ORIGINAL RESEARCH

An analytical study for assessing hyperechoic breast lesions using ultrasonography

Dr. Akansha Bajpai

Associate Professor, Department of Radiology, Kanti Devi Medical College Hospital & Research Centre, Mathura, Uttar Pradesh, India

Corresponding Author
Dr. Akansha Bajpai
Associate Professor, Department of Radiology, Kanti Devi Medical College Hospital & Research Centre, Mathura, Uttar Pradesh
Email: akansha.bajpai23@gmail.com

Received: 21 July, 2022 Acceptance: 24 August, 2022

ABSTRACT

Background: On ultrasonography, benign tumors were believed to be hyperechogenic. This notion has recently been altered, since some malignant breast tumors were found to be hyperechogenic on ultrasonography, and upon histopathologic analysis, the hyperechogenic lesions were shown to be malignant. **Aim:** to evaluate hyperechoic malignant breast lesions for their clinical presentation, frequency, and associated imaging findings in cases involving core needle biopsies guided by ultrasonography. **Methods:** A core needle biopsy guided by ultrasonography was performed on 2168 out of 2255 participants. Out of all the evaluated instances, hyperechoic carcinomas were found using a core needle biopsy guided by ultrasonography.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:**2168 individuals underwent 2255 ultrasonographically guided core needle biopsies; 52.01% (n=1173) of the lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. Based on image analysis, the study's findings indicate that, out of the 2255 lesions evaluated, 13 females had 0.57% (n=13) hyperechoic lesions. 0.97% (n=9) of the 924 malignant lesions had hyperechoic lesions. Among study participants with benign lesions, circumscribed 62.5% (n=5), and non-circumscribed 37.5% (n=3) and 100% (n=5) of those with malignant lesions (p=0.007) were observed. Lesions with irregular and lobular margins were more common in malignant lesions (100; n = 5), while 87.5 (n = 7) of benign lesions had irregular and lobular margins (p=0.002). **Conclusion:** hyperechoic breast lesions on ultrasonography have less prevalence of 0.57% (n=13) which indicate that 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

The first preferable imaging modality for diagnosing and characterizing breast lesions that are found by mammography or clinical means is ultrasound testing. Ultrasonography is often used to evaluate the direction, form, borders, echogenicity, and posterior acoustic characteristics of breast masses. The assessment of hyperechogenicity in the literature is contentious, however the lesion's hyperechogenicity is confirmatory of malignancy and carcinomas.1

One of the most highly recommended and precise radiographic methods for diagnosing breast diseases is ultrasound therapy. An complement to breast mammography or magnetic resonance imaging (MRI) is breast ultrasonography. Numerous data reports have been made by BI-RADS (The American College of Radiology Breast Imaging Reporting and Data System)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.[2]Previously, benign lesions on ultrasonography were believed to be hyperechogenic lesions. This idea has recently been altered when it was discovered that certain malignant breast lesions were hyperechogenic on ultrasonography, and that these lesions were malignant upon histopathologic analysis.3

Lesions that are identified as hyperechoic on ultrasonography should fundamentally be grouped

according to ultrasonography results and linked with the appearance of mammograms. Where required, a biopsy or other histopathologic evaluation should be performed for such lesions. A famous research by Starvos and colleagues revealed that the negative predictors' value was 100% since 42 hyperechoic lesions and nodules were determined to be benign during histopathologic evaluation.[4]Hyperechoic lesions and breast nodules, however, have been identified as malignant by a number of other researchers in their literature data. The investigations were a series that covered fewer cases in the majority of these lesions and nodules, and the other imaging features of these lesions were not assessed.

Data that provide a conclusive evaluation of hyperechoic breast lesions are hard to come by in the literature.Five Therefore, the current study was carried out to evaluate the clinical presentation, frequency, and associated imaging findings of hyperechoic malignant breast lesions in cases where core needle biopsies were guided by ultrasonography. Additionally, the study evaluated ultrasonographic features that aid in the prediction that the hyperechoic lesion is malignant.

MATERIALS AND METHODS

After receiving approval from the relevant ethical committee, the current retrospective clinical investigation was carried out at the Department of Radiodiagnosis. The participants in the research were those who had been referred for a breast core needle biopsy under ultrasonographic guidance.

An ultrasonographically guided core needle biopsy was performed on 2168 of the 2255 participants; of them, 52.01% (n=1173) had benign lesions, 40.97% (n=924) had malignant lesions, and 7% (n=158) had high risk lesions. One radiologist with specialized training performed the ultrasonographically guided core needle biopsy, ultrasonographic imaging, and related interpretation. Two orthogonal views were obtained for documentation. For all study subjects, clinical and mammography parameters and clinical features were assessed along with other radiologic imaging reports if available.

For all research participants, whole breast ultrasonography was performed using linear transducers with frequencies of 5-12, 5-17, or 10-13 MHz. Instead, the current investigation used entire breast ultrasonography instead of focused ultrasound. All of the lesions underwent core needle biopsies guided by ultrasonography using an automated biopsy gun with a 14-gauge needle. Each lesion's mean was determined. Follow-ups were conducted at six months and a year for lesions that were determined to be benign. Full-field equipment was used to perform mammograms in the oblique and craniocaudal planes. A 1.0-T system was used for both the MRI and the mammography. Two specialists in the area, each with over ten years of radiology expertise, independently examined the photos.

The BI-RADS lexicon, which 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, was used to evaluate the ultrasonography results.

The nodule's echotexture was assessed using the following criteria: it was considered hypoechoic if there was less echogenicity with regard to subcutaneous fat, hyperechoic if there was more echogenicity with regard to subcutaneous fat, and mixed if there were comparable amounts of hypoechoic and hyperechoic lesions. Hypoechogenicity focal regions showing less than 305 of the lesion were considered hypoechoic areas in hyperechoic lesions that were found.

Any disagreement between two specialists about sonographic characteristics, echotexture, and hypoechoic region was resolved by reaching a consensus. The pathology results and core needle biopsy follow-up served as references for benign lesions, whereas the surgical pathology results served as references for malignant and high-risk lesions. Out of all the evaluated instances, hyperechoic carcinomas were found using a core needle biopsy guided by ultrasonography.

Imaging malignancy predictors for malignant lesions were found by comparing six ultrasonography images in high-risk and malignant instances. Orientation, vascularity, form, posterior acoustic characteristics, borders, and echogenicity were among the sonographic results evaluated.

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 goal of the current retrospective clinical study was to evaluate the clinical presentation, frequency, and associated imaging findings of hyperechoic malignant breast lesions in ultrasonographically guided core needle biopsies. Additionally, the study aimed to evaluate ultrasonographic features that aid in the prediction of malignant status for hyperechoic lesions.

Out of 2168 individuals, 2255 core needle biopsies were performed using ultrasound guidance; 52.01% (n=1173) of the lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk. The study's findings indicate that, out of the 2255 lesions evaluated, 13 females had 0.57% (n=13) hyperechoic lesions on image analysis. Nine out of 924 malignant lesions (0.97%) had hyperechoic lesions.

In these lesions, there were 1, 1, 1, 1, 2, and 2 cases of low-grade intraductal papillary carcinoma, infiltrating ductal carcinoma with neuroendocrine differentiation

(grade I), infiltrating ductal carcinoma with mucinous differentiation (grade II), infiltrating ductal carcinoma not-otherwise-specified (grade III), infiltrating ductal carcinoma not-otherwise-specified (grade II), and invasive lobular carcinoma (grade II). 1.19% (n=14) of the 1173 benign lesions in the current investigation were determined to be hyperechoic. These 14 lesions included focal fibrosis, fibroadenomas, lipomas, angiolipomas, lymph nodes, hamartoma, fat necrosis, hibernoma, hemangioma, and chronic inflammation in 1, 1, 1, 1, 1, 1, 2, 1, 2, and 3 persons, respectively. At follow-up, no imaging alterations were seen for a year. Out of 158 lesions, none of the high-risk lesions were 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.On sonography, no patient had a pure lesion. There were five palpable lesions, three people with a history of breast cancer, three subjects with MRI correlation, five with mammography correlation, and six lesions with vascularity. The nine lesions measured 8, 8, 11, 7, 13, 10, 9, 8, and 24 in size. Additionally evaluated were orientation, margins, and echogenicity (Table 1).

Vascularity, hypoechoic lesions, shape, and posterior acoustic features were found to be non-significant when evaluating the sonographic aspects of the hyperechoic malignant lesions. In contrast, circumscribed margins were observed in 62.5% (n=5) of the study subjects with benign lesions, non-circumscribed in 37.5% (n=3), and present in 100% (n=5) of the study subjects with malignant lesions.

P = 0.007 indicated that this difference was statistically significant. More malignant lesions exhibited lobular and irregular borders in terms of their form. There were 100 (n=5) lesions, whereas 87.5 (n=7) of the benign lesions had irregular or lobular borders. Table 2 shows that this difference was statistically significant at p=0.002.

Table 1: Clinical and radiographic features of hyperechoic malignant lesions

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

Table 2: Ultrasonographic findings of hyperechoic lesions

Features	Benign % (n=8)	Malignant % (n=5)	p-value
Vascularity			
Present	62.5 (5)	60 (3)	Non-significant
Absent	37.5 (3)	40 (2)	
Posterior acoustic features			
Absent	62.5 (5)	40 (2)	Non-significant
Shadowing	37.5 (3)	60 (3)	

Enhancement	(0)	(0)	
Hypoechoic areas			
Present	37.5 (3)	(0)	Non-significant
Absent	62.5 (5)	100 (5)	
Margins			
Circumscribed	62.5 (5)	(0)	0.007
Non-circumscribed	37.5 (3)	100 (5)	
Orientation			
Parallel	75 (6)	(1)	0.002
Non-parallel	25 (2)	(4)	
Shape			
Round/oval	12.5 (1)	0	Non-significant
Irregular/lobular	87.5 (7)	100 (5)	

DISCUSSION

The goal of the current retrospective clinical study was to evaluate the clinical presentation, frequency, and associated imaging findings of hyperechoic malignant breast lesions in ultrasonographically guided core needle biopsies. Additionally, the study aimed to evaluate ultrasonographic features that aid in the prediction of malignant status for hyperechoic lesions. Out of 2168 individuals, 2255 core needle biopsies were performed using ultrasound guidance; 52.01% (n=1173) of the lesions were benign, 40.97% (n=924) were malignant, and 7% (n=158) were high risk.

According to the study's findings, out of the 2255 lesions evaluated, 13 females had 0.57% (n=13) hyperechoic lesions following image analysis. Hyperechoic lesions were seen in 924 malignant lesions (0.97%; n = 9). Hyperechoic lesions were observed in 1.19% (n=14) of cases. These 14 lesions included focal fibrosis, fibroadenomas, lipomas, angiolipomas, lymph nodes, hamartoma, fat necrosis, hibernoma, hemangioma, and chronic inflammation in 1, 1, 1, 1, 1, 1, 2, 1, 2, and 3 persons, respectively. At follow-up, no imaging alterations were seen for a year. Out of 158 lesions, none of the high-risk lesions were hyperechoic. These findings were in line with those of Linda A. et al. (2011) and Vaidya T. et al. (2018), who demonstrated a similar distribution of hyperechoic breast lesions.

According to clinical data, out of 13, 46.15% (n=6) of the female participants had a palpable breast nodule, whereas 53.84% (n=7) of the individuals showed no symptoms. Six of the seven asymptomatic participants had sonography performed as part of the breast cancer screening, and one of them was monitored for a previously diagnosed breast tumor. Mammograms were also performed on ten research participants. In order to screen for breast cancer in two subjects, examine surgical scars in one subject, and assess preoperative breast cancer in two females, five research participants had breast MRIs. According to study data, one person had synchronous invasive carcinoma in the opposite breast out of nine hyperechoic malignant lesions, whereas two people had metachronous invasive carcinoma in the opposite breast.

According to sonography, none of the subjects had a pure lesion. Five palpable lesions, three participants with a history of breast cancer, three subjects with MRI correlation, five with mammography correlation, and six lesions with vascularity were seen. These findings concurred with those of the clinical examination of hyperechoic breast lesions conducted by Adrada B et al. (2013) and Nassar L et al. (9), which produced findings comparable to those of the current investigation.

The sonographic features of hyperechoic malignant lesions were also evaluated in this study. Vascularity, hypoechoic lesions, shape, and posterior acoustic features were found to be non-significant among benign and malignant hyperechoic lesions, while circumscribed margins were observed in 62.5% (n=5) of the study subjects with benign lesions and non-circumscribed in 37.5% (n=3) of the study subjects with malignant lesions, and by 100% (n=5) of the study 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[10] in 2013 and Bhatia M et al[11] in 2015 where authors showed more irregular margins and non-circumscribed shape of the malignant hyperechoic lesions.

CONCLUSION

Notwithstanding its limitations, the current study finds that the prevalence of hyperechoic breast lesions on ultrasonography is lower, at 0.57% (n=13) lesions. Hyperechoic breast lesions are therefore less common on sonography. Malignancy should not be ruled out, nevertheless, anytime these hyperechoic lesions are seen. It is possible to prevent misdiagnosis in suspected hyperechoic lesions by comparing them to other imaging, histopathologic, and clinical modalities. However, the current study has some drawbacks, such as biases related to geographic location, retrospective nature, and limited sample size. In order to arrive at a conclusive result, further

longitudinal studies with a bigger sample size and longer monitoring duration are needed.

REFERENCES

1. Taboada JL, Stephens TW, Krishnamurthy S, Brandt KR, Whitman GJ. The many faces of fat necrosis in the breast. AJR 2009;192:815-25.
2. Lyou CY, Yang SK, Choe DH, Lee BH, Kim KH. Mammographic and sonographic findings of primary breast lymphoma. Clin Imaging 2007;31:234–8.
3. Chao TC, Chao HH, Chen MF. Sonographic features of breast hamartomas. J Ultrasound Med 2007;26:447–52.
4. Colville J, Feigin K, Tang L, Keating D, Cohen MA. Mammary hibernoma. Breast J 2006;12:563–5.
5. Mesurolle B, Sygal V, Lalonde L, et al. Sonographic and mammographic appearances of breast hemangioma. AJR 2008;191:284.
6. Vaidya T, Ramani S, Rastogi A. A case series of metastases to the breast from extramammary malignancies. Indian J Radiol Imaging 2018;28:470–5.
7. Linda A, Zuiani C, Lorenzon M, et al. The wide spectrum of hyperechoic lesions of the breast. Clin Radiol 2011;66:559–65.
8. Adrada B, Wu Y, Yang W. Hyperechoic lesions of the breast: radiologic-histopathologic correlation. AJR Am J Roentgenol 2013;200:518–30.
9. Nassar L, Issa G, Farah Z. El Zein Y, Berjawi G. Predictors of malignancy in hyperechoic breast lesions. J Ultrasound Med 2016;35:783–90.
10. Yeh ED, Jacene HA, Bellon JR, et al. What radiologists need to know about diagnosis and treatment of inflammatory breast cancer: a multidisciplinary approach. Radiographics 2013;33:2003–17.
11. Bhatia M, Ravikumar R, Maurya VK, Rai R. “Breast within a breast” sign: mammary hamartoma. Med J Armed Forces India 2015;71:377–9.