Original Research Article

Evaluation of breast lesion using shear wave elastogram technique with BI-RADS and HPE correlation – A retrospective study

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Abstract

Background: Elastography is a new promising technique that can be used especially as an adjunct to conventional B-mode ultrasound in evaluating breast lesions. Diagnosis should be achievable in the vast majority of cases without the need for excision biopsy. **Aim:** To establish the role of shear wave elastography in conjunction with B mode ultrasound elastography, proved on HPE. To reach more conclusive diagnosis on BI-RADS 3 lesions so that unnecessary biopsies can be avoided. Elastography is a unique mechanism in ultrasound imaging that has been known for the past decade. SWE is most useful in two basic areas, improving image contrast and tissue characterization, in order to attempt to reduce unnecessary breast biopsies. **Material and Methods:** Retrospective analysis of shear wave elastography performed on a Toshiba Aplio-500 system in 45 patients was done, in whom the diagnosis was confirmed on histopathological analysis. **Results:** Elastography plays an important role for the differentiation of breast tumors in day to day clinical scenario. The specificity improves with the availability of additional diagnostic information using real-time techniques and calculation of shear wave elastography values (kPa). SWE is helpful in women with breast masses for differentiating BI-RADS-US 3 and 4 lesions and for investigating very small lesions without the typical imaging features of malignancy. **Conclusion:** Shear wave elastography has an important role in evaluation of breast lesions and improves in diagnosis of the lesions characterized as BI-RADS 3 and 4A. Implementation of elastography in conventional ultrasound examination should assure examiners on the use of short-term or routine follow-ups instead of unnecessary biopsies in cases of benign and probably benign lesions.

Key Words: Shear wave elastography,Breast masses,Breast Imaging Reporting and Data System, Histopathological examination.

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INTRODUCTION

There are approximately 350,000 consultations for breast symptoms in india each year. Diagnostic breast imaging, of which mammography is the most widely used method, provides specific analytic evaluation of women with breast symptoms.[1] Ultrasound has also been established as a valuable diagnostic tool for both first-line imaging in younger women and as an adjunct to mammography. With increasing awareness of the benefits of early detection of breast cancer, and prompt reporting of breast changes, there is likely to be an increase in the proportion of patients undergoing assessment of symptoms in whom a malignancy is not present. However, not all cases of benign breast changes will require biopsy and often the clinical impression can be confirmed by appropriate imaging. In certain condition we can use a new imaging technique called elastography[2]. The present study was conducted to assess the significance of SWE in ultrasound imaging of characterization of breast lesions

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proved on histopathology. The overall aim of breast imaging is to optimize the early and accurate diagnosis of breast abnormalities and to maximize both the woman's and the clinician's satisfaction with the breast imaging experience.

MATERIAL AND METHODS

This retrospective analysis study was done on45patients who were referred for ultrasound guided tru-cut biopsy of the breast mass detected on ultrasound or mammogram with BI-RADS in the department of radiology and imaging sciences from April 2017 to October 2017. Patients who had undergone Shear wave elastography as an adjunct to B- mode ultrasound and those who underwent tru-cut biopsy of the breast mass in whom HPE correlation was available was included in this study.

Methodology: B-mode Ultrasound and sonoelastography were obtained using Toshiba medical systems ultrasound machine, Aplio™ 500platinum Series, 7.5 MHz superficial linear high resolution transducer was used for imaging. Every mass was examined for the mass characteristics in transverse and longitudinal scans. All examined masses were categorized according to BI-RADS ultrasound lexicon ACR2013 edition. Elastography was then performed, transducer surface was kept parallel to the chest wall, lesion screened. The elastogram is shown in a dual split screen mode showing conventional B mode image on one side and the elastogram on the other side of the screen. Elastography values for breast is expressed in Kpa and it is noted.

RESULTS

A total of 45 patients with breast mass who underwent shear wave elastography and ultrasound with biopsy were included in the study which were labelled BI-RADS 3 and above and those in which the diagnosis was confirmed on histopathology. A total of 24 patients had malignant lesions and 21 had benign breast lesions. The mean age of these patients was 40 years. Shear wave elastography was performed for all the 45 patients. On comparing the final histopathology reports with the BI-RADS score a sensitivity of 100% and a specificity of 58.3% was calculated. The positive predictive value of 67.7% and a negative predictive value of 100% was estimated.

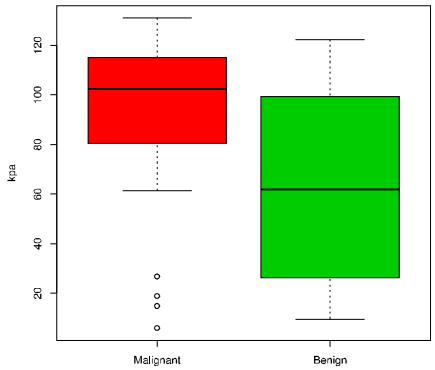

Figure 1: Association between shear wave ratio and nature of the lesion.

The box plot shows that malignant lesions have a higher SWE values with a median of 102.4 in comparison to the benign lesions (median = 61.9).

Table 1: Diagnostic efficiency of BI-RADS/SWE score in comparison to histopathology examination

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
BI-RADS (≥4)	85.7	70.8	72.0	85.0
SWE (kpa >=102)	52.3	83.3	73.3	66.6
BIRADS (≥4)AND SWE (kpa >=102)	100	58.3	67.7	100

The performance of each of each of the tests were evaluated individually comparing to the Gold Standard and the results are tabulated. It can be observed that of BIRADS (≥4)+SWE values (kpa ≥102) had better sensitivity and negative predictive values compared to BI-RADS.

DISCUSSION

Amongst women the commonest malignancy is related to breast, Current World Breast Cancer Incidence rates 39 per 100,000 population in 2008[3]. This higher incidence necessitates the need for prompt detection which requires various screening modalities for early detection and treatment. Modalities which are widely used to screen and detect lesions in breast are X-ray mammogram and sonomammogram. Ultrasound in conjunction elastography is fast gaining popularity. The two most frequently used elastography techniques in the breast are compressive, or strain, elastography and shear-wave elastography (SWE). SWE,BI-RADS and HPE are the interpretation parameters analyzed in our study. To improve the accuracy of ultrasound, elasticity of the

tissues to differentiate benign and malignant lesions on the basis of their firmness is used. The SWE values represents the relative stiffness of the lesions in comparison with the surrounding tissues[4]. Elastography methods take the advantage of the change in elasticity of soft tissues and are known to differentiate pathologies mechanically from the surrounding healthy tissues. Malignant lesions are very stiff, deform less on the elastography images, in contrast, the benign lesions deform easily[5]. The current diagnostic study was planned to assess the utility of ultrasound elastography in differentiating the benign from malignant breast masses in conjunction with B mode ultrasound. The study has included 45 participants with breast lesions confirmed on ultrasound elastography. In our study, the performance of the BI-RADS and SWE values were evaluated individually comparing to the gold standard biopsy test after which the results were obtained. It can observed that SWE had better specificity and positive predictive values compared to BIRADS. Our study also depicted that the mean shear wave elastography values (kPa) were higher for malignant lesions compared to the benign lesions indicating higher scores favoring potentially malignant lesions. Also, the mean SWE values were highest for BI-RADS 5 followed by BI-RADS 4 and BI-RADS 3 lesions. As there is ongoing research for establishing the correct values for differentiation of benign and malignant lesions, the critical shear wave elastography values for detecting malignant breast masses in our study was estimated to be 102kPa. Thus, the elastographic technique provides further data to determine whether a lesion is malignant or benign. It is also useful for optimizing the pre-selection of patients for biopsy and can help downgrade benign masses classified as BI-RADS 4A or 4B. Our study has showed elastography has an important role in evaluation of breast lesions and improves in diagnosis of the lesions characterized as BIRADS 3and 4A. Implementation of elastography in conventional ultrasound examination should assure examiners on the use of short-term or routine follow-ups instead of unnecessary biopsies in cases of benign and probably benign lesions.

CONCLUSION

Shear wave elastography plays a vital role in differentiating benign from malignant lesions of the breast. Shear wave elastography when used in conjunction with B mode ultrasound, helps in downgrading the lesion from BI-RADS 4A to BI-RADS 3, assuring the use of short term or routine follow up in reducing the biopsy rates significantly, particularly in young age female population in probably benign lesions.

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