ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 02 | February - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF SHEAR WAVE ELASTOGRAPHY IN CHARACTERIZATION OF BREAST MASSES USING HISTOPATHOLOGY AS GOLD STANDARD

Radio-Diagnosis

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ABSTRACT

Background: More recent ultrasound technique like SWE have led to better degrees of breast mass characterization by estimating tissue stiffness based on the acoustically generated shear wave propagation speed through the tissue. **Aims and Objectives:** To find out the sensitivity and specificity of shear wave elastography in characterizing palpable breast masses using histopathology as gold standard. **Materials and methods:** This prospective, cross-sectional study was from may 2020 to June 2021. All patients underwent B-mode ultrasound, SWE and USG guided core biopsy of breast mass, BI-RADS on USG with modifications by SWE assigned, cut-off values for qualitative and quantitative variables of SWE for differentiation between benign and malignant masses were estimated. SWE findings were corelated with histopathology.
Results: On histopathology amongst 55 patients 27 (49%) were benign and 28 (51%) were malignant. On USG, 19 were BI-RADS3 and 36 were BI-RADS 4 (4a, *n* = 18; 4b, *n* = 14; 4c, *n* = 4) leading to 78.57% sensitivity and 48.15% specificity. On modified BI-RADS' using E-color and E-mean/E-max, specificity improved to 66.67% and 77.78% respectively. **Conclusion:** Addition of SWE to ultrasound improves characterization of BI-RADS 3 and 4a masses. E-max, E-mean and E-color are the most useful SWE parameters to differentiate between malignant and benign breast masses.

KEYWORDS

Breast masses , USG , SWI , benign , malignant

INTRODUCTION

One of the most common diseases among females in any age group is breast disease. Differentiation of malignant from benign is a very important aspect for adequate patient care and management. (1) In the recent years, introduction of elastography has increased the specificity of ultrasound and facilitated earlier diagnosis of breast cancer. Elastography is an imaging modality based on tissue stiffness or hardness, which is analogous to clinical palpation with ultrasonography for a malignancy. (2) In breast ultrasonography, two elastographic techniques are popular and differ in the type of stress applied: strain and shear-wave elastography (SWE). (2) SWE using the acoustic radiation force induced by the ultrasound push pulse generated by the transducer provides quantitative elasticity parameters, as well as displaying a visual color overlay of elastic information in real time. (3,4)

MATERIALS AND METHODS:

Our study was a prospective cross-sectional study carried out in a tertiary care hospital from May 2020 to June 2021 after approval from institutional ethical committee. 55 patients with breast lump referred from department of surgery after complete clinical workup were included after taking written informed consent. Patients with BIRADS 3/4 masses were included [16—19]. All enrolled patients ultrasound, SWE, and ultrasound guided core biopsy of the breast mass.

BI-RADS categories were assigned to every breast mass on USG and up/downgraded by SWE on USG machine Canon Aplio

RESULTS:

- USG(B-MODE) diagnosed total 34.50%(19) patients in category 3, 18 (32.70%) in 4a , 14 (25.50) in 4b and 4(7.30%) cases in 4c BIRADS categories
- (B-Mode +SWE) diagnosed 27 (100%) in 3, 3 cases (11.10%) in 4a, 2 cases (7.40%) in 4b and 1 case (3.70%) in 4c.
- The B-MODE + SWE was 89.29% sensitive, 77.78% specific, have NPV of 87.50%, PPV of 80.65% and was overall 83.64% accurate
- Best cut-off value for variable E-max and E-mean to differentiate between benign and malignant mases was 137.2 kPa and 97.5 kPa respectively.

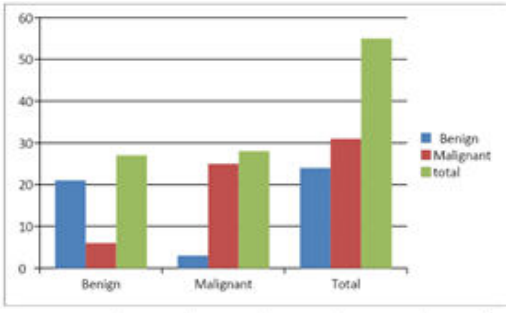
Table 1: Distribution of the according to the AGE

Age	Number	%age
20-25	2	7.4
26-30	2	7.4
31-35	5	18.5
36-40	10	37.0
41-45	7	25.9
46-50	1	3.7
Total	27	100.0

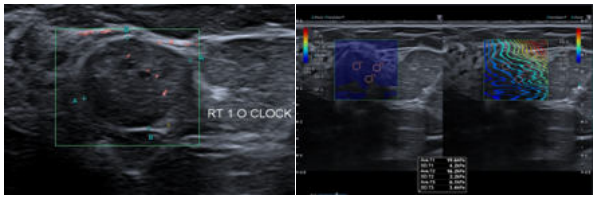
Table 2 : Distribution of patients according to B- MODE+SWE

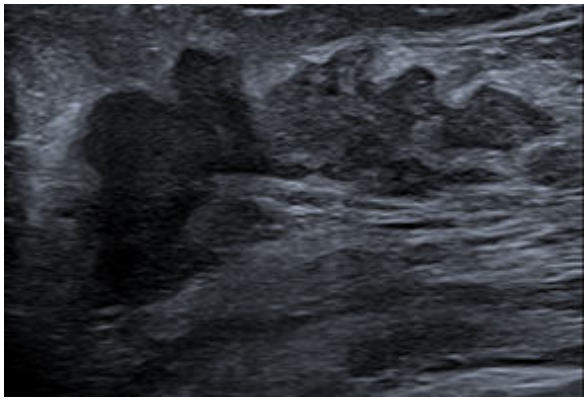
B - MODE+SWE	Benign		Malignant		total		P value
	n	%	n	%	n	%	
3	21	77.80%	3	10.70%	24	43.60%	.0001
4a	3	11.10%	2	7.10%	5	9.10%	
4b	2	7.40%	11	39.30%	13	23.60%	
4c	1	3.70%	12	42.90%	13	23.60%	
total	27	100.00%	28	100.00%	55	100.00%	

Table 3.Distribution of patients according to the B-MODE+ SWE and histopathology

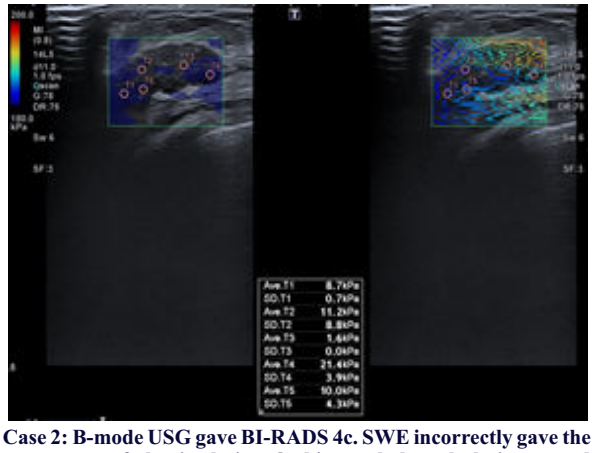


Comparison between B-MODE+ SWE and histopathology	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
	89.29	77.78	80.65	87.50	83.64





Case 1: BI-RADS 3 mass on USG, correctly downgraded to BI-RADS 2 by SWE. Final diagnosis was fibroadenoma on histology.



Case 2: B-mode USG gave BI-RADS 4c. SWE incorrectly gave the parameters of a benign lesion. On histopathology the lesion turned to be malignant pathology

DISCUSSION :

SWE is gaining popularity in clinical practice worldwide. (5)
In our study, out of total 55, 49% (27) were benign and 51% (28) were malignant cases. (6)

Out of 27 benign cases, fibro- adenoma was predominant diagnosis given in 55% (15), giant fibro adenoma in 14.8 % (4), ductal papilloma in 14.8 % (4) complex breast cyst and breast abscess in 7.6% cases each. (6)

Out of 28 malignant cases, invasive ductal carcinoma was the predominant diagnosis which was seen in 53.5% (15 cases) followed by DCIS in 28.5%(8) cases and inflammatory ductal carcinoma seen in 17.8 %(5) cases.(7)

In our study fibroadenomas were the most common benign masses, most of them showed blue colour and lower values then cut-off values of quantitative parameters on SWE (7,8)

In our study invasive ductal carcinomas were the most common malignant masses , most of them showed red colour and higher values then cut-off values of quantitative parameters on SWE (8)

In our study B- mode USG was 78.57% sensitive , 48.15% specific and have PPV of 61.11NPV of 68.42% and was overall 63.64% accurate.(8.9)

In our study SWE was 89.29% sensitive 77.78% specific have NPV of 87.50% PPV of 80.65% and was overall 83.64% accurate. (9)

CONCLUSION :

Addition of SWE to ultrasound improves characterization of BI-RADS 3 and 4a masses. E-max, E-mean and E-color are the most useful SWE parameters to differentiate between malignant and benign breast masses.

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