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# Role of ultrasound electrography in the assessment of breast masses

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ABSTRACT

The high incidence of breast cancer and its slow evolution before diagnosis have led to search for new diagnostic techniques. Sonographic elasticity imaging offers the potential to non-invasively characterize breast lesions. This study aimed to assess the role of ultrasonographic elastography in the differential diagnosis of breast masses. A total of 50 patients with palpable and non-palpable breast masses were examined by B-mode ultrasonography then sonographic elastography was done for evaluation of benign and malignant criteria of masses followed by FNAC or True-cut biopsy histopathology as a confirmatory test. All age groups presented with breast mass (palpable or non-palpable). All patients who have documentary cytology or histopathology. FNA was performed in 29 women (54%), and true cut in 21(42%). Furthermore, FNA revealed 10(34.5%) malignant lesions (breast cancer) and 19(65.5%) were benign (fibro adenoma and breast abscess), on the other hand the true cut biopsies revealed 18(85.7%) malignant lesions and 3(14.3%) benign, these findings giving a total of 28 malignant lesions (56%) and 22(44%) benign among the studied group. There was a statistically significant association between the BIRAD score and malignancy, where the frequency of malignant lesions increased with the advanced BIRAD score, (P value<0.001). Furthermore, the BIRAD II and III were considered as benign and the BIRAD IV and V were considered as malignant and when compared to biopsy it had been found that sensitivity of BIRAD had a sensitivity of (82.1%), specificity (95.5%), PPV (95.8%), NPV (80.7%) and accuracy of (88%). Also when there is comparison of validity test of SR according to different cutoff point where it appear that the cutoff point 2.5 had the higher sensitivity (78.6%) & specificity (95.5%). From other point of view, the sensitivity, specificity, PPV, NPV and accuracy of BIRADs were (82.1%, 95.5%, 95.8%, 80.7% and 88%) respectively and when compared to that of SR with cut- off point 2.5 no statically significant difference had been formed in validity test between SR at this cut off point and BIRAD score. Ultrasound elastography is a simple, fast, and non-invasive technique, which can be performed immediately after conventional sonography. Used as a complementary technique in addition to B-mode sonography, it increases the diagnostic specificity for breast lesions, thus reducing the false-positive rate. Ultrasound elastography has a sensitivity and specificity equal or higher than conventional B-mode US examination.

**Keywords:** ultrasound elastography, breast cancer, BIRADs, FNAC, B-mode ultrasonography

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## INTRODUCTION

Sonography of the breast has grown from an initial limited role in differentiating solid masses from cysts to a much-expanded role, which includes characterization of both cystic and solid lesions. Assessment of solid lesions as either benign or malignant is currently done using sonography by examining many lesion characteristics, including the shape, echogenicity, shadowing, margin irregularity, and microlobulation [1]. The compressibility of breast masses has been used by clinicians to aid in differentiating benign from malignant lesions because it is well known that malignant masses tend to be "harder" than benign ones [2]. Recently, a variety of sonographically based methods for measuring the relative stiffness of lesions have been developed. These methods offer the potential to quantify this qualitative observation of lesion stiffness and provide a more sensitive and specific means of differentiating lesions. They may also allow stiffness measurements of lesions that are not externally palpable because of the size or location in the body [3].

Sonographic elasticity imaging offers the potential to noninvasively characterize these breast lesions. Compression elastography uses sonography to measure the relative stiffness of tissue, and the resulting image is referred to as an elastogram [4].

Previous investigators have applied sonographic elastographic methods to breast imaging [5]. Results using a variety of elastographic techniques to image the liver, breast, and prostate in vivo have been reported [6].

Elastographic methods are more subjective than physical palpation and, in combination with a standard sonographic evaluation, allow more sensitive, more specific, and repeatable differentiation of benign and malignant breast lesions. If these capabilities are proven, more definitive differentiation of lesions may be obtained during the sonographic examination, potentially minimizing the need in many cases for subsequent biopsy of benign lesions. This result would have the effect of reducing patient anxiety and discomfort, as well as reducing the overall cost of care. These considerations become even more important when whole-breast sonographic screening is considered in either patients with dense breasts or the general population [7].

The radiologic report should be clear and concise. The American College of Radiology has developed a standardized format and terminology called: The Breast Imaging Reporting and Data System (BIRADS), for mammograms, breast US, and breast

MRI. All reports should begin with description of breast density will allow the clinician to gauge the sensitivity of the examination [8].

Elastography is a medical imaging modality that maps the elastic properties of soft tissue. The main idea is that whether the tissue is hard or soft will give diagnostic information about the presence or status of disease.

# METHODS

## Study design and patients selection

A cross-sectional study was carried out in radiology department at Al-Sadir medical city in Al- Najaf governorate from August 2014 to February 2015. A total of 50 patients with palpable and non-palpable breast masses were examined by B-mode ultrasonography at the breast clinic and then referred by their surgeon to the Doppler unit where BIRADS and sonographic elastography for the masses done for evaluation of benign and malignant criteria's of masses then FNAC or True cut biopsy histopathology done as a gold standard test.

## Inclusion criteria

- All age groups presented with breast mass (palpable or non-palpable).
- All patients who have documentary cytology or histopathology.

## Exclusion criteria

- Pure cystic breast mass.
- Patient without confirmatory cytology or histopathology.
- BIRADS 6 or known case of breast malignancy.
- Pregnancy & lactation.
- Skin infection & inflammatory breast conditions.

When receiving the patients, information taken from them as in the questionnaire paper. The patients were examined in the supine position with the arm placed over the head. Superficial US probe (frequency 5MHz - 12MHz), started examine the breast and a radial, ductal exploration was made as follows: the transducer was placed perpendicularly to the skin and radially on the breast, with one end overlapping on the areola and the other end directed toward the periphery (Figure 1).

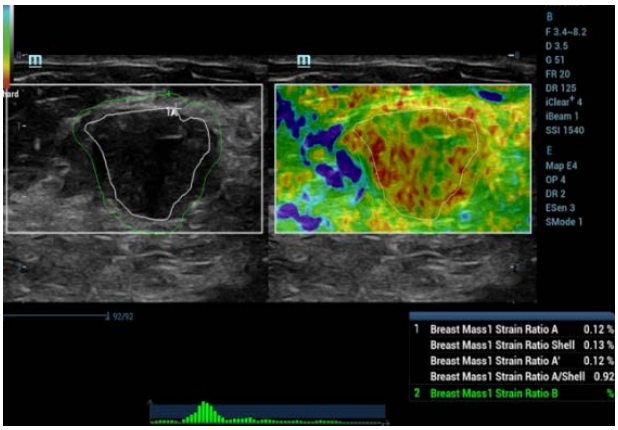


**Fig. 1.** Ultrasound elastography of malignant breast mass, BIRADS = 5, with scoring value = 0.9 SR

Patients with a sonographically visible lesion categorized as BI-RADS II –V were regarded as being suitable for our study. In all lesions (BI-RADS II -V), we calculate the Strain Ratio (SR). The average strain of the lesion was determined by selecting a Region of Interest (ROI) from the lesion and a corresponding ROI of the adjacent normal glandular tissue. Using specific software, the SR value was displayed on a static image as the ratio of tumor-adjusted ROI and the ROI placed in the adjacent normal glandular tissue (Figure 2).

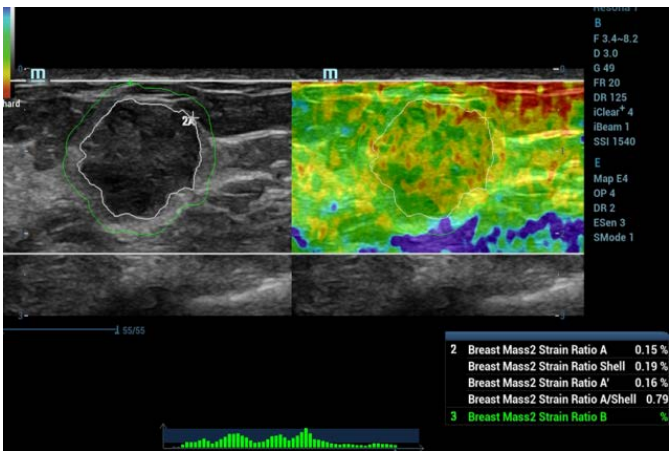


**Fig. 2.** Ultrasound elastography of benign breast mass, BIRADS=3, with scoring value = 0.7 SR

At the beginning we identify the mass then by using the elastographic technique, the elastography box will appear and we put it on the mass and part of the normal tissue, then we do a manual mild repetitive compression on the mass, and by monitoring the green column on the left side of the screen which when at higher level so indicate a better examination.

After that we fix the image and choose elastography analysis button and by the cine option choosing time of good examination indicated by higher level of the green column. Qualitative information obtained from displayed colors in the elastography box so apparently green color might indicate a benign mass while apparently blue color might indicate a malignant mass (red color refer to the most compressible tissue as seen in simple cyst). Then we perform a quantitative assessment for the elasticity of the mass by selecting the ROI from a normal adjacent tissue to the mass then the ROI from the mass and we can select up to three ROI from the mass for more information and the elasticity will be displayed on the left side of the screen as a graph for normal tissue and the mass, and the strain ratio also displayed representing elasticity compared to normal tissue with a higher degree mean less compressible so increasing the possibility of the mass to be malignant.

## Ultrasound machine

Volusion E6 ultrasound instrument (General Electronics) with elastographic properties using (7.5MHz) linear probe (range 5 MHz -12MHz)

## Aspiration needles

Aspiration biopsy was performed with 23x 1 1/4" needle of disposable syrange. Core biopsy was performed with a (14-gauge) core biopsy needle (Figure 3).

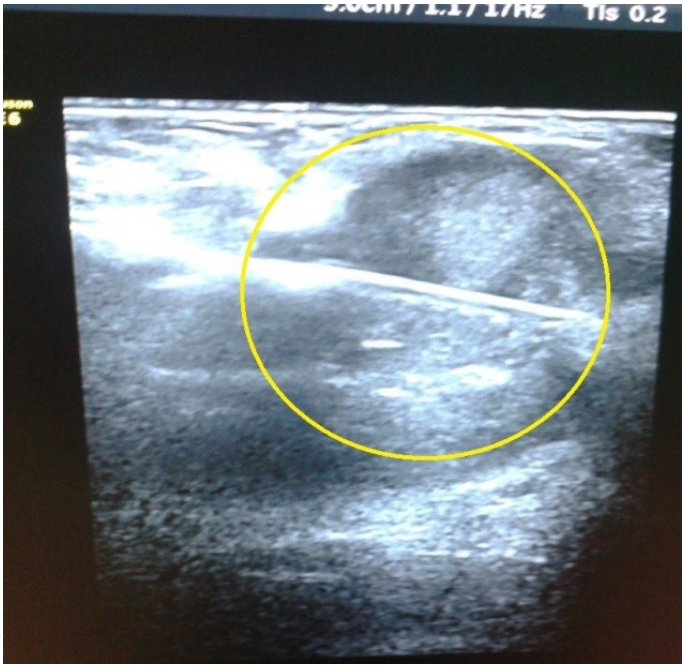

**Fig. 3.** Obtaining core tissue biopsy from breast lesion

## Statistical analysis

Data of the studied group were entered and analyzed by using the Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics were presented as mean, standard deviation, frequencies and percentages. Chi square and Fisher's exact tests were used alternatively. Analysis of Variances (ANOVA) test was used to compare the mean SR across the BIRAD score categories. Level of significance (Pvalue) of ≤ 0.05 was considered as significant.

# RESULTS

As it shown in Table 1, there were 50 women with different breast lesions enrolled in this study with a mean age of 43.1 ± 14.9 (range: 18–76) years., further distribution of the age into 5 age groups revealed that 8 patients (16%) aged ≤ 25 years, 10(20%) aged 26–35 years, 13(26%) aged 36 years – 45 years, 8 (16%) aged 46 years –55 years and 11 patients (22%) aged>55 years, moreover, demonstrates the proportional distribution of the age groups. It can observed that 31 women (62%) were residents of urban areas and the remaining 19(38%) in rural.

Demonstrates the distribution of side and sites of breast lesions, where, 30 women (60%) had their lesions in the right side and 20 (40%) in the left, on the other hand, the sites of these lesions are summarized in the same Table 2.

Demonstrates the characteristics of the breast lesions that reported according to FNA or true cut biopsy, FNA was performed in 29 women (54%), and true cut in 21(42%) Table 3. Furthermore, FNA revealed 10(34.5%) malignant lesions (breast cancer) and 19(65.5%) were benign (fibro adenoma and breast abscess), on the other hand the true cut biopsies revealed 18 (85.7%) malignant lesions and 3 (14.3%) benign, these findings giving a total of 28 malignant lesions (56%) and 22 (44%) benign among the studied group.

As it shown in Table 4, there was a statistically significant association between the BIRAD score and malignancy, where the frequency of malignant lesions increased with the advanced BIRAD score, (P value<0.001). Furthermore in Table 5 the BIRAD II and III were considered as benign and the BIRAD IV and V were considered as malignant and when compared to biopsy it had been found that sensitivity of BIRAD had a sensitivity of (82.1%), specificity (95.5%), PPV (95.8%), NPV (80.7%) and accuracy of (88%).

**Tab. 1.** Demographic characteristics (N= 50)

| Variable | No. | % |
|---|---|---|
| **Age (year)** | | |
| ≤ 25 | 8 | 16 |
| 26 – 35 | 10 | 20 |
| 36 – 45 | 13 | 26 |
| 46 – 55 | 8 | 16 |
| >55 | 11 | 22 |
| Mean ± SD* | 43.1 ± 14.9 | - |
| Range | 18 – 76 | 0 |
| **Residence** | | |
| Urban | 31 | 62 |
| Rural | 19 | 38 |

**Tab. 2.** Distribution of the side and sites of breast lesions of the studied group

| Variable | No. | % |
|---|---|---|
| **Side** | | |
| Right | 30 | 60 |
| Left | 20 | 40 |
| **Site** | | |
| Left lower lateral quadrant | 10 | 20 |
| Left upper lateral quadrant | 8 | 16 |
| Left lower medial quadrant | 1 | 2 |
| Left upper medial quadrant | 1 | 2 |
| Right lower lateral quadrant | 7 | 14 |
| Right upper lateral quadrant | 20 | 20 |
| Right upper medial quadrant | 4 | 8 |
| Retro areolar | 7 | 14 |
| Breast bed | 2 | 4 |

**Tab. 3.** Distribution of methods and findings of biopsy

| Biopsy | Findings | | | | Total | |
|---|---|---|---|---|---|---|
| | Malignant | | Benign | | | |
| | No. | % | No. | % | No. | % |
| FNA | 10 | 34.5 | 19 | 65.5 | 29 | 58 |
| True cut | 18 | 85.7 | 3 | 14.3 | 21 | 42 |
| Total | 28 | 56 | 22 | 44 | 50 | 100 |

**Tab. 4.** Relation between BIRADS score and result on biopsy

| | | Biopsy results | | | | P value |
|---|---|---|---|---|---|---|
| | | Malignant | | Benign | | |
| | | No. | % | No. | % | |
| BIRAD score | II | 0 | 0 | 13 | 100 | <0.001 |
| | III | 5 | 38.5 | 8 | 61.5 | |
| | IV | 13 | 92.9 | 1 | 7.1 | |
| | V | 10 | 100 | 0 | 0 | |
| | Total | 28 | 56 | 22 | 44 | |

**Tab. 5.** Validity of BIRAD score vs. Biopsy in detection of malignancy

| | | Biopsy results | | | P value |
|---|---|---|---|---|---|
| | | Malignant | Benign | | |
| BIRAD score | Malignant (IV& V) | 23 | 1 | 24 | <0.001 |
| | Benign (II&III) | 5 | 21 | 26 | |
| | Total | 28 | 22 | 50 | |

| | |
|---|---|
| Sensitivity of SR | 82.1% |
| Specificity of SR | 95.5% |
| PPV | 95.8% |
| NPV | 80.7% |
| Accuracy | 88% |

The demonstrate the validity test findings of SR in different cut off pointes (1.5, 2.0, 2.5, 3.5) in detection of malignancies compared to findings of FNA & true cut (Tables 6-20). Shows the comparison of validity test of SR according to different cutoff point where it appear that the cutoff point 2.5 had the higher sensitivity (78.6%) & specificity (95.5%). From other point of view, the sensitivity, specificity, PPV, NPV and accuracy of BIRADs were (82.1%, 95.5%, 95.8%, 80.7% and 88%) respectively and when compared to that of SR with cut-off point 2.5 no statically significant difference had been formed in validity test between SR at this cut off point and BIRAD score.

**Tab. 6.** Distribution of the studied group according to the FNA results and BIRADS

| | | FNA | | | | Total | P value |
|---|---|---|---|---|---|---|---|
| | | Positive | | Negative | | | |
| | | No. | % | No. | % | | |
| BIRAD Score | II | 0 | 0 | 12 | 100 | 12 | <0.001 |
| | III | 2 | 22.2 | 7 | 77.8 | 9 | |
| | IV | 5 | 100 | 0 | 0 | 5 | |
| | V | 3 | 100 | 0 | 0 | 3 | |
| Total | | 10 | 34.5 | 19 | 65.5 | 29 | |

**Tab. 7.** Distribution of the studied group according to the True cut results and BIRADS

| | | True cut | | | | Total | P value |
|---|---|---|---|---|---|---|---|
| | | Positive | | Negative | | | |
| | | No. | % | No. | % | | |
| BIRAD Score | II | 0 | 0 | 1 | 100 | 1 | 0.13 |
| | III | 3 | 75 | 1 | 25 | 4 | |
| | IV | 8 | 88.9 | 1 | 11.1 | 9 | |
| | V | 7 | 100 | 0 | 0 | 7 | |
| Total | | 18 | 85.7 | 3 | 14.3 | 21 | |

**Tab. 8.** Validity of SR compared to FNA (using SR cutoff point of 1.5)

| | | FNA | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 10 | 6 | 16 |
| | Negative | 0 | 13 | 13 |
| Total | | 10 | 19 | 29 |

| | |
|---|---|
| Sensitivity of SR | 100% |
| Specificity of SR | 68.40% |
| PPV | 62.50% |
| NPV | 100.00% |
| Accuracy | 79.30% |

**Tab. 9.** Validity of SR compared to True cut biopsy (using SR cutoff point of 1.5)

| | | True cut | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 16 | 2 | 18 |
| | Negative | 2 | 1 | 3 |
| Total | | 18 | 3 | 21 |

| | |
|---|---|
| Sensitivity of SR | 88.90% |
| Specificity of SR | 33.30% |
| PPV | 88.90% |
| NPV | 33.30% |
| Accuracy | 81.00% |

**Tab. 10.** Validity of SR in detecting malignancy (cut off value=1.5)

| | | Biopsy | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 26 | 8 | 34 |
| | Negative | 2 | 14 | 16 |
| Total | | 28 | 22 | 50 |

| | |
|---|---|
| Sensitivity of SR | 92.90% |
| Specificity of SR | 63.60% |
| PPV | 76.50% |
| NPV | 87.50% |
| Accuracy | 80.00% |

**Tab. 11.** Validity of SR compared to FNA (using SR cutoff point of 2)

| | | FNA | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 8 | 2 | 10 |
| | Negative | 2 | 17 | 19 |
| Total | | 10 | 19 | 29 |

| | |
|---|---|
| Sensitivity of SR | 80.00% |
| Specificity of SR | 89.50% |
| PPV | 80.00% |
| NPV | 89.50% |
| Accuracy | 86.20% |

**Tab. 12.** Validity of SR compared to True cut biopsy (using SR cutoff point of 2)

| | | True cut | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 16 | 1 | 17 |
| | Negative | 2 | 2 | 4 |
| Total | | 18 | 3 | 21 |

| | |
|---|---|
| Sensitivity of SR | 88.90% |
| Specificity of SR | 66.70% |
| PPV | 94.10% |
| NPV | 50.00% |
| Accuracy | 85.70% |

**Tab. 13.** Validity of SR in detecting malignancy (cut off value=2)

| | | Biopsy | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 24 | 2 | 26 |
| | Negative | 4 | 20 | 24 |
| Total | | 28 | 22 | 50 |

| | |
|---|---|
| Sensitivity of SR | 85.70% |
| Specificity of SR | 90.90% |
| PPV | 92.30% |
| NPV | 83.30% |
| Accuracy | 88.00% |

**Tab. 14.** Validity of SR compared to FNA (using SR cutoff point of 2.5)

| | | FNA | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 8 | 1 | 9 |
| | Negative | 2 | 18 | 20 |
| Total | | 10 | 19 | 29 |

| | |
|---|---|
| Sensitivity of SR | 80.0% |
| Specificity of SR | 94.7% |
| PPV | 88.9% |
| NPV | 90.0% |
| Accuracy | 89.7% |

**Tab. 15.** Validity of SR compared to True cut biopsy (using SR cutoff point of 2.5)

| | | True cut | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 14 | 0 | 14 |
| | Negative | 4 | 3 | 7 |
| Total | | 18 | 3 | 21 |

| | |
|---|---|
| Sensitivity of SR | 83.3% |
| Specificity of SR | 100.0% |
| PPV | 100.0% |
| NPV | 50.0% |
| Accuracy | 85.7% |

**Tab. 16.** Validity of SR in detecting malignancy (cut off value=2.5)

| | | Biopsy | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 22 | 1 | 23 |
| | Negative | 6 | 21 | 27 |
| Total | | 28 | 22 | 50 |

| | |
|---|---|
| Sensitivity of SR | 78.6% |
| Specificity of SR | 95.5% |
| PPV | 95.7% |
| NPV | 77.8% |
| Accuracy | 86.0% |

**Tab. 17.** Validity of SR compared to FNA (using SR cutoff point of 3.5)

| | | FNA | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 5 | 0 | 5 |
| | Negative | 5 | 19 | 24 |
| Total | | 10 | 19 | 29 |

| | |
|---|---|
| Sensitivity of SR | 50.00% |
| Specificity of SR | 100.00% |
| PPV | 100.00% |
| NPV | 79.20% |
| Accuracy | 82.80% |

**Tab. 18.** Validity of SR compared to True cut biopsy (using SR cutoff point of 3.5)

| | | True cut | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 14 | 0 | 14 |
| | Negative | 4 | 3 | 7 |
| Total | | 18 | 3 | 21 |

| | |
|---|---|
| Sensitivity of SR | 77.80% |
| Specificity of SR | 100.00% |
| PPV | 100.00% |
| NPV | 42.90% |
| Accuracy | 81.00% |

**Tab. 19.** Validity of SR in detecting malignancy (cut off value=3.5)

| | | Biopsy | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| SR | Positive | 19 | 0 | 19 |
| | Negative | 9 | 22 | 31 |
| Total | | 28 | 22 | 50 |

| | |
|---|---|
| Sensitivity of SR | 67.90% |
| Specificity of SR | 100.00% |
| PPV | 100.00% |
| NPV | 71.00% |
| Accuracy | 82.00% |

**Tab. 20.** Comparison of validity of SR in detecting malignancy in different cutoff points and BIRADS

| Validity test | SR cutoff point | | | | | |
|---|---|---|---|---|---|---|
| | 1.5 | 2 | 2.5 | 3.5 | BIRAD | P value* |
| Sensitivity of SR | 92.90% | 85.70% | 78.60% | 67.90% | 82.10% | ns |
| Specificity of SR | 63.60% | 90.90% | 95.50% | 100.00% | 95.50% | ns |
| PPV | 76.50% | 92.30% | 95.70% | 100.00% | 95.80% | ns |
| NPV | 87.50% | 83.30% | 77.80% | 71.00% | 80.70% | ns |
| Accuracy | 80.00% | 88.00% | 86.00% | 82.00% | 88% | ns |

*P value for SR vs. BIRAD, ns ; not significant

As its shown in Table 21 and 22, it had been significantly found that the mean SR value increase with the higher BIRAD score where the lower mean SR (1.29) was reported in patients with BIRAD score II while the higher mean SR(4.06) in those with BIRAD score IV, (P <0.001), (Figure 4).

**Tab. 21.** Comparison of mean SR according to different BIRADS

| BIRADS | N | Mean SR | SD | P |
|---|---|---|---|---|
| II | 13 | 1.29 | 0.36 | <0.001 |
| III | 13 | 1.8 | 0.81 | |
| IV | 14 | 4.06 | 1.62 | |
| V | 10 | 4.97 | 2.61 | |
| Total | 50 | 2.94 | 2.1 | |

**Tab. 22.** Relationship between BIRAD score and SR results at cutoff point of 2.5

| | | SR cutoff point 2.5 | | | |
|---|---|---|---|---|---|
| | | Positive | | Negative | |
| | | No. | % | No. | % |
| BIRAD | II | 0 | 0.0 | 13 | 100.0 |
| | III | 5 | 38.5 | 8 | 61.5 |
| | IV | 13 | 92.9 | 1 | 7.1 |
| | V | 10 | 100.0 | 0 | 0.0 |
| Total | | 28 | 56.0 | 22 | 44.0 |

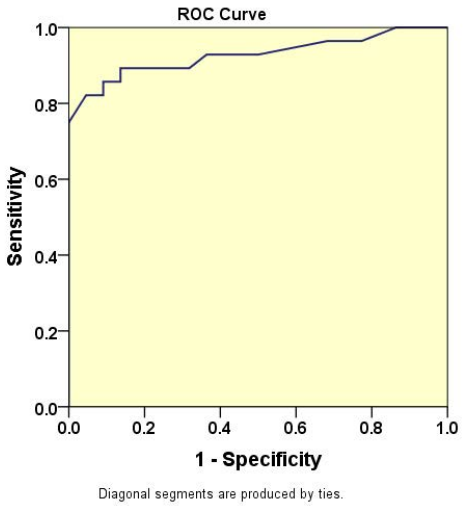


**Fig. 4.** ROC curve of SR in detecting malignancy at different cutoff points

## DISCUSSION

The current study mean age was 43.1 ± 14.9 years, furthermore, majority (84%) of the patients aged more than 25 years and 62% of urban origin. Regarding the distribution of side and sites of breast lesions right sided lesions was found in 60% of the patients, on the other hand, left lower lateral quadrant & right upper lateral quadrant was the dominant sites. Additionally FNA was performed in 29 women (54%), and true cut in 21 (42%). Furthermore, FNA revealed 10 (34.5%) malignant lesions (breast cancer) and 19 (65.5%) were benign, on the other hand the true cut biopsies revealed 18 (85.7%) malignant lesions and 3 (14.3%) benign.
In present study using ultrasound elastography, four cut off values of SR where tested for benign and malignant masses diagnosis. First cut off value was SR of 1.5 that give a high sensitivity of 92.9% and a low specificity of 63.6% with accuracy rate of 80.0%, PPV=76.5% and NPV=87.5%. A second cut off value SR of 2.0 was tested that give a specificity of 90.9% but sensitivity of 85.7% with accuracy of 88.0%, PPV=92.3% and NPV=83.3%. Third cut off value SR of 2.5 was tested & give higher specificity of 95.5% with sensitivity of 78.6% and show accuracy of 86.0%, PPV=95.7% and NPV=77.8%. The last cut off value SR of 3.5 was tested to give higher specificity of 100% but lower sensitivity of 67.9% with accuracy 82.0%, PPV=100% and NPV=71.0%.
However the current study concluded that the cutoff point of 2.5 is the better cutoff point when used in detection of malignancy which have higher sensitivity & specificity which needed in malignancy than other cut off point where it appeared that the specificity decreased with lower cut off point & increase with higher cut off point in contrast to sensitivity so when use this cut off point of 2.5 used the higher accepted sensitivity & specificity used.
These results were consistent with other studies using a nearly similar SR cut off values, Ioana Andreea Gheonea, using cut off value of 3, they found a sensitivity of 86.7% and a specificity of 92.9% [9].
Thomas, study showed a sensitivity of 77.6% and 79.6% and specificity of 91.5% and 84.5% where 108 breast lesions were examined by two examiners separately [10].
Another study done by Itoh, et al of 111 lesions using cutoff point between 1 and 2, sensitivity was 100%, specificity 35.6%, and accuracy 65.8%. When using cutoff point between 2 and 3, sensitivity was 90.4%, specificity 67.8%, and accuracy 78.4% .When using cutoff point between 3 and 4, sensitivity was 86.5%,specificity 89.8%, and accuracy 88.3%. When using cutoff point between 4 and 5, sensitivity was 48.1%,specificity 98.3% and accuracy 74.8% [11].
Elasticity imaging is beneficial in that it only adds a few minutes to each study, and the results can be interpreted immediately. The high specificity and negative predictive value shown by Barr, and replicated in this study show promise regarding the ability of elasticity imaging to eliminate a large number of unnecessary breast biopsies [12].
The current study showed that there was significant positive correlation between BIRAD and SR so with increase in the score of BIRAD there is increase in SR. Thomas, et al showed lower sensitivity and higher specificity for elastography compared with BIRADS and suggested that this was particularly helpful in BIRADs III lesions [13].
In 2007, Tardivon, et al reported BIRADS specificity of 47.5% and RTE specificity of 86.9% [14]. More recently, Cho, reported BIRADS specificity of 33% and RTE specificity of 96.4% [15].

## CONCLUSION

Ultrasound elastography is a simple, fast, and non-invasive technique, which can be performed immediately after conventional sonography. Used as a complementary technique in addition to B-mode sonography, it increases the diagnostic specificity for breast lesions, thus reducing the false-positive rate. Ultrasound elastography has a sensitivity and specificity equal or higher than conventional B-mode US examination.

## FUNDING

None

## CONFLICT OF INTEREST

None

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