressibility is a feature that is particularly useful in the diagnosis of well-circumscribed carcinoma that may simulate benign lesions .This feature is also useful for malignant masses with the same reflectivity as surrounding tissues (isoechoic lesions) that are easily overlooked. In one study by Hasini et al, 100% malignant lesions were incompressible[9]. Hence incompressibility has got a negative predictive value of 100%. Also they concluded that the most discriminating benign ultrasound characteristic as compres-sibility. Similarly thin echogenic capsule is a sonographic feature of benign masses.[10]The presence of a thin, well-circumscribed, echogenic capsule around a solid nodule indicates a slowly growing and non¬infiltrating leading edge of the lesion. Such growth is typical of fibroadenomas and other benign processes. In the Stavros etal 1995 study, 75% of all benign nodules that underwent biopsy were completely encompassed by a thin, echogenic capsule, and the negative predictive value of a complete thin, echogenic capsule was 98%.[5]

AIMS AND OBJECTIVES

- To determine whether real-time B-Mode ultrasound, is reliable in differentiating benign from malignant breast nodules.
- Compare and correlate the ultrasound findings with biopsy results.
- Assess the risk of malignancy for each type of ultrasound features in breast nodules.

MATERIALS AND METHODS

STUDY DESIGN: Observational study with diagnostic test evaluation.

DURATION OF STUDY: The study was performed from July 2013 to June 2014 for a period of one year .Ethical clearance was obtained from the Institutional Ethical Committee of the Govt. T.D. medical college , Alappuzha before the study commenced

STUDY POPULATION: The study population consisted of women over the age of 30 years who visited the mammography unit at our hospital. Breast sonographic imaging is used as a routine procedure as part of the workup for the classification of solid breast nodules, before histologic specimens are obtained. The patients were recruited when nodules were detected on mammography and where the nodules were palpable on clinical examination.

INCLUSION CRITERIA; Over 30 years of age, Presented with a breast nodule either on clinical examination or with Mammography

EXCLUSION CRITERIA: Participants not willing to undergo histopathological evaluation by biopsy or FNAC and subjects already underwent biopsy/FNAC, prior to USG examination.

SAMPLE SIZE: Sample size was calculated using the Buderer'sformula.[11]N(Sn) = (z2 x (Sn x (1-Sn))/W2))/P N(Sp) = (z2 x (Sp x (1-Sp))/W2))/(1-P) Where Sn=sensitivity, Sp=specificity , Z=1.96(for 95% CI), W= precision, P= prevalence. Sensitivity and specificity used in computing were 88% & 96%,were taken from literature.[6] Prevalence of breast cancer in the sample to be studied was assumed to be20% from data collected from hospital records. W was set as 0.20. The sample size thus calculated was obtained as 56. In our study we include 64 subjects.

METHOD

Each participant was asked to complete and sign informed consent. Participants were interviewed to collect personal and clinical data. A structured, pre-prepared case proforma (CP) was used to enter the clinical history, physical examination findings, investigations- sonography and histopathology findings.

Breast ultrasound studies were performed with Siemens Acuson X300 USG machine using a high frequency (-7.5 MHZ) linear array transducer (VF 13-5 probe). Confirmation of ultrasound results was made by histopathology done by pathologist. The tissue diagnosis was obtained in all cases. Later the tissue diagnosis results were correlated with sonological findings by statistical analysis.

STATISTICAL METHODS

Pearson's chi-squared test *(x2)* is a statistical test applied to sets of categorical data to evaluate how likely it is that any observed difference between the sets arose by chance. It measures the strength of the linear relationship between two variables. The chi-square statistic compares the observed count in each table cell to the count which would be expected under the assumption of no association between the row and column classifications. The chi-square statistic may be used to test the hypothesis of no association between two or more groups, populations, or criteria. A low p-value forthis test (less than 0.05) implies that there is evidence to reject the null hypothesis or that there is a statistically significant relationship between the two variables.

The value of the test-statistic is

$$x^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where x^2 = Pearson's cumulative test statistic, O_i= an observed frequency; E_i = an expected (theoretical) frequency, asserted by the null hypothesis; n = the number of cells in the table.

SENSITIVITY, SPECIFICITY AND ACCURACY

Sensitivity relates to the test's ability to identify a condition correctly. Specificity relates to the test's ability to exclude a condition correctly[12]

	Disease present	Disease absent
Test positive	a(TP)	b(FP)
Test negative	c (FN)	d(TN)
	Sensitivity; a/(a+c)	Specificity; d/ (b+d)

TP: True positive, FP: False positive, FN: False negative, TN:Trae negative

table for calculation of sensitivity & specificity

$$\text{Sensitivity} = \frac{\text{number of true positives}}{\text{number of true positives+number of false negatives}}$$

$$\text{Sensitivity} = \frac{\text{number of true negatives}}{\text{number of true negatives+number of false positives}}$$

Positive predictive value is calculated as

$$\text{PPV} = \frac{\text{number of true positives}}{\text{number of true positives+number of false positives}}$$

Negative predictive value is calculated as

$$\text{NPV} = \frac{\text{number of true negatives}}{\text{number of true negatives+number of false negatives}}$$

Accuracy = (TN + TP) / (TN+TP+FN+FP) = (Number of correct assessments)/ Number of all assessments)

RECEIVER OPERATING CHARACTERISTICS (ROC) ANALYSIS

For a given diagnostic test, the true positive rate (TPR) against false positive rate (FPR) can be measured, where TPR= TP/ (TP+FN) And FPR = FP/(FP+TN) TPR is equivalent to sensitivity and FPR is equivalent to (1 - specificity). All possible combinations of TPR and FPR compose a ROC space. One TPR and corresponding FPR together determine a single point in the ROC space, and the position of a point in the ROC space shows the trade-off between sensitivity and 1-specificity, i.e. the increase in sensitivity is accompanied by a decrease in specificity or increase in 1-specificity (FPR).

ETHICAL CONSIDERATIONS: Study was conducted only after getting approval from Institutional Ethical Committee. Anonymity was ensured by means of patient identification through a research number. No personal information concerning the examination was divulged to anyone who was not involved in the study.

OBSERVATION AND RESULT OVERVIEW OF DATA PRESENTATION

A total of 64 participants who presented with a breast nodule either on clinical examination or mammography were recruited to take part in the study. Data was presented by following the study objectives with the aid of descriptive statistical analysis and cross tabulations. A statistical analysis was performed to ascertain to what degree each contribute to the accuracy with which benign versus malignant breast nodules can be characterized

DATA ANALYSIS

LENGTH : HEIGHT RATIO	FINAL DIAGNOSIS		Total
	MALIGNANT	BENIGN	
TALLER THAN WIDE	29	4	33
WIDER THAN TALL	14	17	31
TOTAL	43	21	64

Taller than wide appearance, a feature suggestive of malignancy showed a sensitivity of 67.4% and specificity of 81%. PPV, NPV and accuracy were 87.9%, 54.8% & 78.1% respectively. The Pearson Chi-Square test showed a p-value of 0.0007, which means that the results are statistically significant for length: height ratio.

RELATION OF SHAPE OF THE MASSES WITH TISSUE DIAGNOSED BENIGN & MALIGNANT MASSES

Table : A Shape(sp)* final diagnosis (fn)Cross tabulation

			Final diagnosis		Total
			Malignant	Benign	
	Irregular	Count	27 100.0%	0 0.0%	27 100.0%
		% within sp			
		% within fn	62.8%	0.0%	42.2%
	Lobulated	Count	3 25.0%	9	12 100.0%
		% within sp		75.0%	
Sp	Oval	% within fn Count	7.0% 8	42.9% 10	18.8% 18
		% within sp	44.4%	55.6%	100.0%
		% within fn	18.6%	47.6%	28.1%
	Round	Count	5	2	7
		% within sp	71.4%	28.6%	100.0%
		% within fn	11.6%	9.5%	10.9%
		Count	43	21	64
Total		% within sp	67.2%	32.8%	100.0%
		% within fn	100.0%	100.0%	100.0%

On ultrasound masses were i bund to be re >und in 7 cas<is, oval in 18,lobulated in l2 and irregular in 27. Two (28.6%) of 7 round nodules were classified as benign, and 5(71.4%) were malignant. Ten of 18 (55.6%) oval nodules were benign and 8 (44.4%) of 18 nodules were malignant. Out of 12 lobulated masses 9(75%) and 3(25%) were benign and malignant respectively. There were 27 irregular nodules, of which 100% were malignant nodules. The sensitivity, specificity, PPV, NPV & accuracy for irregular shape were 62.8%, 100%, 100%, 56.7% & 75%.

The Pearson Chi-Square test showed that the results are statistically significant when the result with p-value < 0.0001 for the shape.

SHAPE	FINAL DIAGNOSIS		Total
	MALIGNANT	BENIGN	
IRREGULAR POSITIVE	27	0	27 37 64
NEGATIVE	16	21	
Total	43	21	

RELATION OF MARGINS OF THE MASSES WITH TISSUE DIAGNOSED BENIGN AND MALIGNANT MASSES

Table : margin (mar) * final diagnosis (fn) Cross tabulation

			fn		Total
			Malignant	benign	
		Count	41	3	44
	Spiculated	% within mar	93.2%	6.8%	100.0%
Mar		% within fn	95.3%	14.3%	68.8%
		Count	2	18	20
	smooth	% within mar	10.0%	90.0%	100.0%
		% within fn	4.7%	85.7%	31.2%
		Count	43	21	64
Total		% within mar	67.2%	32.8%	100.0%
		% within fn	100.0%	100.0%	100.0%

MARGINS	FINAL DIAGNOSIS		Total
	BENIGN	MALIGNANT	
SMOOTH	18	2	20
SPICULATED	3	41	44
TOTAL	21	43	64

Out of 44 malignant lesions 41 showed spiculated borders. Spiculation showed a high sensitivity (95.3 %).Specificity measured 85.7%. PPV, NPV and accuracy were 93.2%, 90% and 92.2% respectively.

The Pearson Chi-Square test showed a p-value <0.0001 which indicated that the test between the variables was statistically significant.

RELATION OF ECHOGENICITY OF THE MASSES WITH TISSUE DIAGNOSED BENIGN AND MALIGNANT MASSES

Table echogenicity (ech) * final diagnosis (fn) Cross tabulation

			fn		Total
			Malignant	Benign	
Ech	Hypoechoic	Count	39	18	57
		% within ech	68.4%	31.6%	100.0%
		% within fn	90.7%	85.7%	89.1%
	Hypoechoic	Count	0	1	1
		% within ech	0.0%	100.0%	100.0%
		% within fn	0.0%	4.8%	1.6%
	Isochoric	Count	2	1	3
		% within ech	66.7%	33.3%	100.0%
		% within fn	4.7%	4.8%	4.7%
	Anechoic	Count	2	1	3
		% within ech	66.7%	33.3%	100.0%
		% within fn	4.7%	4.8%	4.7%
Total		Count	43	21	64
		% within ech	67.2%	32.8%	100.0%
		% within fn	100.0%	100.0%	100.0%

	Final Diagnosis		Total
	malignant	benign	
Hypoechopositive	39	18	57
negative	4	3	7
Total	43	21	64

The echogenicity of lesions on ultrasound was described as hypoechoic in 58 eases, anechoic in 3 cases, isoechoic in 2 cases and hyperechoic in 1 case. Malignant masses on ultrasound were characterized as hypoechoic in 90.7% (39) cases, anechoic in 4.7% (2) cases, and isoechoic in 4.7% (2) cases. Hypo echogenicity as a feature of malignancy showed 90.7% sensitivity but a very low specificity (14.2%). PPV, NPV and accuracy were 68.4%, 42.8% and 65.6% respectively. From the results it appears as if echogenicity is not a strong predictor of malignancy. The Pearson Chi-Square test showed a p-value (0.554) which indicated that the test between the variables was not statistically significant, as was to be expected.

RELATION OF POSTERIOR ACOUSTIC EFFECT OF THE MASSES WITH TISSUE DIAGNOSED BENIGN AND MALIGNANT MASSES

Table Posterior acoustic effect (pae) * final diagnosis (fn) Cross tabulation

		fn		Total
		Malignant	Benign	
Shadowing	Count	33 91.7%	3 8.3%	36 100.0%
	% within pae			
	% within fn	76.7%	14.3%	56.2%
Enhancement pae	Count	3 75.0%	1 25.0%	4 100.0%
	% within pae			
	% within fn	7.0%	4.8%	6.2%
None	Count	7	17	24
	% within pae	29.2%	70.8%	100.0%
	% within fn	16.3%	81.0%	37.5%
Total	Count	43	21	64
	% within pae	67.2%	32.8%	100.0%
	% within fn	100.0%	100.0%	100.0%

	Final Diagnosis		Total
	malignant	benign	
posterior acoustic present	33	. 3	36
shadowing absent Total	10	18	28
	43	21	64

Table. Demonstrates that 33 (91.7%) malignant nodules showed acoustic shadowing on ultrasound, compared to 3 (8.3%) benign nodules. Only 3 malignant nodules showed posterior acoustic enhancement. Posterior acoustic enhancement showed a sensitivity of 76.7 % and a specificity of 85.7%. accuracy was 79.7%. PPV and NPV were 91.6% and 64.2%.

The Pearson Chi-Square test showed a p-value of 0.000, which means that the results are statistically significant for posterior acoustic shadowing.

RELATION OF ECHOTEXTURE OF THE MASSES WITH TISSUE DIAGNOSED BENIGN AND MALIGNANT MASSES

Table echotexture (et) * final diagnosis (fn) Cross tabulation

Table 5 echotexture (et) * final diagnosis (fn) tabulation

		fh		Total
		Malignant	Benign	
Non-	Count	37	6	43
uniform	% within et	86.0%	14.0%	100.0%
et	% within fn Count	86.0% 6	28.6% 15	67.2% 21
uniform	% within et	28.6%	71.4%	100.0%
	% within fn	14.0%	71.4%	32.8%
	Count	43	21	64
Total	% within et	67.2%	32.8%	100.0%
	% within fn	100.0%	100.0%	100.0%

Internal echo texture	FINAL DIAGNOSIS		Total
	Malignant	benign	
non-uniform	37	6	43
uniform	6	15	21
TOTAL	43	21	64

The results in Table showed that 86 % (37) of malignant nodules were non¬uniform compared to the 14% (6) benign nodules. On ultrasound 71.4% (15) benign nodules showed uniform echotexture and only 28.6% (6) of the malignant nodules were homogeneous. It could therefore be argued that malignant nodules more often had an inhomogeneous appearance while benign nodules mostly had a homogenous appearance. Non-uniform echotexture showed a sensitivity of 86% & specificity of 71.4%. PPV, NPV, accuracy were 86%, 71.4% and 81.3% respectively. The Pearson Chi-Square test showed a p-value 0.000 which indicated that the test between the variables was statistically significant.

RELATION OF LESION BOUNDARY OF THE MASSES WITH TISSUE DIAGNOSED BENIGN AND MALIGNANT MASSES

Table : A boundary (bou) * final diagnosis (fn) cross tabulation

			Fn		Total
			Malignant	Benign	
Bou	Ill-defined	Count	25 96.2%	1 3.8%	26 100.0%
		% within bou			
		% within fn	58.1%	4.8%	40.6%
	Echogenic	Count	15	2	17
	Halo	% within bou	88.2%	11.8%	100.0%
		% within fn	34.9%	9.5%	26.6%
	Abrupt interface	Count	3	18	21
		% within bou	14.3%	85.7%	100.0%
		% within fn	7.0%	85.7%	32.8%
Total		Count	43	21	64
		% within bou	67.2%	32.8%	100.0%
		% within fn	100.0%	100.0%	100.0%

Ill-defined or echogenic halo	Final Diagnosis		Total
	Malignant	Benign	
Present absent	40 3	3 18	43 21
Total	43	21	64

Table Showed out of 43 malignant mases 15(34.9%) masses had echogenic halo and 25 (58.1%) cases showed ill-defined boundaries. Abrupt interface is mostly seen in benign lesions. Echogenic halo alone showed a sensitivity of 34.8% but a high specificity of 90.4%, whereas echogenic halo and ill-defined boundary combined data gave a sensitivity and specificity of 93% and 85.7% respectively. PPV, NPV and accuracy were 93%, 85.7 % and 90.6%.The Pearson Chi-Square test showed a p-value O.0001 which indicated that the test between the variables was statistically significant

RELATION OF B-MODE SONOGRAPHIC AND PATHOLOGIC DIAGNOSIS IN SOLID BREAST LESIONS

Table sonologicaldiagnosis(dg) * final hpr diagnosis(fn) cross tabulation

Sonological diagnosis		Final diagnosis		Total
		Malignant	Benign	
Malignant	Count % within vas	41 93.2%	3 6.8 %	44 100.0%
	% within fii Count	95.3% 2	14.3% 18	68.8% 20
Benign	% within vas	10.0%	90.0%	100.0%
	% within &	4.7%	85.7%	31.2%
	Count	43	21	64
Total	% within vas	67.2%	32.8%	100.0%
	% within fa	100.0%	100.0%	100.0%

Sonological Diagnosis	Final Diagnosis		Total
	Malignant	Benign	
Malignant Benign	41 2	3 18	44 20
Total	43	21	64

Breast lesions with any one of the above mentioned parameters showing malignant characteristics was given sonological diagnosis of malignancy. According to table there were 2 false positive and 3 false negative cases. Sensitivity and specificity of sonography in this study were 95.3% and 85.7%. The PPV, NPV and accuracy of ultrasonography were 93.2%, 90% and 92.2%.

DISCUSSION

In our study sonography showed a sensitivity of 95.3% and a specificity of 85.7% when the criteria that if any one of the sonological parameter showed malignant features as described in literarature the breast lesion was given sonological diagnosis as malignant. Positive predictive value for the b-mode sonography was 93.2% and accuracy was 92.2%. Stavros et al showed a sensitivity of 98.4% for detecting malignancy[5].

According to Constantini the shape of the nodule is the most reliable criterion for differentiating between benign and malignant breast nodules[13]. While benign breast nodules are mostly round or oval, malignant nodules are found to be irregular in shape. The results of our study concur with current literature with the majority of benign nodules were either oval (47.6%) or lobulated (42.9%), while 62.8% (27) of malignant breast nodules were irregular in shape. Thus shape of lesion got a low sensitivity of 62.8% but a high PPV of 100%.

Hypoechogenicity as a feature of malignancy showed 90.7% sensitivity but a very low specificity (14.2%). Benign breast nodules are likely to be homogeneous whereas malignant nodules tend to be inhomogeneous/ heterogeneous[14]. In our study the echopattern also showed significant association and non-uniform pattern showed a sensitivity of 86% and PPV of 86%.

In our study spiculation, taller than wide, posterior shadowing showed high specificity than sensitivity (ta. Stavros et al studied the above features and given a sensitivity and specificity respectively as follows : spiculations (36%, 99.4%), taller than wide (41.6%, 98.1%), posterior shadowing (48.8%, 94.7%)(21).Hong et al in their study showed showed high predictive value for malignancy for spiculated margin (86%,), irregular shape (62%), and nonparallel orientation (69%)(54\ In our study spiculation and posterior acoustic shadowing showed high positive predictive value of 93.2% and 91.6% respectively. Margin showed high accuracy of 92.2%.Absent compressibility and absent echogenic capsule showed high negative predictive values of 100% for malignancy.

The results of our study were encouraging in that we were able to identify the most applicable US features for differentiating benign from malignant solid masses. These features have the potential to help decrease the number of biopsies performed for benign solid masses.

One limitation of our study was the results were obtained in exclusively palpable tumors with a high fraction of malignancies. Therefore study group does not reflect a normal population, where the prevalence of breast cancer is lower. Other limitation is the single observer interpret-tation. So, we did not assess interobserver variability in the evaluation of these features and in the final assessments. The limitations of this study also include smaller number of patients; lack of correlation with MVD on histopathology and nonconsideration of nodal, lymphovascular and distant metastasis.

CONCLUSION

The features most predictive of a malignant tissue diagnosis were Spiculations, posterior acoustic

shadowing, ill-defined margins and non-uniform echo pattern . Length: height ratio and irregular shape showed moderate sensitivity but high specificity. High positive predictive values were shown by irregular shape, spiculated borders, posterior acoustic shadowing and ill-defined borders. Absent echogenic capsule showed high negative predictive values for malignancy. In our study sonography showed a sensitivity of 95.3%, specificity of 85.7% and PPV of 93.2%. The accuracy of sonological evaluation was 92.2% with NPV of 90%.

Our study shows that B-Mode ultrasound should continued to be used as an adjunct to mammography. The value is greatest when mammographic findings are indeterminate and the decision to biopsy or follow-up can be enhanced by the addition of ultrasound.

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