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TO EVALUATE ROLE OF STRAIN ELASTOGRAPHY IN DIFFERENTIAL DIAGNOSIS OF SOLID BREAST LESIONS WITH HISTOPATHOLOGY AS GOLD STANDARD

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Abstract
Background: Elastography has increased the specificity of USG and enabled early diagnosis of breast cancer. Quantitative elastography, especially with strain ratio (SR) index, improves diagnostic accuracy and decreased number of biopsies.
Aims: The purpose of this study was to assess the role of USG elastography in the differential diagnosis of solid breast lesions.
Materials and Methods: Fifty patients diagnosed with breast lesions between May 2019 and may 2020 were included in this prospective study. All the patients were examined in the supine position, compression was applied with the probe over the lesion and elastographic images were examined. The elasticity region of interest (ROI) was placed to cover the lesion and the target lesion was placed in the center and the B-mode USG image was displayed along side the elastography strain image. Elastography images were obtained by a EUS Hitachi ultrasound system with a 6.5-MHz linear probe. The elastography strain images were scored according to the Tsukuba elasticity score.
Results: In this study we included 50 patients with breast lesions confirmed on US. The average age of the women was 43.3 years. There were 23 (46%) benign and 37 (54%) malignant lesions. Among the benign nodules the common lesions were fibroadenoma. Among the malignant nodules, the most common lesion was infiltrative ductal carcinoma. To calculate the sensitivity and specificity of strain elastography, lesions with elasticity scores 1-3 were classified as benign, while those with scores of 4 or 5 were classified as malignant. Sensitivity of 85.67% and a specificity of 92.6% was obtained for Tsukuba elasticity score.
Conclusions: Elastography is a fast, simple method that can complement conventional USG examination. This method has the lowest cost/efficiency ratio and it is also the most noninvasive and accessible imaging method, with an accuracy comparable to MRI.
Keywords: Elastography, MRI, USG

Introduction

Breast cancer is the most frequently diagnosed malignancy and the leading cause of cancer death among women worldwide [1] , Breast cancer was the most common cancer in women in India in 2012[2]. Due to overlapping sonographic features of some benign and malignant lesions, biopsies become inevitable causing discomfort to the patients and increased costs. To overcome these limitations, ultrasound elastography was introduced which has high specificity in characterization of breast lesions. Elastography methods can differentiate benign from malignant masses by measuring the stiffness of the mass. There are two main methods of assessing stiffness (elasticity) of a mass: strain elastography and shear wave elastography. In strain elastography, the stiffness of the mass can be viewed from the degree of strain (displacement) on manual compression

AIM:
To assess the role of USG strain elastography in the differential diagnosis of breast lesions

OBJECTIVE

To calculate sensitivity, specificity, diagnostic accuracy of Tsukuba elasticity score and Strain ratio in diagnosing malignant breast masses assuming histopathological findings as gold standard

MATERIALS AND METHODS:

- **Type of study:** Prospective study
- **Place of study:** Department of Radiodiagnosis .S.M.S. medical college and attached hospitals, Jaipur
- **Duration:** January 2020 To August 2020

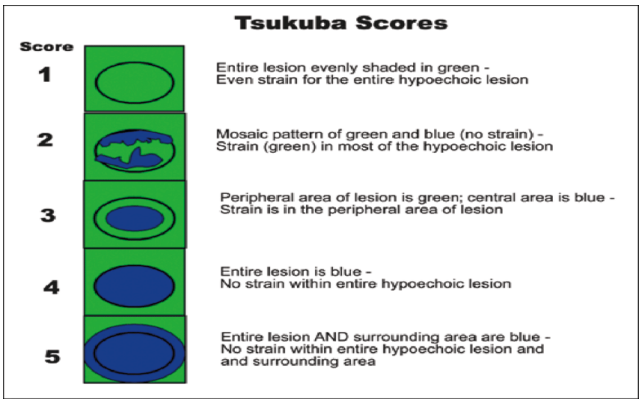
➢ Patients aged between 16 to 86 years presenting with palpable breast lumps were assessed with mammography and conventional B-mode USG. Those confirmed to have a breast mass were then assessed with SE (using a Hitachi

US system with an elastography module and a 6.5 MHz linear probe) after informed consent was obtained, each case was scored according to the **Tsukuba** elasticity score

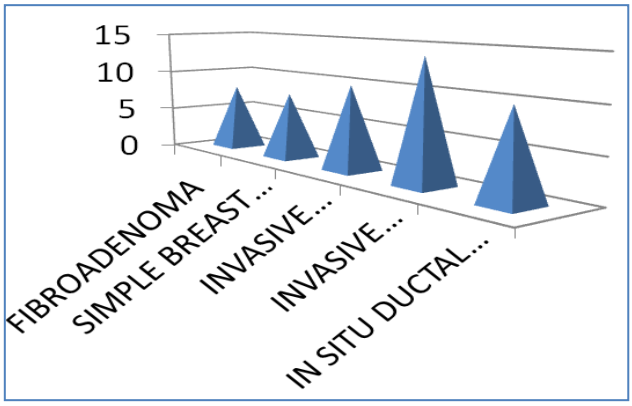
➢ Strain ratio was calculated for each patient, The average strain of the lesion was determined by selecting a region of interest (ROI) from the lesion and a corresponding ROI of the adjacent adipose tissue. Patients with breast implants, postoperative changes, diffuse lesions, were excluded from the study

Statistical analysis

- Student's t-test was used to compare mean strain ratios for benign and malignant solid masses
- ROC analysis was used to determine the cut-off strain ratio point
- IBM SPSS Statistics program version 22 was used for statistical analysis



Histopathological diagnosis of all lesions



RESULTS

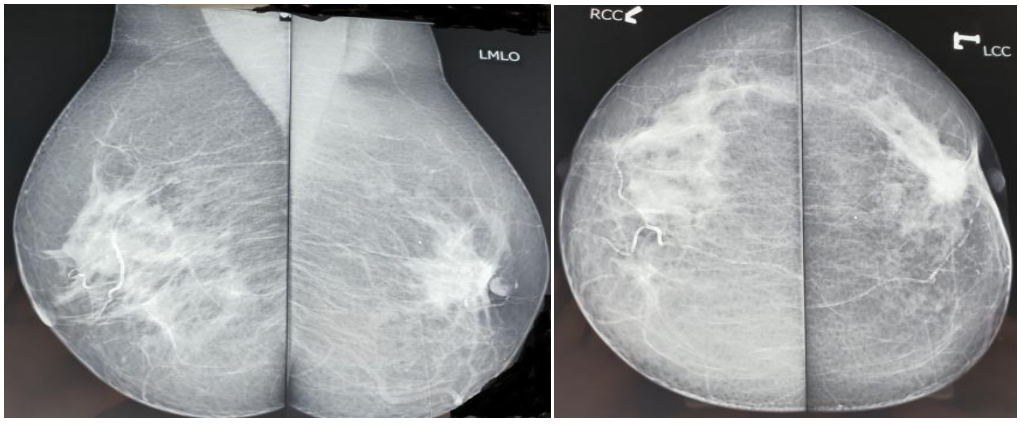
This study included n=50 females

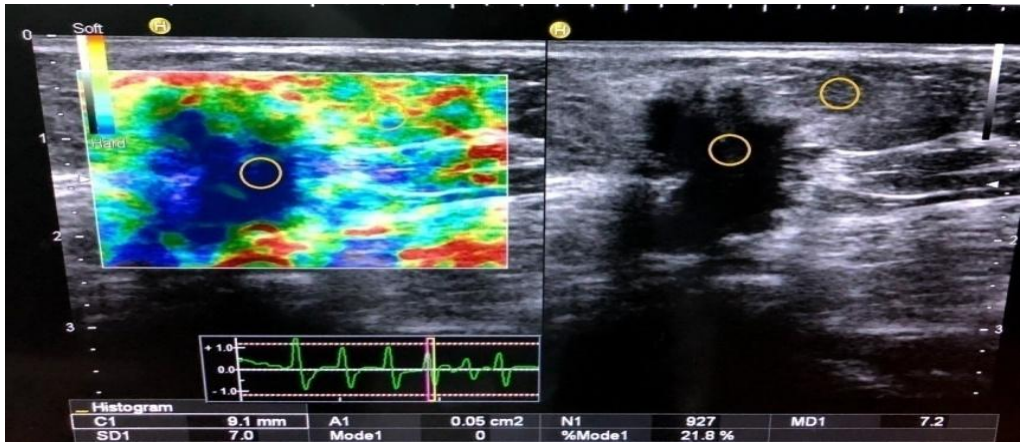
TABLE 1: TSUKUBA ELASTICITY SCORE FOR BENIGN AND MALIGNANT LESIONS

ELASTICITY SCORE	BENIGN LESIONS	MALIGNANT LESIONS	TOTAL
1	9	1	10
2	4	1	5
3	1	3	4
4	1	13	14
5	1	16	17

CASE 1:

- 67 years old female presented with h/o retraction of left nipple and lump in left breast
- No h/o nipple discharge



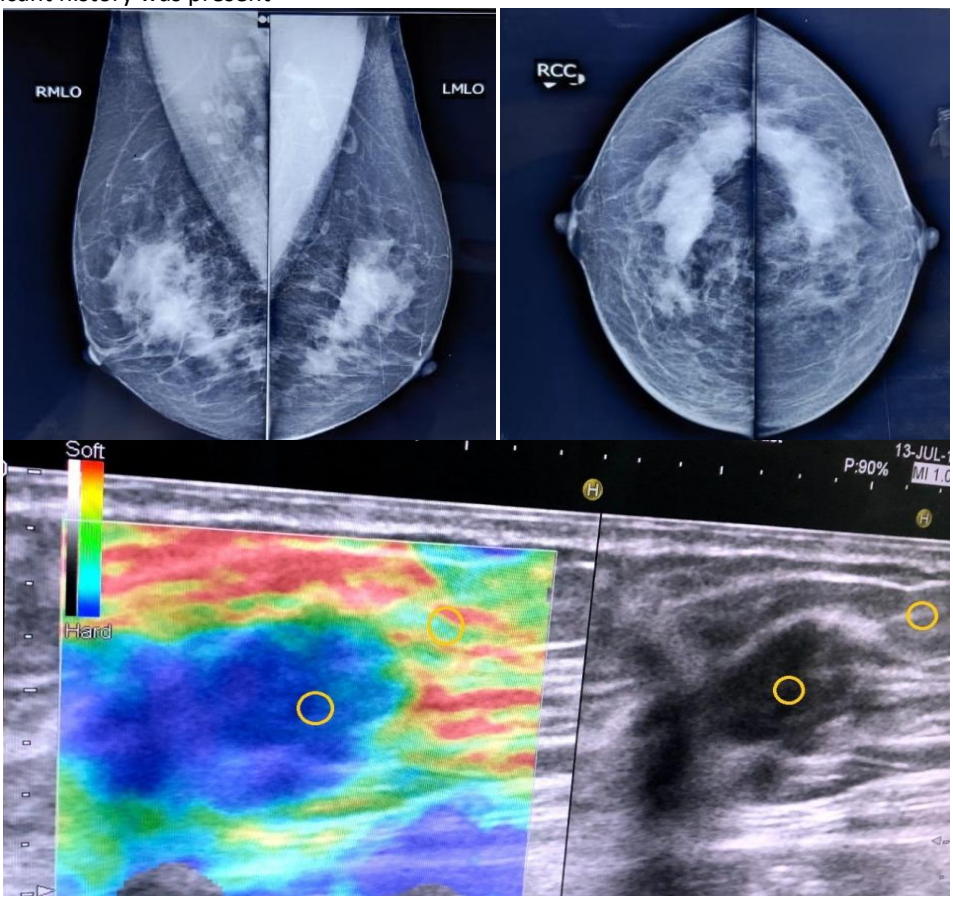


B MODE: Hypoechoic 17 x 11 mm spiculated , anti parallel mass at retroareolar region with internal vascularity

- Strain elastography image: Tsukuba score: **5 (Malignant), Strain ratio: 4.8**
- Histopathological diagnosis: **Invasive Ductal Carcinoma**

CASE 2:

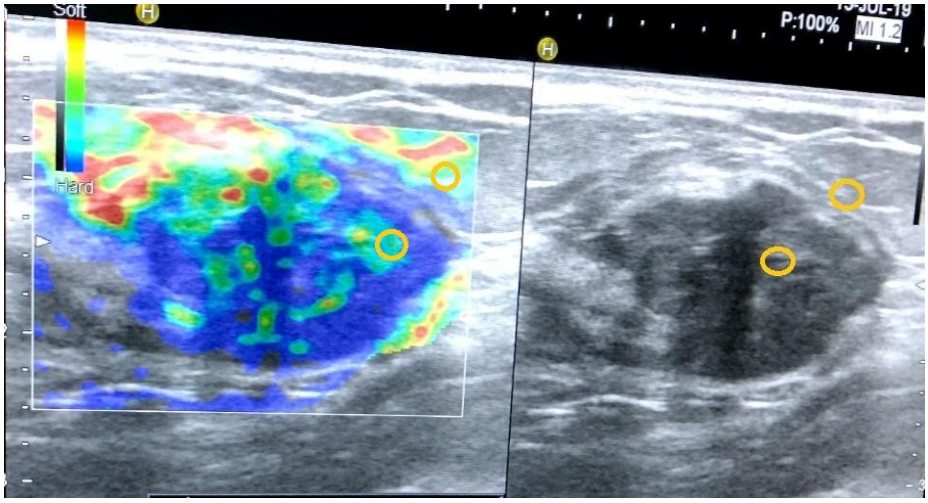
- 45 years old female presented with h/o lump in right breast
- No other significant history was present



- B MODE : Hypoechoic illdefined lesion at 4 o clock postion with posterior acoustic shadowing
- Strain elastography image : Tsukuba Score: 4 (**Malignant**), Strain ratio: 3.5
- Histopathological diagnosis: **Invasive lobular carcinoma**

CASE 3:

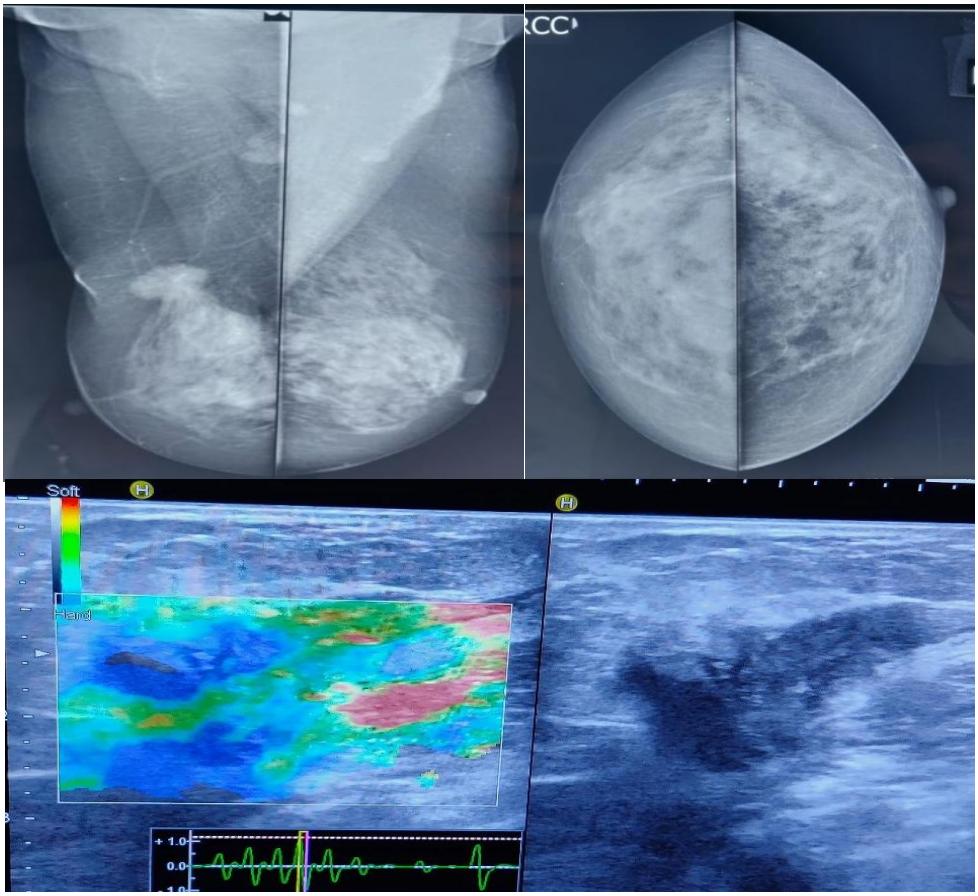
30 years old female presented with movable palpable mass in right breast



- B MODE: oval hypoechoic lesion of size 31 x 17mm was noted in 9 o clock position in
- right breast
- Strain elastography image : Tsukuba Score : **3 (Benign), Strain ratio: 1.76**
- Histopathological diagnosis: **Fibroadenoma**

CASE 4:

- 55 years old female presented with a palpable lump in right breast
- No h/o nipple discharge, pain



- B Mode: Hypoechoiec 25 x 13 mm spiculated mass at 10 o' clock position with internal vascularity
- Strain elastography image : **Tsukuba score – 3 (Benign), Strain ratio: 3.98**
- Histopathological diagnosis:- **Infiltrating ductal carcinoma**

DISCUSSION

USG elastography (SE) differentiates between benign and malignant lesions on the basis of their elasticity: benign lesions have an elasticity similar to the surrounding tissue deform much more easily and are depicted in **green colour**, while malignant lesions are harder than adjacent tissue defrom less are displayed in **blue colour**. For characterization of breast lesions, two elasticity scoring systems have been proposed: the Tsukuba score developed by Itoh and Ueno [3] another designed by the Italian Research Group after Locatelli, Rizzatto et al.[4] we used Tsukuba score in our cohort. Elasticity score of 3 was used as cut off in our study. 14 patients with elasticity score 3 or <3 came out as benign and 29 cases with score 4 or >4 came out as malignant on histopathological examination. 2 cases with elasticity score 4 or >4 came out as benign **(False positive),** These benign lesions were too hard due to presence of a lot of fibrous tissue and 5 cases with elasticity score 3 or <3 came out as malignant (**False negative**) due to false negative results in color map mode. In our study, when a **cutoff point of 3 for Tsukuba score** was used, we found a sensitivity of **85.29%** and a specificity of **87.50% in accordance with** Stoin et al. [7], & Mousa et al. [8] with sensitivity of 80–87%. In our study, average strain ratio for benign lesions was 1.5 and for malignant lesions was 4.6. when we used cut off value of 3 for SR we found sensitivity of and specificity of 94.12% and 84.21%, this same cut off value was used by Stoin et al. [7] & Mousa et al. [8]

CONCLUSIONS AND RECOMMENDATIONS

Sonoelastography has a higher specificity than B-mode ultrasound in the differentiation between benign and malignant masses, and it has the potential to reduce biopsies with benign results. Breast SE is a very simple and rapid method which does not require complex software, it can improve the sensitivity and specificity of B mode USG, especially when dealing with BI-RADS 3 or 4 lesions.

LIMITATIONS

Inability to use shear wave elastography, which is a newer and potentially more objective method. The device we used did not have that option. Operator dependent. Soft malignant masses can be missed by strain elastography**.**

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