Original Research Article

Sonoelastography in the diagnosis of breast mass: an extended armamentarium

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ABSTRACT

Background: To presenting with breast lumps are very common in surgical practice and the routine use of ultrasound in the diagnosis is well validated. But there are gray zones in equivocal cases which increase the number of negative biopsies. To increase the sensitivity and specificity of ultrasound by adding another non-invasive modality, namely strain elastography, can reduce this rate. To evaluate the sensitivity and specificity of strain elastography in the diagnosis of breast masses.
Methods: As part of the triple assessment patients presenting with breast lumps underwent ultrasonography and strain elastography, where strain ratios were calculated. Based on which they either underwent percutaneous biopsy or surgical excision. A total of 30 patients with breast lesions underwent sonomammogram in which the breast lesions were both graded with BIRADS and also the elastography and strain ratio was calculated.
Results: Strain ratio has higher sensitivity and specificity which makes it a valid diagnostic tool in the evaluation of breast masses.
Conclusions: It can also help in reducing the number of benign lesion biopsies and also reduce the number of negative biopsies. Being a non-invasive modality, it is much more patient compatible and economically cheaper when compared with MRI and modalities.

Keywords: Biopsy, Evaluation of breast masses, Strain elastography, Strain ratio

INTRODUCTION

Breast ultrasonogram is a non-invasive modality employed in the detection of breast lesions. Being an inexpensive modality, it has widely been used in the screening of carcinoma breast. All though ultrasound has a high diagnostic accuracy it has certain Gray zones when it comes to equivocal cases (BIRADS 3). The specificity of ultrasound alone ranges between 7.1-98.8%.[1] The positive predictive value was 8.4-13.7% for biopsies performed as a result of screening studies which is much lower than the optimal positive predictive value of 25-40% achieved at mammographic screening.[2]

Since then other modalities have been investigated to aid in distinguishing benign from malignant diseases. Sonoelastography was found to be a valuable addition to ultrasound in this context. Malignant tissues are harder in consistency due to the diffuse desmoplastic reaction occurring in them. Taking into consideration that malignant tissues are comparatively harder in consistency when compared to benign lesions, sonoelastography which measures the compressibility between two fixed specified points can distinguish between malignant and benign lesions. This compressibility is termed elastography.[3] The elasticity of the lesion is compared

with the surrounding tissue and graded between 1 to 5 and is called strain ratio.

Thus, elastography when combined with ultrasonoraphy has greatly increased the accuracy in distinguishing malignant and benign tissue lesions. This paves the way to reducing the number of negative biopsies performed, which happens to be the aim of this pilot study.

METHODS

Approval was obtained from the institutional ethics committee and patients were included in the study after getting their written, informed consent. The study period was between March 2016 to June 2016. All patients who complained of a breast lump were subjected to triple assessment. During imaging along with ultrasonography, the strain ratios was also calculated for all patients. Those who underwent percutaneous or excision biopsies were included in the study.

Ultrasound was performed by using a high frequency linear transducer (11 Mhz). Ultrasound was performed to assess the breast lump size, shape, border, echogenecity, posterior acoustic shadows and also to look for other obvious features. The Breast Imaging Reporting and Data System (BIRADS) was used to report the findings.

Strain elastography was performed immediately after the conventional ultrasound with Toshiba Apilo 400 machine. With the patient in the supine position and the transducer above the lesion, parallel to the long axis of the mass, five to six consecutive uniform compressions and decompressions were performed in the antero-posterior direction. In all patients strain ratio was calculated.

RESULTS

A total of 30 patients with breast lumps who underwent both elastography and ultrasound with subsequent biopsy of the lesions were included in the study. A total of 19 patients had malignant lesions and 11 had benign breast conditions.

Three patients had a BIRADS score of 3 or less. Ten patients were reported as 4A, three patients as 4C and fourteen patients were reported as 5 (Table 1). On comparing the final histopathology reports with the BIRADS score a sensitivity of 100% and a specificity of 27.27% was calculated. The positive predictive value of 70.3% and a negative predictive value of 100% was estimated.

Table 1: Data of BIRADS tabulated.

BIRADS	II	III	IV A	IV B	IV C	V	Total
Benign	1	2	8	-	-	-	11
Malignant	-	-	2	-	2	14	18

According to the strain ratio scoring patients were categorized into five categories and five patients with benign lesions fell into the 0-1 score. Four with benign diseases fell into 1-2 score and two benign lesions fell into the 2-3 score. As fast as malignant lesions were concerned, three patients were below 3. Seven cases had a score of 3 to 3.9 and eight patients had a score of 5 and above (Table 2). The sensitivity and specificity were both calculated to be at 90%. The positive predictive value was 89.4% and negative predictive value was 90%.

Table 2: Data of strain ratio tabulated.

Strain ratio	0-1	1-1.9	2-2.9	3-3.9	4-4.9	5-5.9	<6
Benign	5	4	2	-	-	-	-
Malignant	-	1	2	7	-	3	5

DISCUSSION

The gold standard in detecting breast lesions being mammography, ultrasound has been used as an adjunct in detecting breast malignancies. While the sensitivity is acceptable the specificity is very low and of concern. This leads to suspicious lesions being biopsied and around 50% to 60% turn out to be benign.[4] This has lead to increasing patient discomfort and altering normal anatomy by invasive techniques to obtain a diagnosis. Newer modalities have been researched to reduce the amount of invasve biopsies done. MRI which proves to be another valuable option is expensive and also has a low specificity.[5] Sonoelastography has proved to be both cost effective and also patient compliance is better. The firmness of the tissue can be visualized in real time in the form of colour codes and a qualitative visual scoring can be done. The strain ratio of the lesion in question is also calculated by comparing the strain ratio of the surrounding tissue to the lesion. This gives us a semiquantitative score of the lesions stiffness.[6]

Many studies have quoted higher sensitivity and specificity of elastography when compared with ultrasound alone. Amani et al. determined the sensitivity to be 94.3% and specificity to be around 94.2%.172 women with 190 breast lesions were included in the study and ultrasound findings were classified according to BIRADS and elastography was classified according to a 5-point method.[7]

The sensitivity of conventional ultrasound as 98.2% and a specificity as 44.1%, when conventional ultrasound was used in conjunction with elastography the sensitivity and specificity was found to be significantly higher at 89.1% and 50.5%, respectively.[8]

Sensitivity and specificity for conventional ultrasound was estimated at 100% and 33%, respectively. They used a cut-off value of BIRADS 3 and 4a. When elastography was combined the sensitivity was 82% and a specificity

of 84%. The cut-off value used in elastography was a score of 2 and 3.[9]

111 lesions in 111 patients and reported a sensitivity of 96.2% and a specificity of 62.7% for conventional ultrasound, while using a cut-off value of BIRADS 4 and 5. When elastography was used in conjunction and a cut-off value of elastography score between 3 and 4, the sensitivity and specificity were estimated at about 86.5% and 89.8% respectively.[10]

Other studies reported a sensitivity of 93.3% and a specificity of 92.9%. Barr et al. estimated sensitivity and specificity at 93.6% and 87.4%. In the review of other studies an elasticity score of 0 was common for benign lesions and a score of 2 for malignant lesions.[11]

This study yielded a sensitivity and specificity of 90% for the combination of strain elastography with conventional ultrasound, whereas only ultrasound's sensitivity was estimated at 100% and a low specificity of only 27.3%. The positive predictive value was also higher 89.4% when compared to conventional ultrasound 70.3%. This study being a pilot study in our institution has proven that elastography is a significantly important adjunct to conventional ultrasound of breast lesions. The use of elastography can be added to the existing triple assessment of breast lesions and significantly reduce the number of negative biopsies. However, being a pilot study, the number of patients is considerably low, and the results can be validated in a larger population.

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