

## **Diagnostic accuracy of ultrasonography to distinguish between benign and malignant solid breast masses**

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### **Abstract**

**Background:** Ultrasound is an important imaging modality in the assessment of palpable breast masses. It has become a valuable tool to use along with mammogram because it is widely available, portable, non-invasive, not using ionizing radiation, and less expensive than other options.

**Objectives:** to determine the accuracy of ultrasonography to distinguish between benign and malignant solid breast masses and comparing it with histopathological results obtained from biopsy of breast mass.

**Patients and methods:** This is a Cross sectional study, conducted in Rizgary Teaching Hospital / Radiology Department and Maternity Teaching Hospital /Breast Center in Erbil from April 2014 to March 2015. Ultrasonographic evaluation of 100 patients with breast lumps was done. Diagnosis was made considering four features of the lumps i.e. shape, margins, width, A/P ratio and echogenicity. Diagnosis was confirmed by fine needle aspiration cytology or histopathology.

**Results:** the validity of ultrasonography in the differentiation of breast masses was calculated. A sensitivity value of 100%, specificity of 78.3%, positive and negative predictive values of 67.5% and 100% respectively with accuracy of 85% were noted. Among the multiple ultrasonographic parameters, all were significant in the diagnosis of benign versus malignant masses except the maximum diameter.

**Conclusion:** this study shows that sonography is useful in characterization of breast masses. Attention must be paid to combination of sonographic features rather than any single characteristic.

**Key words:** Breast Mass, Benign, Malignant, Ultrasonography

## **Introduction**

Breast cancer is one of the most common cancers to affect women in the developed world. It has been speculated that the lack of an early cancer detection program is responsible for the majority of women presenting at a late, symptomatic stage when cure is impossible.<sup>1</sup> Unlike many cancers, breast cancer is not dominantly a disease of the elderly, it affects young women.<sup>2</sup>

The Risk factors for breast cancer increases with age , nulliparous,<sup>3</sup>and upper class female are more affected than lower social class females and Unmarried are affected more than married women.<sup>4</sup> Also increases in the nulliparous ,Early age at menarche <12 years, late age of menopause >55.

Ultrasound is an important imaging modality in the assessment of palpable breast masses. Its main role has been differentiating cystic from solid masses Though the use of ultrasound is determined by the patient age and nature of the breast lesion.<sup>5</sup> It has become a valuable tool to use along with mammogram because it is widely available, portable, non- invasive , not using ionizing radiation , and less expensive than other options.<sup>6</sup>

The purpose of this study is to evaluate the accuracy of ultrasonography to distinguish between benign and malignant solid breast masses and comparing it with histopathological results obtained from biopsy of breast mass.

Malik G, et al proves the efficacy of ultrasound as a method of choice to evaluate breast masses in young patients avoiding the need of biopsy, and also reflect that the benign diseases dominate the disease spectrum in young patient. The sensitivity was more for benign 92% than malignant lesions 67% and its specificity was high for malignant lesions 92.4%.

## **Methods**

Ultrasonographic evaluation of 100 female with breast masses was done in Radiology Department of Rizgary Teaching Hospital and Maternity Hospital breast centre- Erbil between April 2014 to March 2015.

One hundred patients were found to have breast masses on ultrasound, a total of 13 patients were excluded, because 10 of them were simple cystic masses and 3 patients of them due to lack of histological result or inconclusive Fine Needle Aspiration (FNA).

A total of 87 patients with breast masses were included in this study, many of these masses underwent truecut biopsy, and some masses underwent US guided Fine Needle Aspiration Cytology and had a conclusive diagnosis.

The patient laid supine , the ipsilateral arm comfortably raised and placed under the neck to help spread out the breast, keep the breast firm on to the chest wall and allow better evaluation of the axillary region, and then the patient turned slightly in oblique position to scan the breast

A high frequency 7.5MHz linear array transducer with US equipment (Siemens sono line prima Unit Germany) was used to scan both breasts. Sonographic gel was applied over the skin of the entire breast including the axilla. The probe was gently applied over the mass and both sagittal and transverse scans were done radially as shown in figure (2). The axilla was scanned to check for any associated lymphadenopathy. This procedure was done on both breasts. For a large glandular breast more compression with the transducer have been required to obtain better penetration.

The location of lesion was labeled according to the breast quadrants and the distance from the nipple.

The scans included information regarding the four features of the palpable breast mass:-

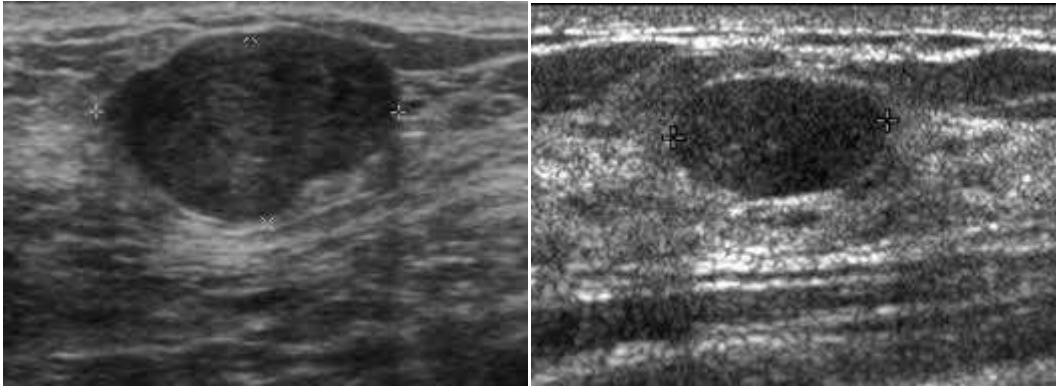
1. Shape: Round/ Oval or irregular margin ,well define or irregular margin.
2. Margins : well defined or ill defined
- 3.Orientation of solid mass: taller than wide or wider than tall.
- 4.Echogenicity: hyperechoic , isoechoic or hypoechoic.

The prospective classification of the masses into benign or malignant categories was performed based on previously published criteria which were established by Stavros et al.<sup>8</sup>

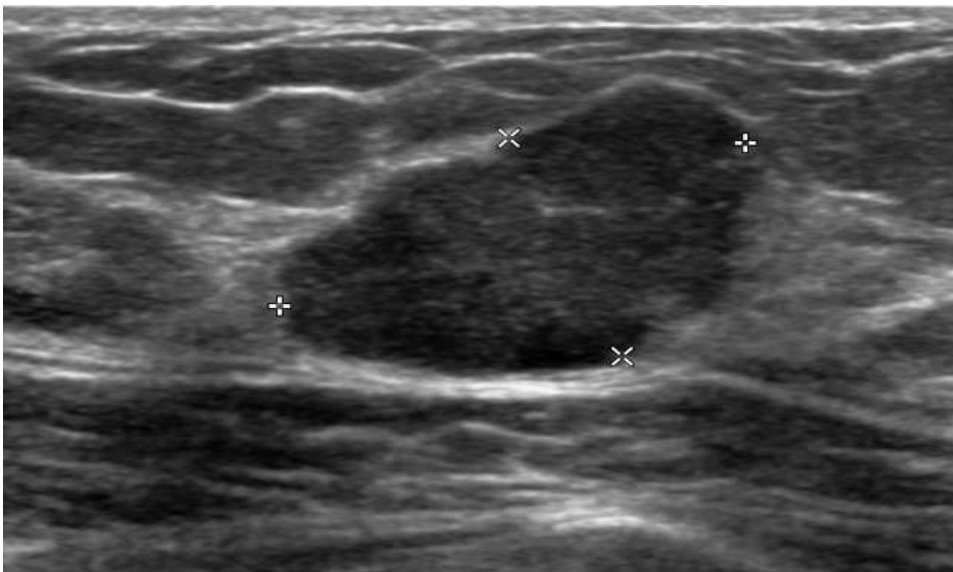
To be classified a solid mass as malignant, a mass need to have any of the following characteristics: spiculated contour, antiparallel orientation, marked hypoechogenicity, posterior acoustic shadowing, microlobulation or duct extension as shown in figure (2and3). If even a single malignant feature was present the mass was excluded from the benign classification..

We classified masses as benign, if they had no malignant characteristics and also demonstrated 1 of the 3 following combinations of benign characteristics: 1) intense uniform hyperechogenicity; 2) wider than tall (parallel orientation along with a thin, echogenic capsule; 3) two or three gentle lobulations and a thin echogenic capsule as shown in figure (1).

On the bases of the above features, an impression about diagnosis was made from ultrasound. Confirmation of ultrasound results was made by fine needle aspiration cytology or core biopsy done by expert pathologist in the department of pathology.



**Figure 1:** Ultrasound image of benign mass, reviewed a well circumscribed benign fibroadenoma.



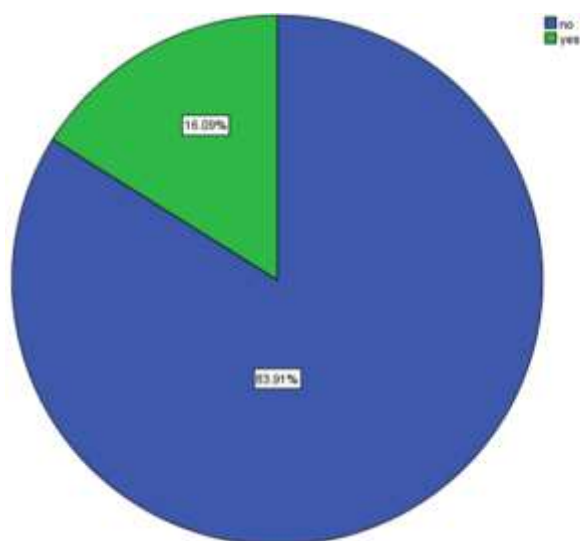
**Figure 2:** Ultrasound image of infiltrative ductal carcinoma . hypoechoic irregular outline breast mass in a 20 years old patient .



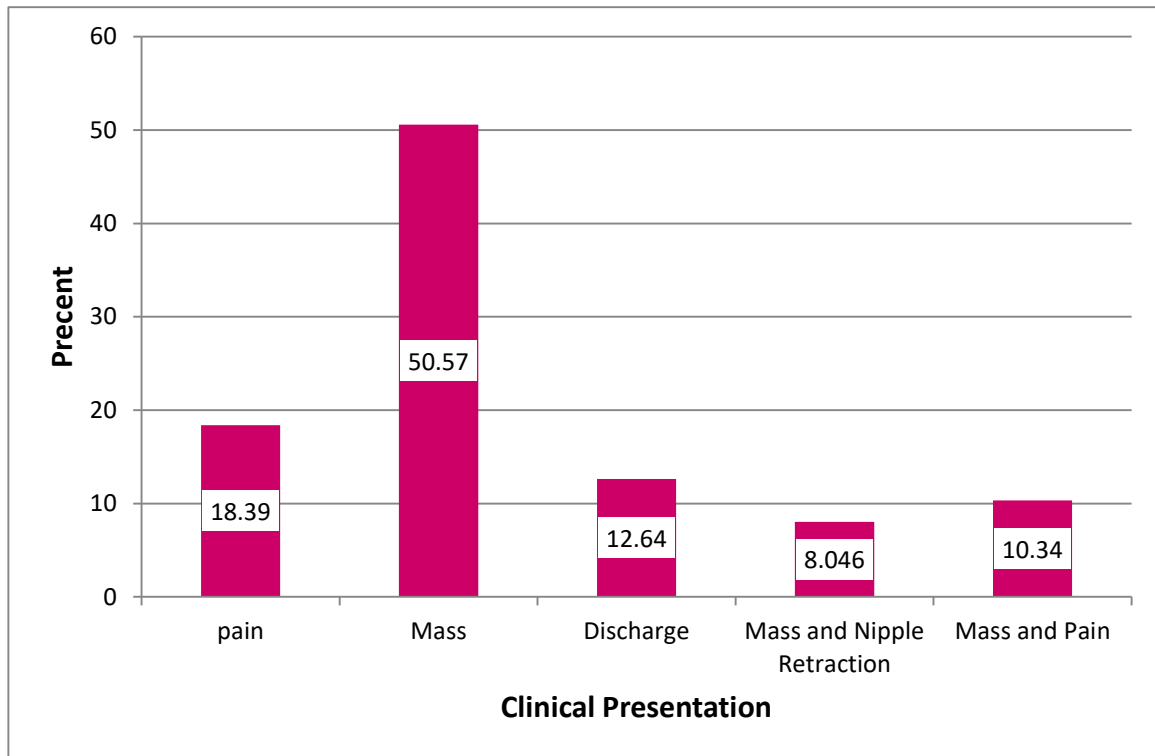
**Figure 3:** Ultrasound image of malignant mass, Targeted ultrasound of the right breast showed a 16mm poorly defined irregular hypoechoic solid mass with posterior acoustic shadowing, consistent with malignancy.

### Results

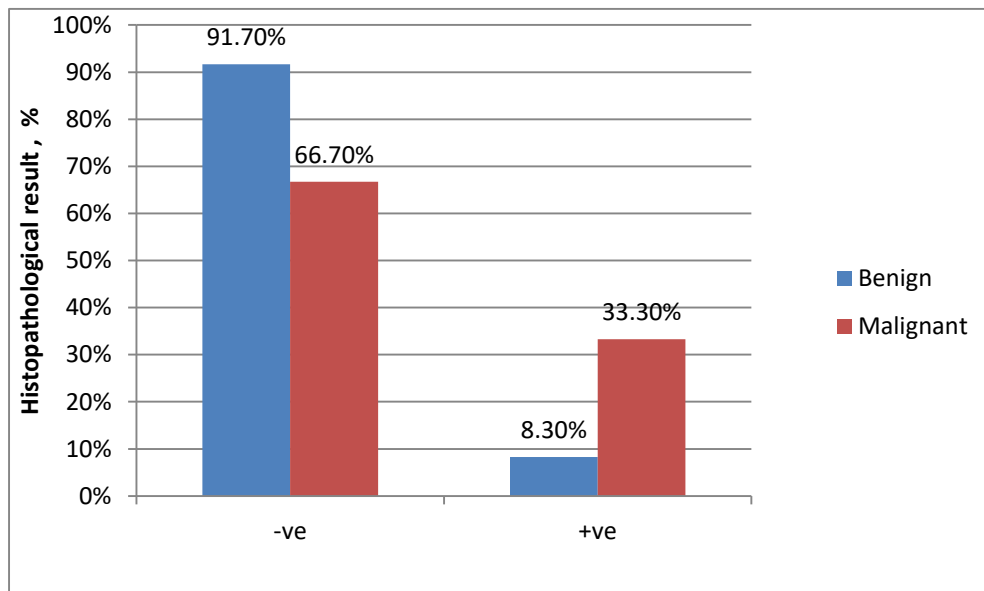
A total of 87 female patients with solid breast masses have been included in the study; their average age was approximately 34 years with S.D of 9.5 years, 75.9% of them were young. The mean diameter  $\pm$  S.D of their breast mass were  $28 \pm 15$  mm respectively. Majority of the participants (84%) had no family history of breast cancer as shown in (Figure 4). Half of the patients sought medical care after feeling a palpable mass as shown in (figure 5).



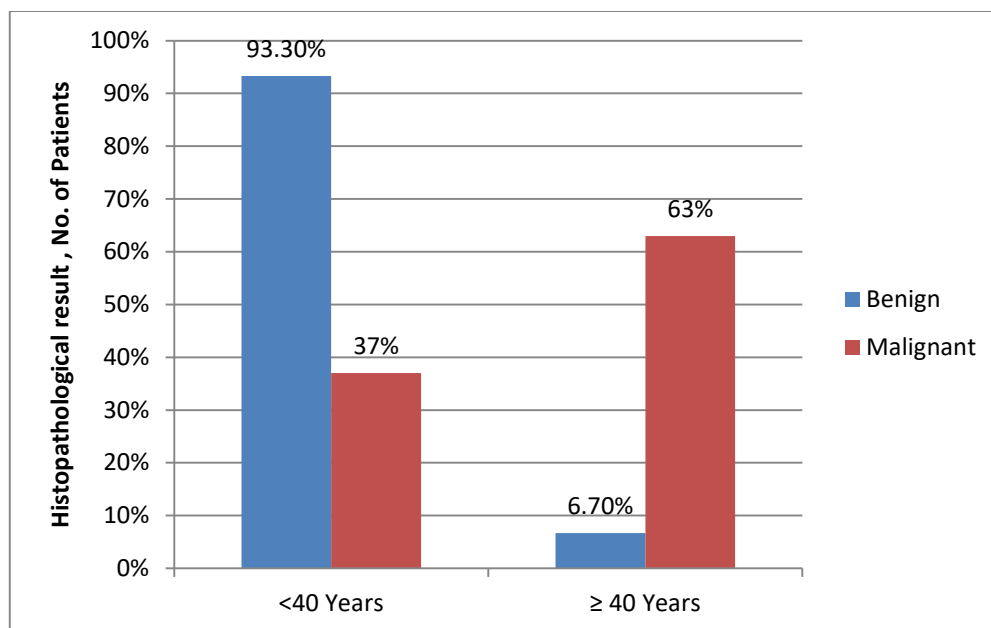
**Figure 4:** Family history of breast cancer



**Figure 5:** Clinical presentation of breast masses



**Figure 6:** Family history of Breast Cancer and histopathological results (P – value: 0.003)



**Figure 7:** Age variation and Histopathological results (P-value 0.001)

**Table (1):** Sensitivity, specificity, PPV and NPV of US

U/S results	Histopathological results		Total
	Malignant	Benign	
Malignant	27 (TP)	13 (FP)	40
Benign	0 (FN)	47 (TN)	47
Total	27	60	87

The data of Table (1) indicate that in this study ultrasound had 100% sensitivity and NPV. The specificity and PPV were 78.3% and 67.5% respectively. The accuracy rate was also high representing 85%.

## Discussion

Ultrasound services have been widely introduced at relatively inexpensive cost compared to other investigation.<sup>4</sup> Therefore due to the accessibility of these ultrasound services, they form a vital role in evaluating palpable breast masses.

The highest incidence of breast lumps was relatively higher in women of reproductive ages (below 40 years old); most of the patients with a malignant breast mass were aged 40 years and older, This agrees with Hasni H. et al study.<sup>9</sup> Where findings are comparable to what Kailash et al<sup>10</sup> and Khanna et al<sup>11</sup> found out. This is also comparable to the findings reported by Smallwood et al.<sup>12</sup>

The validity of ultrasonography in our study (table1), confirms the sensitivity of ultrasound for breast cancer( identification of malignant lesions in patients with breast cancer; 100%). Of 27 malignant lesions, all correctly classified as malignant. This agrees with Hansi H. et al study.<sup>13</sup> In this study shows high Negative Predictive Value of the sonographic classification. The Negative Predictive Value for a sonographically benign classification was 100%. No lesion classified as benign were found to be malignant at biopsy, this agrees with study done by Hansi H. et al,<sup>13</sup> and agrees with a study done by P.SKaane et al.<sup>14</sup> The specificity of our result was 78.3%, and the Positive Predictive Value was (67.5%). In Stavros study the specificity was (67.8%) and the Positive Predictive Value was lower than ours (38%), because of larger number of sample size in Stavros study

In this study, the sonographic accuracy was (85%) in differentiating benign from malignant lesions was higher than the result of Stavros et al,<sup>8</sup> in which the accuracy was 72.9%.

This therefore means that sonography is a useful imaging modality in giving important clues about breast masses as either benign or malignant, thus could be used as initial investigation that could guide other subsequent investigations.

Form this study, it can also be concluded that benign masses were more readily diagnosed by ultrasound than malignant masses. Among the multiple ultrasonographic parameters, all were statistically significant ( $P < 0.001$ ) except maximum diameter of masses.

In this study, There was a significant statistical relationship between family history of breast cancer and histopathological results. One third of the participants with malignancy had a positive family history of breast cancer in comparison to only 8% of those with benign masses , this disagrees with Hasni H. et al study.<sup>13</sup>

In this study, 74.1% of the malignant breast masses have irregular shape and 41.7% of oval shape masses were benign, this agrees with Costantini M et al study,<sup>15</sup> and with Pande AR at al study.<sup>16</sup>



In this study, There was a significant association between margins of the mass and histopathological results. The smooth and macrolobulated margins were more often associated with benign masses. For spiculated margins, 90% were found to be malignant and 10% were benign this agrees with Costantini M et al study<sup>15</sup> in which the result were 87.5% and 12.5% respectively.

Regarding the margin definition; this study shows that 70.4% of the ill defined masses were malignant and benign pathology can be associated with ill defined margin in a small number while well defined contour is often associated with benign lesions , these findings agrees with AL-Dabbagh et al study.<sup>17</sup>

In this study 55.6% of the malignant masses show shadowing , this agrees with Costantini M et al study.<sup>15</sup> While most of benign masses show enhancement with edge shadowing pattern in the posterior echo.

In this study, There were no any statistically significant relationship between the size of masses and histopathological results i.e. the mean size of malignant tumors in mm did not differ statistically from that of benign masses, this agrees with Stavros et al study.<sup>8</sup>

In this study, 30% of our benign lesions were mild hypoechoic or isoechoic to fat, while 55.6% of malignant masses were markedly hypoechoic; therefore marked hypoechogenicity is a worrisome finding for malignancy and mild hypoechogenicity and isoechogenicity are not necessarily reassuring, and these findings agree with Stavros at el study.<sup>8</sup>

### **Conclusion**

The sensitivity of ultrasound for detection of cystic masses is very high so it has a definite role in differentiation of cystic from solid masses of the breast. The sonographic evaluation of a simple cyst should eliminate the need for further invasive procedures including aspiration and biopsy.

This study shows that sonography is useful in characterization of some solid masses by good sonographic technique and strict adherence to the criteria for a benign lesion, which require the absence of even a single malignant finding. By using these few benign characteristics we found that the false negative nodules can be avoided.

Attention must be paid to combination of sonographic features rather than any single characteristic.

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