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## Evaluating the Hyperechoic lesions of breast by ultrasonography: A clinical and radiologic study

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### Abstract

**Background:** Benign lesions in the past were thought to be hyperechogenic lesions on ultrasonography. Recently, this conception has been changed where various malignant breast lesions were hyperechogenic on ultrasound and hyperechogenic lesions turned out to be malignant on histopathologic examination.

**Aim:** The present retrospective clinical study was conducted to assess the clinical presentation, frequency, and related imaging finding of hyperechoic malignant breast lesions in cases with core needle biopsies guided ultrasonographically, and also, to assess ultrasonographic features that help in the prediction of the hyperechoic lesion to be malignant.

**Methods:** In a total of 2255 subjects, an ultrasonographically guided core needle biopsy was done for 2168 subjects. The hyperechoic carcinomas were identified among all the assessed cases diagnosed by ultrasonography-guided core needle biopsy was calculated. For malignant lesions, imaging malignancy predictors were identified using 6 ultrasonography images comparison in malignant and high-risk cases. The sonographic findings assessed were orientation, vascularity, shape, posterior acoustic features, margins, and echogenicity. The results were formulated after the statistical evaluation.

**Results:** A total of 2255 ultrasonographically guided core needle biopsy was done for 2168 subjects where 52.01% (n=1173) lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. The study results have shown that in total 2255 lesions assessed, 0.57% (n=13) lesions were hyperechoic in 13 females after analyzing the image. In 924 malignant lesions 0.97% (n=9) lesions were hyperechoic. Circumscribed margins were seen in 62.5% (n=5) and non-circumscribed by 37.5% (n=3) study subjects with benign lesions, and by 100% (n=5) subjects with malignant lesions (p=0.007). For the shape of the lesions, more malignant lesions had irregular and lobular margins 100 (n=5) lesions, whereas, in benign lesions, 87.5 (n=7) had irregular/lobular margins (p=0.002).

**Conclusion:** The present study concludes that hyperechoic breast lesions on ultrasonography have less prevalence of 0.57% (n=13) lesions in the present study. Hence, hyperechoic breast lesions are less encountered on sonography. However, whenever these hyperechoic lesions are seen, the probability of malignancy should not be excluded.

**Keywords:** Breast carcinoma, breast lesion, ultrasonography, hyperechoic lesions, core needle biopsy, sonography

### Introduction

Mammographically or clinically detected breast lesions are being subjected to the ultrasonographic examination which is used as the first preferred imaging modality for their diagnosis and characterization. For breast masses, ultrasonography usually assesses orientation, shape, posterior acoustic features, margins, and echogenicity. Hyper echogenicity of the lesion is confirmatory to malignancy and carcinomas, whereas, the assessment of hyper echogenicity is controversial in the literature <sup>[1]</sup>.

Ultrasound of the breast is one of the most recommended and accurate radiographic modalities that help in the diagnosis of the pathologies of the breast. Breast ultrasonography is used as an adjunct to MRI Magnetic resonance imaging) or breast mammography. BI-RADS (The American College of Radiology Breast Imaging Reporting and Data System) has reported a wide data that reports that breasts lesion on ultrasonography can help in differentiating malignant breast lesions from benign ones with the help of various parameters and descriptors including echogenicity, margin, shape, and others <sup>[2]</sup>. Benign lesions in the past were thought to be hyperechogenic lesions on ultrasonography. Recently, this conception has been changed where various malignant breast lesions were hyperechogenic

on ultrasound and hyperechogenic lesions turned out to be malignant on histopathologic examination<sup>[3]</sup>.

The lesions that are detected as hyperechoic on the ultrasonography should be essentially categorized based on findings on ultrasonography and should be correlated with mammographic appearance. For such lesions, histopathologic examination such as biopsy should be done wherever necessary. In a classic study conducted by Starvos and co-workers, it was seen that the negative predictors' value was found to be 100% as 42 hyperechoic lesions and nodules examined were found to be benign on histopathologic examination<sup>[4]</sup>. However, various other scholars in their literature data have reported that hyperechoic lesions and nodules of the breast were found to be malignant. In most of these lesions and nodules, the studies were a series that included a lesser number of cases and the other imaging factors of these lesions were not evaluated.

The data in the literature with a definitive assessment of the hyperechoic breast lesions are scarce in the literature<sup>[5]</sup>. Hence, the present study was conducted to assess the clinical presentation, frequency, and related imaging finding of hyperechoic malignant breast lesions in cases with core needle biopsies guided ultrasonographically, and also, to assess ultrasonographic features that help in the prediction of the hyperechoic lesion to be malignant.

## Materials and Methods

The present retrospective clinical study was conducted to assess the clinical presentation, frequency, and related imaging finding of hyperechoic malignant breast lesions in cases with core needle biopsies guided ultrasonographically, and also, to assess ultrasonographic features that help in the prediction of the hyperechoic lesion to be malignant. The present study was conducted at Department of Radio diagnosis, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram, Andhra Pradesh, India after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects referred to the Department of Radiology of the Institute for ultrasonographically guided core needle biopsy of the breast.

In the total of 2255 subjects, an ultrasonographically guided core needle biopsy was done for 2168 subjects where 52.01% (n=1173) lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. The ultrasonographically guided core needle biopsy and ultrasonographic imaging and associated interpretation were done by a single radiologist with expertise in the field. For documentation, two orthogonal views were taken. For all study subjects, clinical and mammography parameters and clinical features were assessed along with other radiologic imaging reports if available.

Whole breast ultrasonography of all the study subjects was done using linear transducers as follows linear transducers of 5-12, 5-17, or 10-13 MHz. Rather than targeted whole breast ultrasound was done in the present study. Core needle biopsies guided ultrasonographically were done for all the lesions using a biopsy gun that was automated using a needle of 14-gauge. The mean was obtained per lesion. In lesions found benign, the follow-up was done at 6 months and 1 year. Mammography was done in the craniocaudal and oblique plane with full-field equipment. Mammography was done with a 1.0-T system and MRI using a 1.0-T

system.

The images were analyzed by two experts in the field separately having experience of more than 10 years in radiology. The assessment of the ultrasonography findings was done following the BI-RADS lexicon that defines orientation as nonparallel and parallel, posterior acoustic features as shadowing, enhancement, or normal, shape as lobular or irregular versus round or oval, vascularity as absent or present, and margins as non-circumscribed versus circumscribed.

Echotexture of the nodule was evaluated based on the following criteria as hypoechoic when reduced echogenicity was seen concerning subcutaneous fat, hyperechoic when increased echogenicity was seen concerning subcutaneous fat, and mixed when hypoechoic and hyperechoic lesions were seen in similar proportions. In hyperechoic detected lesions hypoechoic areas were evaluated and were defined as hypoechogenicity focal areas presenting <30% of the lesion. Any discrepancy among two experts concerning hypoechoic area, echotexture, and sonographic features was managed by coming to a single agreement.

Reference for benign lesions was served by the pathology results and follow-up of core needle biopsy and reference for malignant lesions and high-risk lesions was served by the results of the surgical pathology.

The hyperechoic carcinomas were identified among all the assessed cases diagnosed by ultrasonography-guided core needle biopsy was calculated. For malignant lesions, imaging malignancy predictors were identified using 6 ultrasonography images comparison in malignant and high-risk cases. The sonographic findings assessed were orientation, vascularity, shape, posterior acoustic features, margins, and echogenicity.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at  $p < 0.05$ .

## Results

The present retrospective clinical study was conducted to assess the clinical presentation, frequency, and related imaging finding of hyperechoic malignant breast lesions in cases with core needle biopsies guided ultrasonographically, and also, to assess ultrasonographic features that help in the prediction of the hyperechoic lesion to be malignant. A total of 2255 ultrasonographically guided core needle biopsy was done for 2168 subjects where 52.01% (n=1173) lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. The study results have shown that in total 2255 lesions assessed, 0.57% (n=13) lesions were hyperechoic in 13 females after analyzing the image. In 924 malignant lesions 0.97% (n=9) lesions were hyperechoic. In these lesions, low-grade intraductal papillary carcinoma, infiltrating ductal carcinoma with neuroendocrine differentiation- grade I, Grade II infiltrating ductal carcinoma with mucinous differentiation, infiltrating ductal carcinoma not-otherwise-specified- Grade III, infiltrating ductal carcinoma not-otherwise-specified- Grade II, and invasive lobular carcinoma- Grade II was seen in 1, 1, 1, 1, 1, 2, and 2 cases respectively. In the present study, in 1173 benign lesions, 1.19% (n=14) lesions were found to be hyperechoic. Among these 14 lesions, there were chronic

inflammation, hamartoma, fat necrosis, hibernoma, hemangioma, lymph nodes, fibro adenomas, lipomas, angioliomas, and focal fibrosis in 1, 1, 1, 1, 1, 2, 1, 2, and 3 subjects respectively. No changes on imaging were seen at follow-up till 1 year. No high-risk lesion among 158 lesions was hyperechoic.

The present study also assessed radiographic findings and clinical pictures of the lesion (Table 1), it was seen that on clinical findings, among 13, 46.15% (n=6) females had a palpable nodule in the breast, whereas, 53.84% (n=7) subjects had no symptoms. In these 7 asymptomatic subjects, sonography was done in 6 subjects during the screening of breast cancer, and 1 subject was followed up for breast neoplasm diagnosed previously. The mammographic examination was also done on 10 study subjects. 5 study females underwent MRI of the breast owing to preoperative breast cancer assessment in 2 females, breast cancer screening in 2 subjects, and evaluating surgical scar in 1 subject. The study results have shown that in 9 hyperechoic malignant lesions, synchronous invasive carcinoma in opposite breast was seen in 1 subject,

whereas, in 2 subjects metachronous invasive carcinoma was seen in the opposite breast. No subject had a pure lesion as seen on sonography. 5 lesions were palpable, 3 subjects had a previous history of carcinoma breast, 3 subjects had MRI correlation, 5 had mammography correlation, and vascularity was seen in 6 lesions. The size of the 9 lesions were 8, 8, 11, 7, 13, 10, 9, 8, and 24. Orientation, margins, and echogenicity were also assessed (Table 1).

On assessing the sonographic aspects of the hyperechoic malignant lesions, it was seen that vascularity, hypoechoic lesions, shape, and posterior acoustic features were non-significant among benign and malignant hyperechoic lesions, whereas, circumscribed margins were seen in 62.5% (n=5) and non-circumscribed by 37.5% (n=3) study subjects with benign lesions, and by 100% (n=5) subjects with malignant lesions. This difference was statistically significant with  $p=0.007$ . For the shape of the lesions, more malignant lesions had irregular and lobular margins 100% (n=5) lesions, whereas, in benign lesions, 87.5% (n=7) had irregular/lobular margins. This difference was statistically significant with  $p=0.002$  (Table 2).

**Table 1:** Clinical and radiographic features of hyperechoic malignant lesions

Palpability	Breast cancer history	MRI Correlation	Mammography Correlation	Size	Vascularity	Sonographic Features
+	-	-	+	8	+	Parallel, no circumscribed, hyperechoic
-	-	+	-	8	+	Non-Parallel, no circumscribed, hyperechoic
-	-		+	11	-	Non-Parallel, non-circumscribed, hyperechoic
+	+	-	-	7	-	Parallel, circumscribed, hyperechoic
-	-	+	+	13	-	Non-Parallel, non-circumscribed, no hyperechoic lesion
+	+		-	10	+	Non-Parallel, no circumscribed, hyperechoic
-	+	+	+	9	+	Non-Parallel, no circumscribed, hyperechoic
+	-			8	+	Non-Parallel, no circumscribed, no hyperechoic lesion
+	-		+	24	+	Parallel, no circumscribed, hyperechoic

**Table 2:** Ultrasonographic findings of hyperechoic lesions

Features	Benign % (n=8)	Malignant % (n=5)	p-value
<b>Vascularity</b>			
Present	62.5 (5)	60 (3)	Non-significant
Absent	37.5 (3)	40 (2)	
<b>Posterior acoustic features</b>			
Absent	62.5 (5)	40 (2)	Non-significant
Shadowing	37.5 (3)	60 (3)	
Enhancement	(0)	(0)	
<b>Hypoechoic areas</b>			
Present	37.5 (3)	(0)	Non-significant
Absent	62.5 (5)	100 (5)	
<b>Margins</b>			
Circumscribed	62.5 (5)	(0)	0.007
Non-circumscribed	37.5 (3)	100 (5)	
<b>Orientation</b>			
Parallel	75 (6)	(1)	0.002
Non-parallel	25 (2)	(4)	
<b>Shape</b>			
Round/oval	12.5 (1)	0	Non-significant
Irregular/lobular	87.5 (7)	100 (5)	

## Discussion

The present retrospective clinical study was conducted to

assess the clinical presentation, frequency, and related imaging finding of hyperechoic malignant breast lesions in

cases with core needle biopsies guided ultrasonographically, and also, to assess ultrasonographic features that help in the prediction of the hyperechoic lesion to be malignant. A total of 2255 ultrasonographically guided core needle biopsy was done for 2168 subjects where 52.01% (n=1173) lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. The study results have shown that in total 2255 lesions assessed, 0.57% (n=13) lesions were hyperechoic in 13 females after analyzing the image. In 924 malignant lesions 0.97% (n=9) lesions were hyperechoic. 1.19% (n=14) of lesions were found to be hyperechoic. Among these 14 lesions, there were chronic inflammation, hamartoma, fat necrosis, hibernoma, hemangioma, lymph nodes, fibro adenomas, lipomas, angioliomas, and focal fibrosis in 1, 1, 1, 1, 1, 2, 1, 2, and 3 subjects respectively. No changes on imaging were seen at follow-up till 1 year. No high-risk lesion among 158 lesions was hyperechoic. These results were consistent with the results of Vaidya T *et al.* <sup>[6]</sup> in 2018 and Linda A *et al.* <sup>[7]</sup> in 2011 where authors have shown the comparable distribution of hyperechoic breast lesions.

The results of the present study have shown that on clinical findings, among 13, 46.15% (n=6) females had a palpable nodule in the breast, whereas, 53.84% (n=7) subjects had no symptoms. In these 7 asymptomatic subjects, sonography was done in 6 subjects during the screening of breast cancer, and 1 subject was followed up for breast neoplasm diagnosed previously. The mammographic examination was also done on 10 study subjects. 5 study females underwent MRI of the breast owing to preoperative breast cancer assessment in 2 females, breast cancer screening in 2 subjects, and evaluating surgical scar in 1 subject. The study results have shown that in 9 hyperechoic malignant lesions, synchronous invasive carcinoma in opposite breast was seen in 1 subject, whereas, in 2 subjects metachronous invasive carcinoma was seen in the opposite breast. No subject had a pure lesion as seen on sonography. 5 lesions were palpable, 3 subjects had a previous history of carcinoma breast, 3 subjects had MRI correlation, 5 had mammography correlation, and vascularity was seen in 6 lesions. These results were in agreement with the results of Adrada B *et al.* <sup>[8]</sup> in 2013 and Nassar L *et al.* <sup>[9]</sup> in 2016 where the clinical evaluation of hyperechoic breast lesions showed similar results as the present study.

The present study also assessed the sonographic aspects of the hyperechoic malignant lesions, it was seen that vascularity, hypoechoic lesions, shape, and posterior acoustic features were non-significant among benign and malignant hyperechoic lesions, whereas, circumscribed margins were seen in 62.5% (n=5) and non-circumscribed by 37.5% (n=3) study subjects with benign lesions, and by 100% (n=5) subjects with malignant lesions. This difference was statistically significant with  $p=0.007$ . For the shape of the lesions, more malignant lesions had irregular and lobular margins 100 (n=5) lesions, whereas, in benign lesions, 87.5 (n=7) had irregular/lobular margins. This difference was statistically significant with  $p=0.002$ . These findings were comparable to the results by the studies of Yeh ED *et al.* <sup>[10]</sup> in 2013 and Bhatia M, *et al.* <sup>[11]</sup> in 2015 where authors showed more irregular margins and non-circumscribed shape of the malignant hyperechoic lesions.

## Conclusion

Within its limitations, the present study concludes that

hyperechoic breast lesions on ultrasonography have less prevalence of 0.57% (n=13) lesions in the present study. Hence, hyperechoic breast lesions are less encountered on sonography. However, whenever these hyperechoic lesions are seen, the probability of malignancy should not be excluded. Misdiagnosis can be avoided in suspicious hyperechoic lesions can be avoided on correlating suspicious sonographic lesions to other clinical, histopathologic, and imaging modalities. However, the present study had a few limitations including small sample size, retrospective nature, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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