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Ultrasound Evaluation of Palpable Breast Masses in Correlation with FNAC /Histopathology

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Abstract

Background: According to many studies the positive predictive value for biopsy can be increased by proper complete diagnostic work up in which sonography is also included. Improvements in imaging technique with high resolution ultrasonography, many studies have described the reliable signs to differentiate benign and malignant masses. However, there are very limited Indian studies to investigate the general applicability of US features to distinguish benign from malignant solid masses. Hence this study was carried out for, Ultrasonological characterization of palpable solid breast masses and categorizing each mass as benign and malignant and to correlate categorized benign and malignant breast masses with tissue diagnosis. **Methodology:** Our study was a prospective analysis. Our study included 50 patients of age range between 22—75 years (mean age, 42 years) with history of palpable breast masses. Data for the study was collected from the patients referred to Department of Radio diagnosis at teaching hospitals attached to Bangalore Medical College and research institute, Bangalore for the period of two years. A structured, pre-prepared case proforma (CP) was used to enter the clinical history, physical examination findings, investigations-sonography and histopathology findings. Initially sonography was performed with BIOMEDICA ESOATE AUX scanner with 7.5-10 MHz linear array transducer and data was Obtained of only solid masses. Then tissue diagnosis was obtained in all 50 cases. Later the tissue diagnosis results were correlated with sonological findings by statistical analysis. **Results:** The US features most predictive of a benign tissue diagnosis were oval or round shape, circumscribed margins, and width-to—AP dimension ratio greater than 1.4. The features most predictive of a malignant tissue diagnosis were spiculated or micro lobulated margins, irregular shape, ill-defined margins, and width-to—AP dimension ratio of 1.4 or less. Some features were not reliable in differentiating between benign and malignant lesions. For example, the effects of masses on posterior echo intensity were not a useful determinant. Some features that showed excellent correlation with a benign or malignant tissue diagnosis were too infrequent to be generally applicable. For example, a hyperechoic lesion was very reliable as a predictor of benignity but was reported in only 2°/ of the masses. **Conclusion:** In our study we performed the prospective analysis of the sono mammography findings in correlation with tissue diagnosis. The results of our study well correlated the results of the prior studies. The US features in our study most predictive of a benign tissue diagnosis were oval or round shape, circumscribed margins, presence of edge refraction, and width-to-AP dimension ratio greater than 1:4. Some features were not reliable in differentiating between benign and malignant lesions. For example, the effects of masses on posterior echo intensity were not a useful determinant. Some features that showed excellent correlation with a benign or malignant tissue diagnosis were too infrequent to be generally applicable. The evaluation of the cases was prospective, but the sample size was relatively small and we did not asses interobserver variability in the evaluation of these features and in the final assessments. However, 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.

Keywords: Sono mammography, benign mass, malignant mass.

INTRODUCTION

Breast cancer remains one of the leading causes of non-preventable cancer death. Lump in the breast is a serious concern to women and fear to both patient and doctor. Breast Cancer is one of the best-studied human tumors, yet remains poorly understood. Fortunately, a disease process does not have to be understood to be treated successfully, but needs to be detected. The emphasis on early detection of cancer and not to miss a malignant lesion in early stage of disease and the current medico-legal environment encourages an aggressive biopsy approach to breast problems. The large number of biopsies performed for benign breast abnormalities has long been recognized as a serious problem.

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Excessive biopsies for benign lesions have adverse effects on society and on the women who undergo them by increasing the costs of screening projects, causing morbidity, and adding to the barriers that keep women from using a potentially lifesaving procedure Attempts have been made to increase the positive predictive value for biopsy by performing a complete diagnostic work-up that often includes ultrasonography (US). For a palpable lesion, characterization of lesion is important in further management of the problem. Improvements in US equipment have prompted more recent studies with findings that describe reliable signs for differentiating benign from malignant masses. We conducted a prospective analysis of 50 consecutive cases in which patients presented palpable breast masses and underwent breast US followed by tissue diagnosis. According to many studies the positive predictive value for biopsy can be increased by properr complete diagnostic work up in which sonography is also included. Improvements in imaging technique with high resolution ultrasonography, many studies have described the reliable signs to differentiate benign and malignant masses.[1,2] The

present study was carried out for, Ultrasonological catheterization of palpable solid breast masses and categorizing each mass as benign and malignant and to correlate categorized benign and malignant breast masses with tissue diagnosis.

METHODS

Type of study: Our study was prospective analysis type.
Source of data: Data for the study was collected front the patients referred to Department of Radio-Diagnosis, Vydehi institute of medical science and research institute. Whitefield. Bangalore, with clinically detected palpable breast masses.
Method of collection of data: A structured, pre-prepared case proforma (CP) was used to enter the clinical history, physical examination findings, investigations-sonography and histopathology findings. Total number of subjects selected for the study was 50 patients of age range between 22— 75 years (mean age, 42 years). Initially sonography was performed and data was obtained. Then tissue diagnosis was obtained in all 50 cases. Later the tissue diagnosis results were correlated with sonological findings by statistical analysis.
Inclusions criteria: All female patients with palpable solid breast lesions based on sonological findings and within age group between 22-75 years.
Exclusion criteria: All female patients with palpable cystic breast lesions based on sonological findings and outside the age group between 22-75 years.
Technique of Sono mammography. In this study all US examinations were performed with a 7-10-MHz high frequency linear-array of ESOATE AU5 model.

Statistical Methods.[3,4]

Statistical Methods: Chi square test/Fisher Exact test has been used to find the significant association of US features in differentiating Malignancy and Benign.

1. Chi-Square Test

$$\chi^2 = \frac{\sum(Oi - Ei)^2}{Ei}$$, Where Oi is Observed frequency and Ei is Expected frequency

2. Fisher Exact Test

	C1ass1	Class2	Total
Samplel	A	B	a+b
Sample	C	D	c+d

$$\text{Fisher Exact Test statistic} = \sum p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!} \cdot \frac{1}{\sum a!b!c!d!}$$

Statistical software: The Statistical software namely SPSS 15.0, Stata 8.0, MedCalc
9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

Benign versus Malignant Solid breast Masses: US differentiation.

Table 1: Association of US Features with Malignant versus Benign Tissue diagnosis

US features	Number	Tissue Diagnosis		P value
	(n=50)	Malignant	Benign	
Shape				
Round /Oval	22 (44.t))	I (4.5)	21(95.5)	0.004*"
Three or fewer lobulations	9(18.0)	2 (11.1)	7(77.7)	1.000
>3 lobulations	9(18.0)	3(33.3)	6(66.7)	0.668
Irregular	10(20.0)	6(60.0)	4(40.0)	0.007**
Margins				
Circumscribed	32(64.0)	2(6.3)	30 (93.8)	<0.001**
Microlobulated	3(6.0)	2(66.7)	1(33.3)	0.139
Ill defined	14(28.0)	7(50.0)	7(50.0)	0.023*
Speculated	1(2.0)	l (100.0)	0	0.240
Width of AP dimension ratio				
>1.4	29(38.0)	4 (13.8)	25(86.2)	0.047*
1.4	21(42.0)	8(38.1)	13(61.9)	0.047*
Echotexture Heterogeneous	13(26.0)	4(30.8)	9(69.2)	0.506
Intermediate	8(16.0)	3(37.5)	5(62.5)	0.379
Homogeneous	29(58.0)	5(17.2)	24(82.8)	0.199
Echogenicity				
Hyperechoic	1(2.0)	0	1(100.0)	1.000
Isoechoic	23(46.0)	4 (17.4)	19(52.6)	0.313
Hypoechoic	26(52.0)	8(30.8)	18(69.2)	0.243
Posterior Echo Intensity				
Enhanced	20(40.0)	4(20.0)	16(80.0)	0.740
Unaffected	23(46.0)	6(26.1)	17(73.9)	0.750
Attenuated	7(14.1))	2 (28.6)	5(71.4)	J.000
Table 1: Continued				

US features	Number of patients	Tissue Diagnosis		P value
		Malignant	Benign	
Pseudo capsule				
Present	19 (38.0)	2 (10.5)	17(89.5)	0.100
Absent	31(62.0)	10(32.3)	21(67.7)	0.100
Edge of refraction				
Present	18 (36.0)	2(11.1)	16(88.9)	0.170
Absent	32 (64.0)	10(31.3)	22(68.8)	0.109
3 (6.0)	ND		ND	
47 (94.0)	ND		ND	

Significant figures

\+ Suggestive significance 0.05<P<0.10
* Moderately significant 0.0l<P 0.05
** Strongly significant Pñ0.01

Table 1 shows the frequency of specific US features and the correlation between these specific features and the tissue diagnosis (benign vs. malignant). The US features most predictive of a benign tissue diagnosis were oval or round shape, circumscribed margins, presence of edge refraction, and width-to—AP dimension ratio greater than 1.4. The features most predictive of a malignant tissue diagnosis were spiculated or micro lobulated margins, irregular shape, ill-defined margins, and width-to—AP dimension ratio of 1.4 or less.

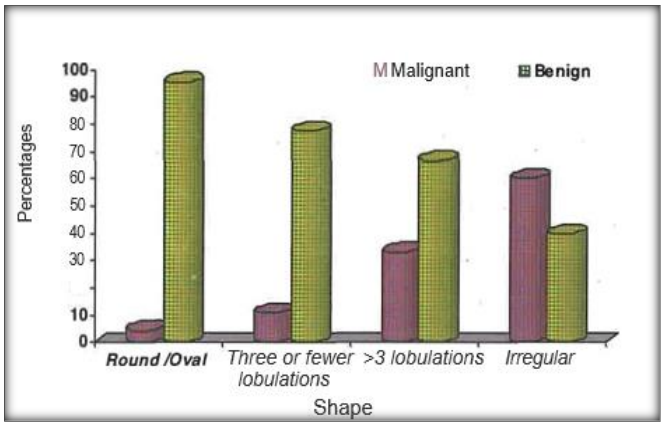


Figure 1: Correlation of shape of the masses with tissue diagnosed benign and malignant masses

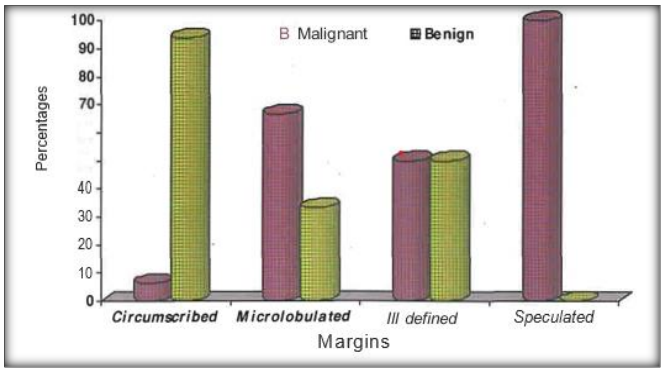


Figure 2: Correlation of margins of the masses with tissue diagnosed benign and malignant masses

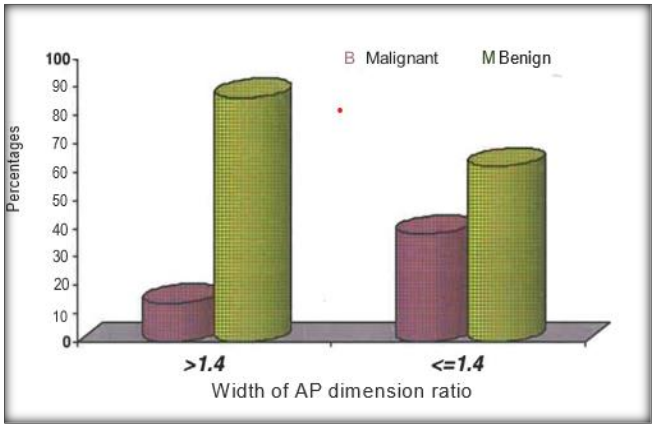


Figure 3: Correlation of AP dimensions of the masses with tissue diagnosed benign and malignant masses

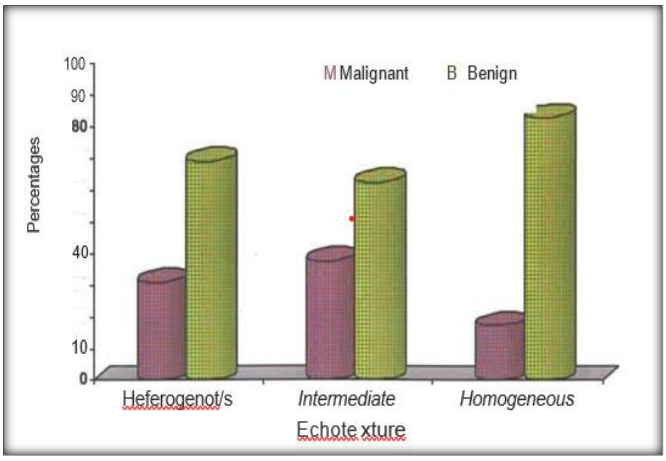


Figure 4: Correlation of echotexture of the masses with tissue diagnosed benign and malignant masses

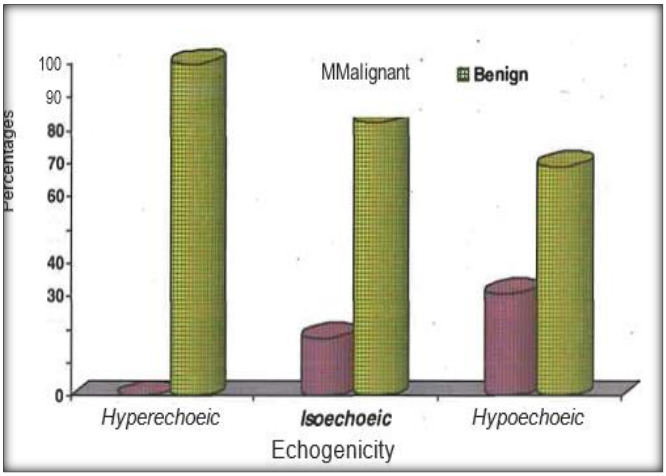
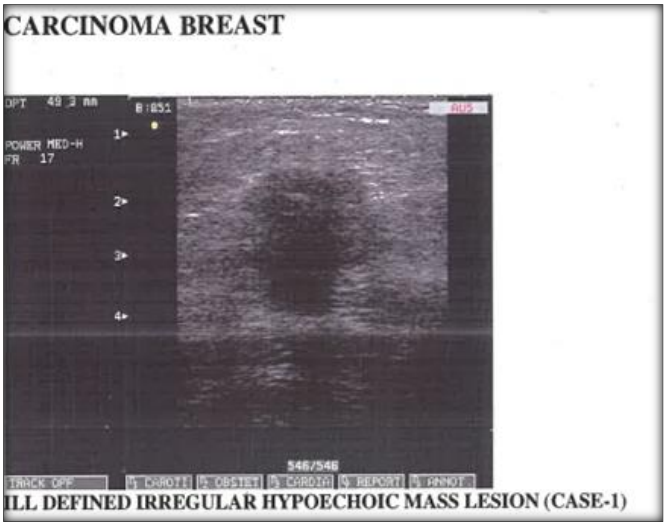
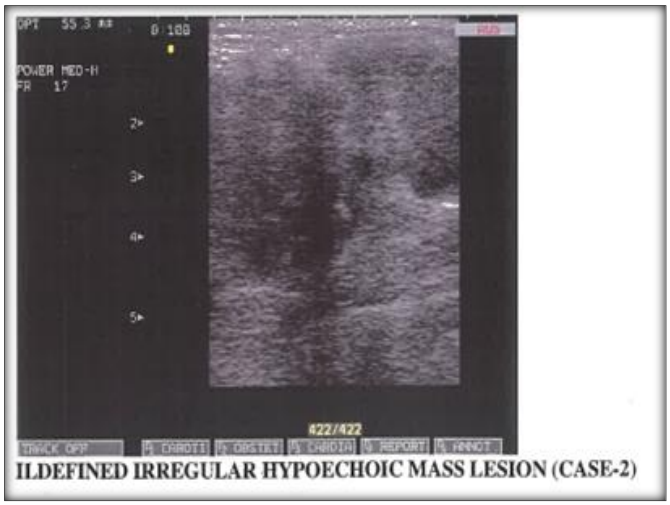
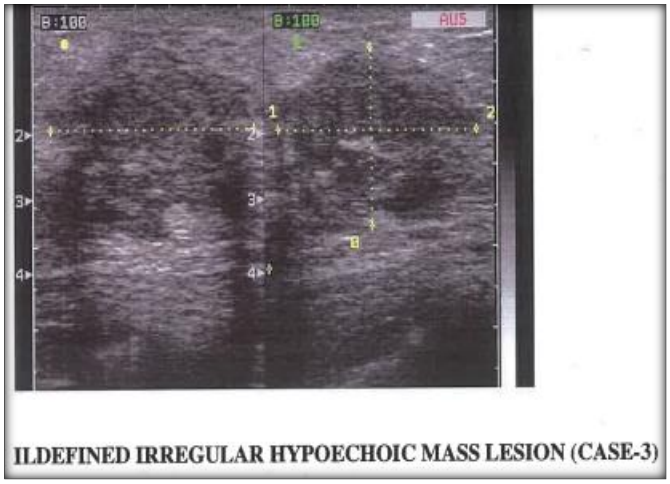


Figure 5: Correlation of echogenicity of the masses with tissue diagnosed benign and malignant masses

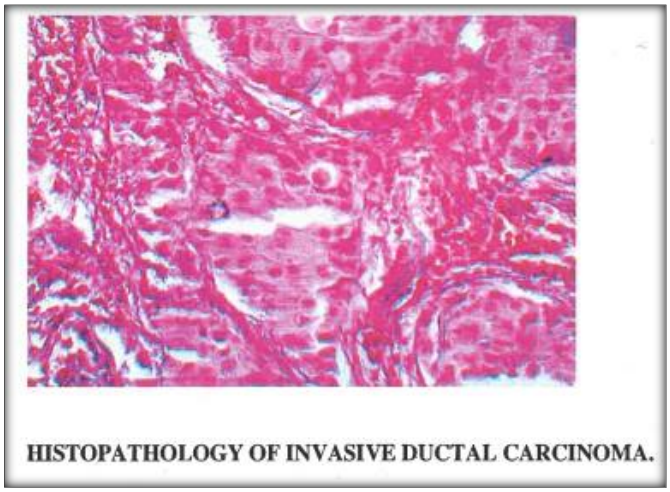




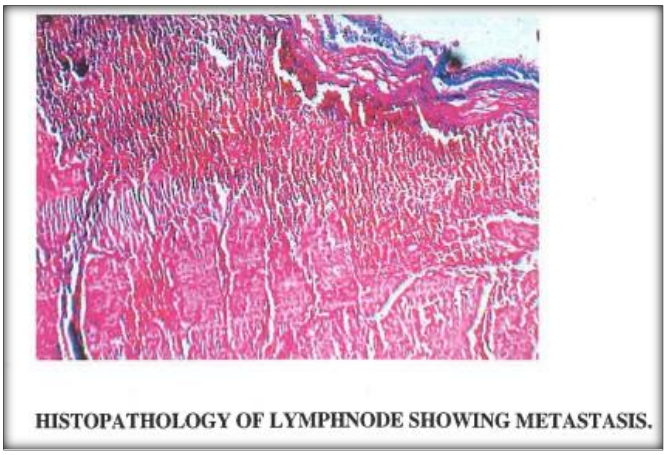
ILDEFINED IRREGULAR HYPOECHOIC MASS LESION (CASE-2)



ILDEFINED IRREGULAR HYPOECHOIC MASS LESION (CASE-3)



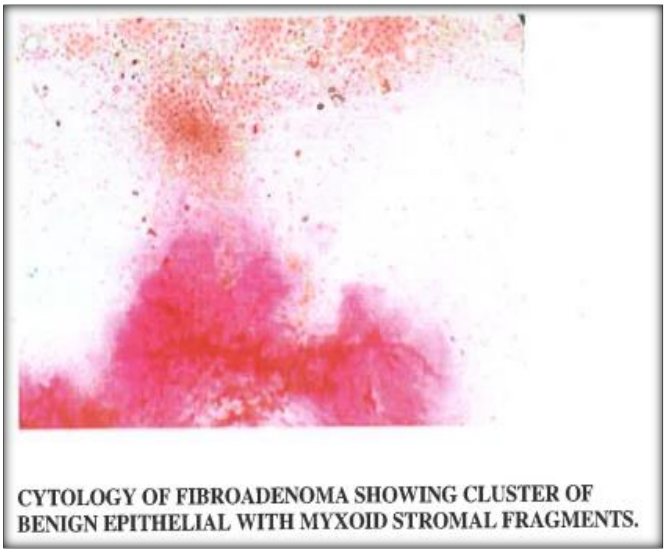
HISTOPATHOLOGY OF INVASIVE DUCTAL CARCINOMA.



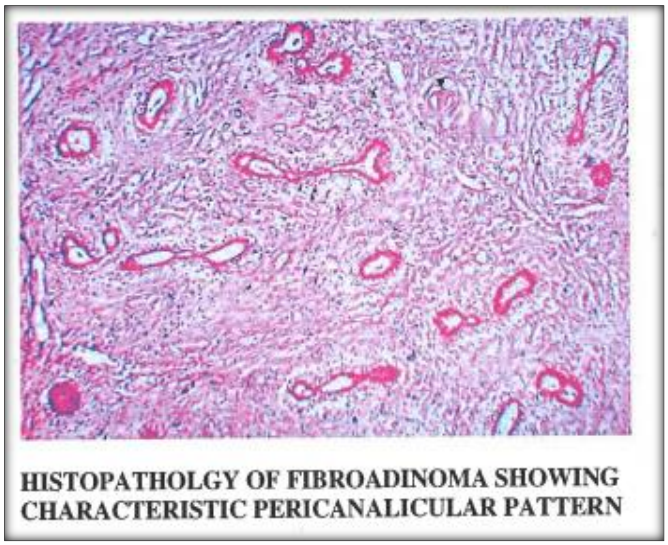
HISTOPATHOLOGY OF LYMPHNODE SHOWING METASTASIS.

FIBROADENOMA

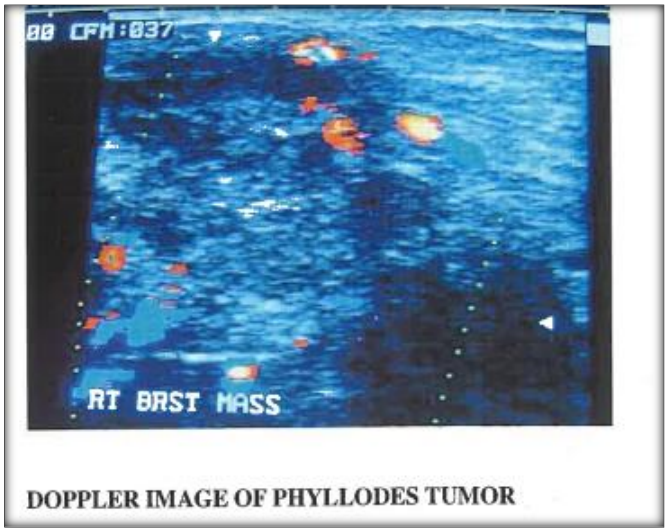
WELL DEFINED OVAL HYPOECHOIC MASS (CASE-1)



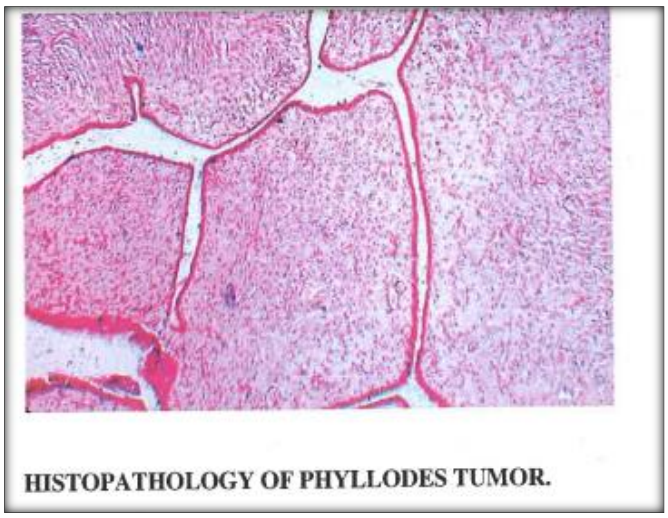
CYTOLOGY OF FIBROADENOMA SHOWING CLUSTER OF BENIGN EPITHELIAL WITH MYXOID STROMAL FRAGMENTS.



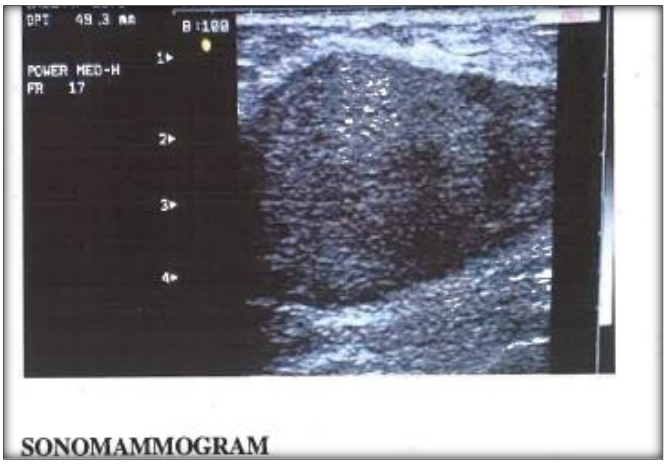
HISTOPATHOLGY OF FIBROADINOMA SHOWING CHARACTERISTIC PERICANALICULAR PATTERN



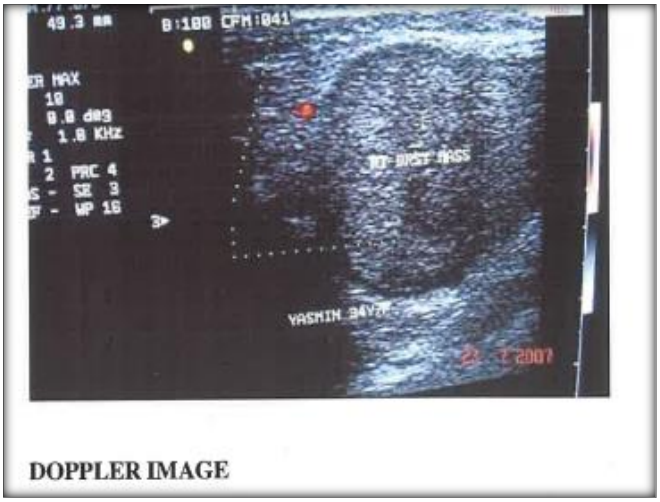
DOPPLER IMAGE OF PHYLLODES TUMOR



HISTOPATHOLOGY OF PHYLLODES TUMOR.



SONOMAMMOGRAM



DOPPLER IMAGE

DISCUSSION

The role of US in breast imaging has evolved over the years. In most clinical practices, the use of breast US has been restricted to differentiation of cysts versus solid masses. Today, US also play an important role in guiding interventional procedures such as needle aspiration. core-needle biopsy, and prebiopsy needle localization. Recently, screening US has also been advocated for the dense breast. The purpose of our study was to investigate the general applicability of US features in differentiating benign from malignant solid breast masses. Since only cases with positive results were evaluated, our study does not address detectability. In addition, the role of US in differentiating benign from malignant solid masses is still evolving. The investigators in several studies in the past have described specific US findings to determine if a solid mass is benign or malignant.[3,5] The features of masses that are usually analyzed are shape, margins, and echogenicity. A recent investigation by Stavros et al has renewed interest in the potential value of these US diagnostic criteria. However, in the latter investigation, one highly experienced radiologist obtained and interpreted the images, so the accuracy might not be reproducible in gene1'al practice.[3,6] For an individual US characteristic to be deemed to have practical applicability

in the differentiation of benign from malignant lesions, we concluded that it must (o) be present frequently and {b) help i'eliab1y distinguish benign from malignant lesions. The effect of a mass on posterior echoes was not reliable for ’differ entailing benign from malignant masses. Overall, the least useful US features in our study were echogenicity, presence of pseudo capsule, posterior echo intensity, presence of calcifications, and echotexture.

In our study, we identified three features described in the literature that best met the criteria of frequency and reliability. These three features were the shape, margins, and width-to-AP dimension ratio of the mass. In women younger than 30 years, in whom mammography is less useful, US is often considered the modality of choice to initiate the evaluation of a palpable mass '5''52’53. n our study, the younger women who underwent US but not mammography would have benefited the most from the application of US criteria for benign versus malignant solid masses. Use of the diagnostic criteria would have eliminated the need for biopsies in the women who did not have mammograms.[7,8]

We believe that our study has several strengths. First, very limited such types of studies are done on Indian populations. So, our study will be very useful in reference to the Indian oriented studies. Second, it proves the results of previous studies results and further strengthening the importance of sonomammography in evaluation of breast masses. Thirdly the fact that our study is a prospective evaluation of the cases, but the sample size was relatively small. Other limitation is the single observer interpretation. So, we did not assess interobserver variability in the evaluation of these features and in the final assessments. When assessing the general usefulness of US diagnostic criteria as method of avoiding unnecessary excisional biopsy, it is also important to remember that there are other options for determining whether a solid mass is benign or malignant. For example, fine-needle aspiration biopsy with cytologic analysis is a relatively inexpensive, minimally invasive procedure that many experienced radiologists find useful in the evaluation of solid masses.[9,10] Core-needle biopsy is now widely used for the evaluation of nonpalpable solid masses and is readily adaptable to US guidance.[10] Some women and their physicians will insist on excisional biopsy of a palpable mass because of fear, physician uncertainty, or traditional standard-of-care protocols despite improvements in diagnostic criteria for determining whether a solid mass is benign or malignant. In conclusion, 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.

CONCLUSION

Breast cancer is one of the leading killers in both developed and developing countries. So, the consciousness about this is increasing in the society. Screening for the breast cancer is one of the most common prescribed procedures which includes mammography/sonomammography alone or both. The main aim of these investigations is to identify the mass and to differentiate whether the lesion is a benign or a malignant disease. The emphasis on early detection of cancer and not to miss a malignant lesion in early stage of disease and the current medico-legal environment encourage an aggressive biopsy approach to breast problems. The large number of biopsies performed for benign breast abnormalities has long been recognized as a serious problem. Excessive biopsies for benign lesions have adverse effects on society and on the women who undergo them by increasing the costs of screening projects, causing morbidity, and adding to the barriers that keep women from using a potentially life saving procedure. Improvements in US equipment have prompted more recent studies with findings that describe reliable signs for differentiating benign from malignant masses. Many Indian and foreign studies have published their results with respect to the features differentiating the benign and malignant sonomammography features. In our study we performed the prospective analysis of the sonomainriography findings in correlation with tissue diagnosis. Tire results of our study well correlated the results of the prior studies. The US features in our study most predictive of a benign tissue diagnosis were oval or round shape, circumscribed margins, presence of edge refraction, and width-UAP dimension ratio greater than 1.4. The features most predictive of a malignant tissue diagnosis were spiculated, irregular shape, ill-defined margins, and width-to- AP dimension ratio of 1.4 or less. Some features were not reliable in differentiating between benign and malignant lesions. For example, the effects of masses on posterior echo intensity were not a useful determinant. Some features that showed excellent correlation with a benign or malignant tissue diagnosis were too infrequent to be generally applicable. 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.

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