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Ultrasound Assessment of Echogenic Breast Lesions. Is It Enough For Diagnosis?

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Abstract

Background: On U/S, a hyperechoic breast mass is defined as a lesion that is of increased echogenicity compared to the subcutaneous adipose tissues. Approximately 0.6–5.6% of breast masses are hyperechoic. The aim of the work was to assess the diagnostic value of US of echogenic is valid for proper diagnosis comparing with histopathological findings as a gold standard. Methods: This was a prospective study was done on cases at Benha university hospital radiology department. Our study included 50 cases in whom US revealed suspicious masses of these patients. Results: According to diagnosis based on ultrasonography 11 (22%) patients with Lipoma, 8 (16%) patients with Hamartoma, 7 (14%) with Mastitis 5 (10%) with Intramammary lymph nodes, 3 (6%) with Fat Necrosis, 4 (8%) with Fibroadenoma, 1 (2%) with Seroma, 3 (6%) with Fibrocystic breast condition, 3 (6%) with Adenoma , 1 (2%) with Angiosarcoma and no patient showed Primary cancer as a provision diagnosis. While final diagnosis showed 11 (22%) patients with Lipoma, 6 (16%) patients with Hamartoma, 6 (26%) with Mastitis 5 (10%) with Intramammary lymph nodes, 3 (6%) with Fat Necrosis, 5 (10%) with Fibroadenoma, 1 (2%) with Seroma, 3 (6%) with Fibrocystic breast condition, 4 (8%) with Adenoma , 1 (2%) with Angiosarcoma and one (2%) patient showed Primary cancer. According to validity of ultrasonography in diagnosis of different echogenic breast lesions, it was 100% accurate in all types of lesions except 3 lesions (2 cases of hamartoma and one case of mastitis) which finally diagnosed as (Adenoma , Angiosarcoma and Primary breast cancer). Conclusion: We can conclude that Hyperechogenicty appearance of breast lesion by US is enough to exclude malignancy while hypoechgenic and other types of breast lesions needs further investigations for excluding malignancy. Other US BI-RADS categories is necessary to differentiate the types of breast of lesion.

Key words: Ultrasound Assessment, Echogenic Breast Lesions**.**

1. Introduction

Ultrasonography is a popular imaging technique because it is comfortable for patients, widely available at a relatively low cost, and does not involve the use of ionising radiation or contrasting agents. Despite the appeal of ultrasonography to patients, concerns have been raised about the use of HHUS for screening given its lower rates of specificity compared with FFDM. Furthermore, the application of HHUS for the early detection of breast cancer has been limited by a lack of technologists or physicians with the level of experience required to perform HHUS examinations [(1).]

Le-Petross & Shetty [(2)] referred to six cohort studies which found that the use of U/S as a screening technique identified primarily invasive cancers in 0.32% of women. The mean tumour size was 9.9mm, and 90% of cancers were node negative. Biopsy rate was high at 2.3% to 4.7%, with positive predictive value of 8.4% to 13.7% for those biopsied because of an abnormal finding on the U/S examination. They observed, however, that the added benefit of using this imaging modality to screen for breast cancer was lower in women aged 50-69 years. The Le-Petross and Shetty review also noted that U/S was able to identify small nonpalpable masses while undeterred by presence of dense breast tissue, which is an inherent limitation of mammography. However, unlike mammography, DCIS is not usually identified by U/S. Their review (as well as the review by **Kornecki,** [(3)] noted that no study had advocated for U/S to be used as the only modality to screen for breast cancer. This was said to be due to the low yield of U/S alone detected breast cancers.

Although the vast majority of sonographically echogenic breast masses are benign, malignant entities are important differential diagnostic considerations. Determining whether an echogenic breast lesion warrants biopsy requires correlation with the mammographic appearance, lesion location, clinical history, patient demographics, and presence or absence of suspicious findings at mammography and US. [(4)]

The aim of the work was to assess the diagnostic value of US of echogenic is valid for proper diagnosis comparing with histopathological findings as a gold standard.

2. Patients and Methods

A. Study design

This was a prospective study was done on cases at Benha university hospital radiology department.

B. Patient/ Study Subjects

Our study included 50 cases in whom US revealed breast masses of these patients with average age of 45 years from January 2021 to January 2022

Inclusion criteria:

Female patients with echogenic breast masses on US and approved to participate in the study

Exclusion criteria:

- Breast masses with other echogenesty rather than echogenic.

The patients underwent full history taking, General examination of the patient, local examination of the breast mass by inspection and palpation was also assessed

Ultra sound examination, classified according breast imaging reporting and data system (BIRADS) and biopsy was done with correlation to pathological results as a gold standard.

After approval from ethical committee, an informed consent was obtained from all patients in this research.

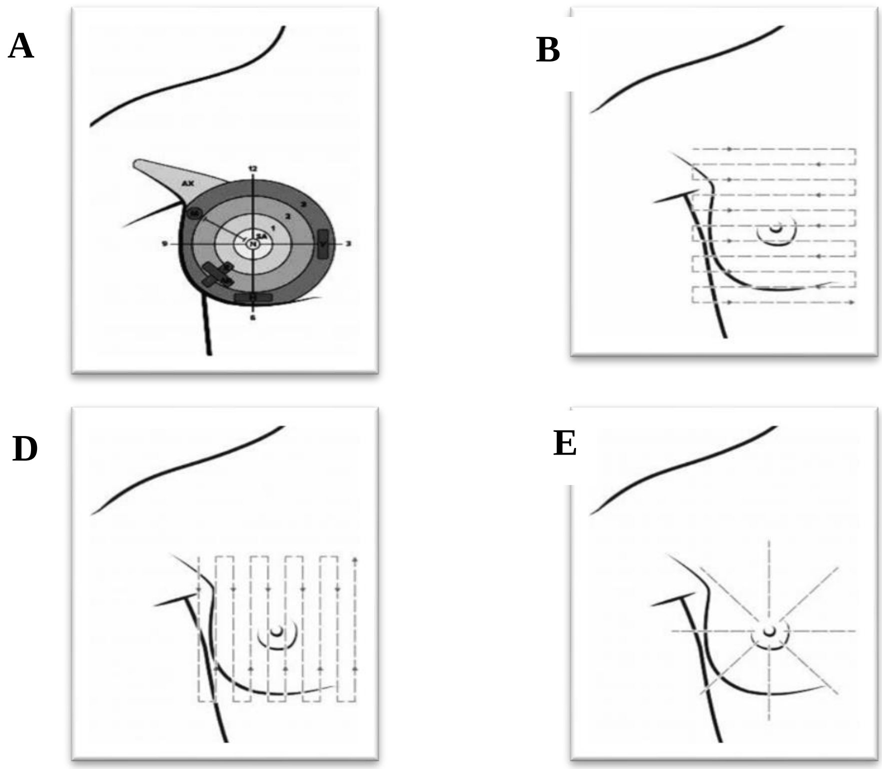
All data of patients had been confidential with secret codes and private file for each patient, and the photos applied only to the parts of the body linked to the research. Every patient received an explanation for the purpose of the study. All given data were used for the current medical research only.

- **Equipment:**

Ultra sound (LOGIQ P6 PRO, LOGIC P7) with a 7.5-12 MHz linear array transducer with apparatus parameters adjusted for breast examination. **(Fig.)**

Fig. (1) LOGIC P6 PRO.

- **<u>Procedure:</u>**



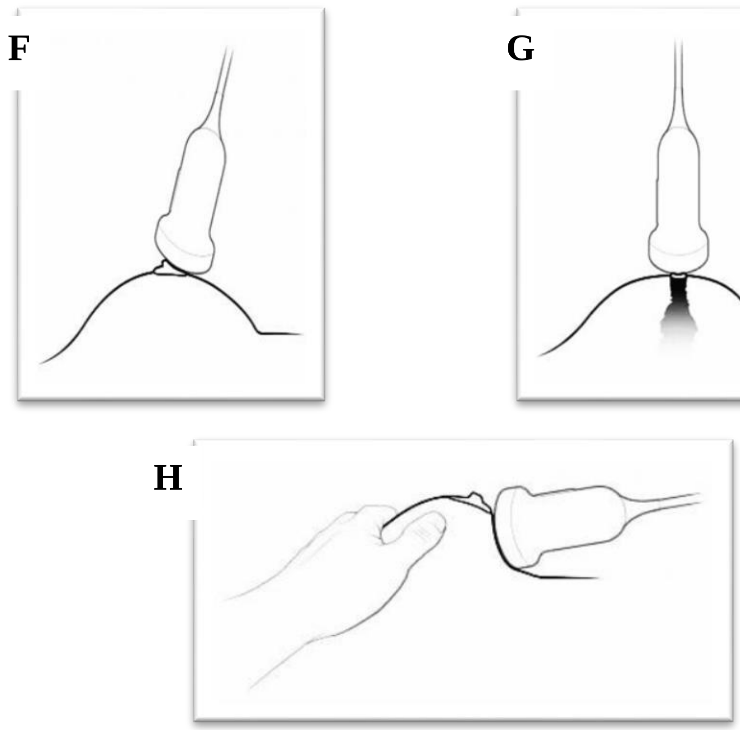


Fig. (2) Breast annotation scheme.

A. The nipple is designated "N," the subareolar are "SA," the axilla is "AX." Three concentric, almost equally sized circular zones are designated by the numbers 1, 2, and 3. The clock face is used for radial localization, and the 4 clock times are represented by the blue arrows. The mass given by the black area (M) would be identified as R, 10, 3 (right breast, 10 o'clock, zone 3).

B. The breast is examined in an overlapping raster pattern to ensure that the whole organ has been seen. The raster patterns are executed in the horizontal as well as vertical planes. This diagram shows the horizontal raster pattern. The raster pattern is followed by radial scanning, along the direction of the lobes and ducts.

C. The breast is examined in an overlapping raster pattern to ensure that the whole organ has been seen. The raster patterns are executed in the horizontal as well as vertical planes. This diagram shows the vertical raster pattern. The raster pattern is followed by radial scanning, along the direction of the lobes and ducts.

D. The breast is examined in an overlapping raster pattern to ensure that the whole organ has been seen. The raster patterns are executed in the horizontal as well as vertical planes. The raster pattern is followed by radial scanning, along the direction of the lobes and ducts. This diagram shows the radial scanning pattern.

E. Scanning the nipple and subareolar region is challenging because the nipple pushes into the breast substance, appearing as a vaguely shadowing nodule in the subcutaneous area. The tightly packed ducts in the breast are parallel to the U/S beam, making these difficult to see in case of pathology.

F. With nipple lesions, it is helpful to "roll" the nipple, using the probe to scan it along its side. This improves the angle of the ducts to the U/S beam making for easier and better visualization.

G. In some cases, the breast can be supported by the other hand to optimize the nipple-probe geometry. This gives the highest quality images of the area but has a learning curve because the nipple tends to slip away.

Other sonographic features described were:

- Echotexture of the lesions were defined as hypoechoic or isoechoic or hyperechoic (compared with the subcutaneous fat)
- Margins of the lesion – well defined, ill defined, spiculated, lobulated
- Presence of axillary nodes
- Categorised BIRADS of the lesion with sonogram

Statistical Analysis

The clinical data were recorded on a report form. These data were tabulated and analyzed using the computer program SPSS (Statistical package for social science) version 20 to obtain: ***Descriptive statistics were calculated for the data in the form of:*** 1. Mean and standard deviation $(\pm SD)$. 2. Frequency and distribution for qualitative data. Inter-group comparison of categorical data was performed by using fisher exact test (FET). A *P* value <0.05 was considered statistically significant (*) while >0.05 statistically insignificant P value <0.01 was considered highly significant (**) in all analyses.

3. Results

The mean age of the studied group is 46.2 years (±SD 14.7) ranging between 27-62 years. 19 cases have positive family history of breast cancer, while 31 cases were negative family history of breast cancer. (table 1)

Table (1) patient's characters of the studied group.

		mean ±SD (range/%)
Age		45.05±13.09 (27.0-62.0)
BMI		27.6 ±7.51 (22.3-30.8)
Family history	**Yes**	**19 (38%)**
	No	**31 (62%)**

Aim of examination: 4 patients came with breast enlargement, while 19 patients came with mastalgia, 9 patients came with nipple discharge and 11 patients came for screening.(table 2)

Table (2) Distribution of patients based on indication of US.

Indication of US		**Number**	**Percentage (%)**
Screening		11	22%
Symptoms	breast enlargement	4	8%
	Nipple discharge	9	18%
	Pain	19	38%
	Lump	7	14%

Mass distribution of the studied group according to the side. 29 of the masses were right sided, while 21 masses were left sided. (table. 3)

Table (3) Mass distribution of the studied group according to the side.

	N	**%**
Side		
Rt	29	58.0
Lt	21	42.0
Total	50	100

28 of masses were in upper outer quadrant (UOQ), while 9 masses were in upper inner quadrant (UIQ) ,6 masses in lower outer quadrant (LOQ) and 7 masses were retro areolar in location.(table.4).

Table (4) Mass distribution of the studied group according to quadrant.

	N	**%**
Quadrant		
Retroarea	7	14
UIQ	9	18
LOQ	6	12
UOQ	28	56
Total	50	100

According to **diagnosis based on ultrasonography** 11 (22%) patients with Lipoma,
8 (16%) patients with Hamartoma, 7 (14%) with Mastitis 5 (10%) with Intramammary lymph nodes, 3 (6%) with Fat Necrosis, 4 (8%) with Fibroadenoma, 1 (2%) with Seroma, 3 (6%) with Fibrocystic breast condition, 3 (6%) with Adenoma , 1 (2%) with Angiosarcoma and no patient showed Primary cancer as a provision diagnosis

While final diagnosis showed 11 (22%) patients with Lipoma, 6 (16%) patients with Hamartoma, 6 (26%) with Mastitis 5 (10%) with Intramammary lymph nodes, 3 (6%) with Fat Necrosis, 5 (10%) with Fibroadenoma, 1 (2%) with Seroma, 3 (6%) with Fibrocystic breast condition, 4 (8%) with Adenoma , 1 (2%) with Angiosarcoma and one (2%) patient showed Primary cancer .(table.5) & fig (1).

Table (5) Distribution of diagnosis based on ultrasonography and final diagnosis**.**

Type of lesion	U/S diagnosis	Final Diagnosis
Lipoma	11 (22%)	11 (22%)
Hamartoma	8 (16%)	6 (16%)
Mastitis	7 (14%)	6 (26%)
Intramammary lymph nodes	5 (10%)	5 (10%)
Fat Necrosis	3 (6%)	3 (6%)
Fibroadenoma	4 (8%)	5 (10%)
Seroma	1 (2%)	1 (2%)
Fibrocystic breast condition	3 (6%)	3 (6%)
Adenoma	3 (6%)	4 (8%)
Angiosarcoma	1 (2%)	1 (2%)
Primary cancer	0 (0%)	1 (2%)

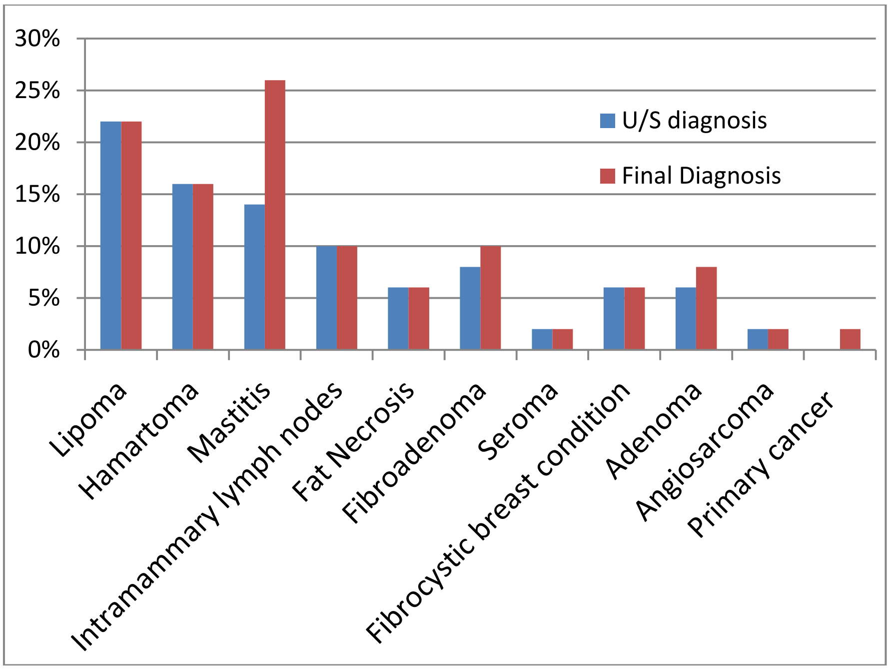


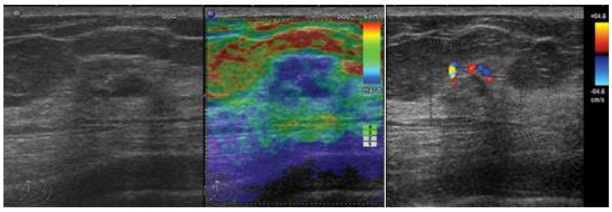
Fig. (3) Distribution of diagnosis based on ultrasonography and final diagnosis.

According to validity of ultrasonography in diagnosis of different echogenic breast lesions, it was 100% accurate in all types of lesions except 3 lesions (2 cases of hamartoma and one case of mastitis) which finally diagnosed as (Adenoma , Angiosarcoma and Primary breast cancer)

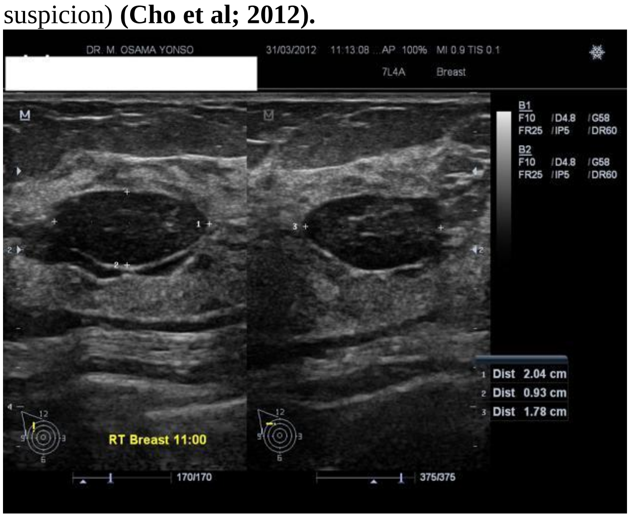
Table (6) Validity of ultrasonography in diagnosis of different echogenic breast lesions.

Type of lesion	Sensitivity	Specificity	Accuracy
Lipoma	100%	100%	100%
Hematoma	100%	95.45%	95.91%
Mastitis	100%	97.73%	97.95%
Fat Necrosis	100%	100%	100%
Fibroadenoma	80%	100%	98%
Seroma	100%	100%	100%
Fibrocystic breast condition	100%	100%	100%
Adenoma	75%	100%	97.5%
Angiosarcoma	100%	100%	100%
Primary cancer	0%	100%	90%

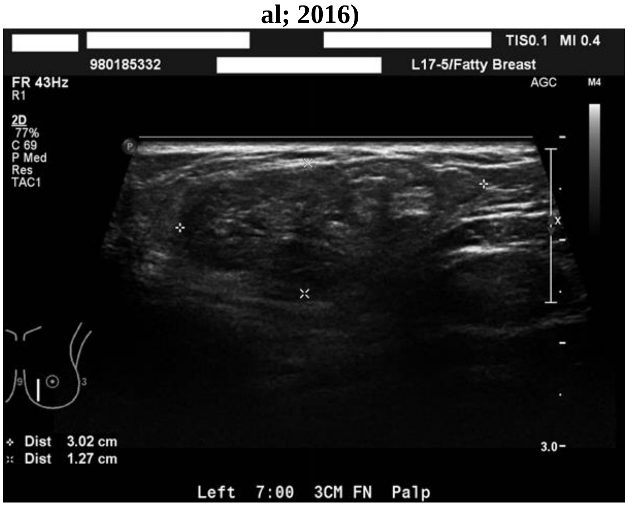
4. Cases presentation



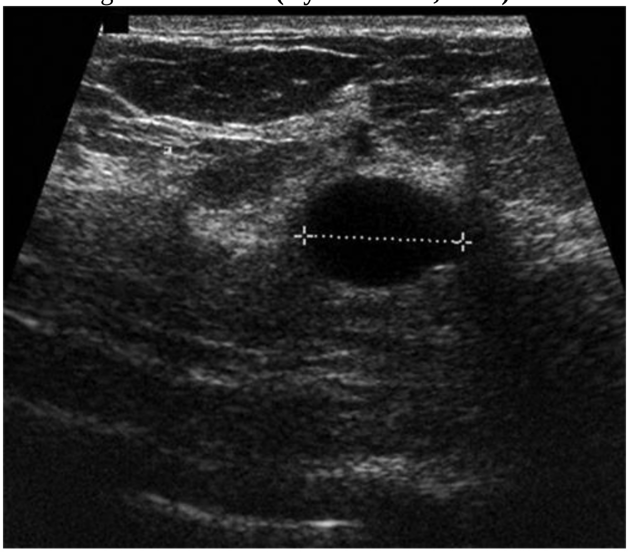
Fig(3) : US images in 57-year-old woman with infiltrating ductal carcinoma at core biopsy. **(a)** B-mode image shows an irregular hypoechoic mass. **(b)** US elastographic image shows the entire lesion as blue, indicating a hard lesion. **(c)** Color Doppler US image shows increased vascularity. At the first reading session (B-mode alone), three readers classified the lesion as a likelihood of malignancy score of 3 (intermediate suspicion), and two readers classified the lesion as a likelihood of malignancy score of 4 (moderate suspicion). At the fourth reading session (B-mode, elastography, and Doppler US), all five readers upgraded it to a likelihood of malignancy score of 5 (high suspicion) **(Cho et al; 2012).**



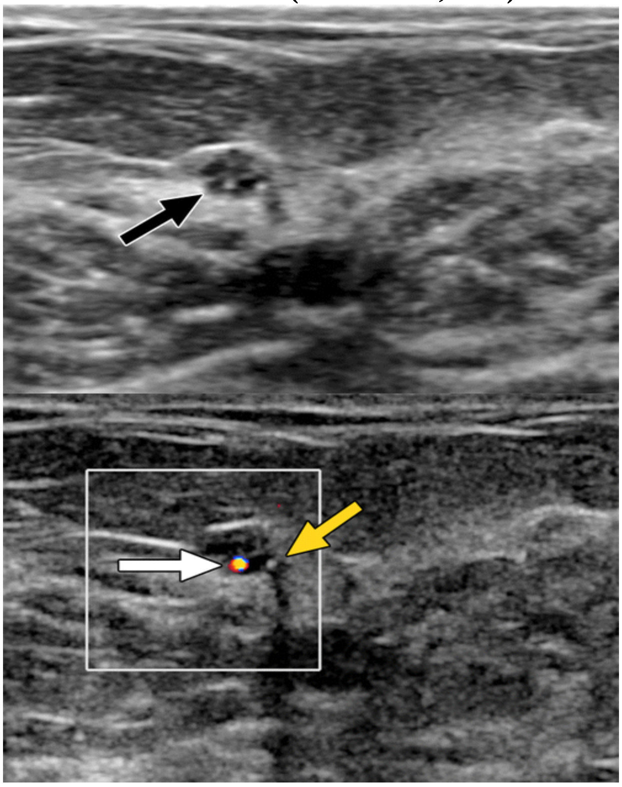
Fig(4) : US appearance of a fibroadenoma **(Aydiner et al; 2016)**



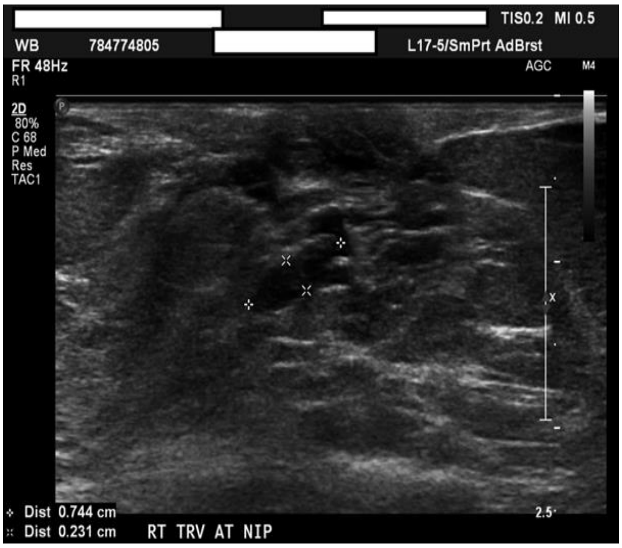
Fig(5) : US of a hamartoma demonstrating a 3-cm circumscribed lesion that was isoechoic to normal fatty and fibroglandular tissue **(Aydiner et al; 2016)**



Fig(6) : US of the left breast in a 32 year old woman showing a simple cyst appearing as an anechoic circumscribed round mass **(Rinaldi et al; 2010).**



Fig(7) : (**A**) US image demonstrates a small clustered microcyst, containing tiny echogenic foci (arrow). **(b)** Color Doppler twinkle artifact (white arrow) confirms the presence of a microcalcification. Note also a second shadowing echogenic focus (yellow arrow), consistent with another shadowing microcalcification. This cluster microcyst was stable at short-interval follow-up US **(Hooley et al; 2013).**



Fig(8) : US picture of a centrally located intraductal papilloma. There is an intraductal hypoechoic mass measuring 7 × 2 mm **(Aydiner et al; 2016).**

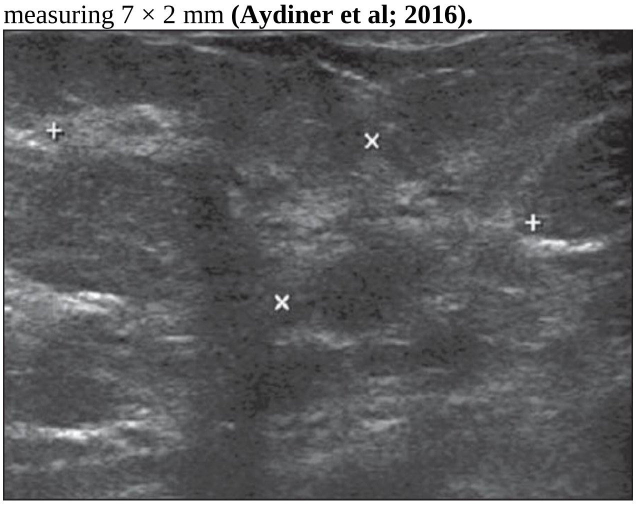


Figure (9) *Ductal carcinoma in situ* in a patient with Paget disease. Ultrasonography showing heterogeneous, irregular area with subtle parenchymal disorganization associated with intermingled microcysts.

Figure (10) *Lymphoma*. Ultrasonography showing a slightly heterogeneous, regular nodule parallel to the skin. Lesion identified at follow-up of a patient undergoing treatment for non-Hodgkin lymphoma.

5. Discussion

The mean age of the studied group is 46.2 years (±SD 14.7) ranging between 27-62 years. 19 cases have positive family history of breast cancer, while 31 cases were negative family history of breast cancer.

Aim of examination: 4 patients came with breast enlargement, while 19 patients came with mastalgia, 9 patients came with nipple discharge and 11 patients came for screening

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Melnikow et al [(5)] looked at breast cancer detection outcomes for supplementary ABUS and HHUS in 13 studies. The cancer detection rate ranged from 1.9 to 15.2 per 1,000 screening examinations for ABUS (3 studies) and 0.4 to 18.9 per 1,000 for HHUS, with comparable recall rates ranging from 2 to 14%. While there was little to distinguish between the two U/S techniques in terms of cancer detection rates, they noted that the sensitivity rate for ABUS (68.0%) was lower than HHUS (which ranged from 80.0 to 100.0%), although specificity was higher for ABUS (92.0%) than HHUS (72.0 to 95.0%).

While the previous study demonstrated equal or greater lesion detectability with ABUS than handheld imaging, **Gilbert & Selamoglu** [(6)] raised concerns regarding false positives and high recall rates, which were higher when U/S was used as a supplementary tool to mammography compared with mammography alone.

In one of the studies they referred to, recall rates with U/S alone were 20.9% in the prevalent round although they dropped to 10.7% in subsequent rounds, compared to mammography recall rates of 11.5% and 9.4%. Increased recall rates were observed in three other studies. They also noted a reader study of 185 cases, including 52 cancer cases that compared the use of mammography alone to mammography combined with ABUS. This study found that while using mammography combined with ABUS decreased specificity from 78.1% to 76.1%, sensitivity increased significantly from 57.9% to 74.1%. As the performance of the readers in this study was variable, it was stressed that training was essential **(6).**

Due to the physics of sound propagation, U/S is particularly useful in dense breasts compared with mammography. In contrast, mammography in dense breasts shows almost no tissue details because of the lack of contrast between fibroglandular tissue and soft tissue masses. U/S shows even small lesions with low echogenicity in highly echogenic dense breast tissue. However, U/S is more operator dependent than mammography. Therefore, standardization of examination technique and interpretation and quality control of technical standards is essential [(7)]

In 1995, **Stavros *et al*** [(8)] described lesions that were uniformly hyperechoic with no isoechoic or hypoechoic areas as benign, reporting a negative predictive value of 100% after 42 biopsies of hyperechoic nodules. One of the most common benign hyperechoic breast lesion is fat necrosis from previous breast trauma. Other benign entities include lesions containing adipose tissue (lipoma), lesions containing fibrotic tissue (pseudoangiomatous stromal hyperplasia and others), vascular lesions (haemangioma) and a combination of tissue types such as a hamartoma and angiomyolipoma. A number of authors have published data indicating that a very small proportion of hyperechoic lesions are malignant. **Linda *et al*** [(9)] reported 9 (0.5%) hyperechoic malignant lesions out of 1849 biopsied malignancies. **Nam *et al*** [(10)] reported 103 hyperechoic lesions out of 16416, of which 27 were biopsied, five (4.9%) were malignant, and Soon *et al*. found two (0.5%) hyperechoic nodules among 393 screen detected breast cancers.

Nassar et al. [(11)] reported that Hyperechoic breast lesions, although rare, are not all benign. Occasionally a breast malignancy can present as a hyperechoic mass. The worrisome features in a sonographically echogenic lesion are: irregular shape, non-circumscribed margin, and nonparallel orientation. The decision to biopsy should be based on the most suspicious US features, correlation with the mammographic appearance, and the clinical history. When used in conjunction, this knowledge can help the radiologist formulate an accurate differential diagnosis and management plan.

6. Conclusion

From our finding we can conclude that Hyperechogenicty appearance of breast lesion by US is enough to exclude malignancy while hypoechgenic and other types of breast lesions needs further investigations for excluding malignancy. Other US BI-RADS categories are necessary to differentiate the types of breast of lesion.

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