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Radiology

DIAGNOSTIC VALUE OF ULTRASOUND ELASTOGRAPHY OF BREAST MASSES AND ITS CORRELATION WITH FNAC AND/OR HISTOPATHOLOGY

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ABSTRACT Breast cancer being the second most common primary cause of cancer related death is completely curable when diagnosed at an early age. The technique of elastography which provides information on strain or hardness of tissues has become a routine tool in evaluation of breast lesions. This prospective observational study was done at a tertiary care centre in southern India with a total study population of 95 patients who presented with palpable/mammographically/ultrasonographically detectable breast lesions. The primary objective of this study is to assess the severity of breast lesions using elasticity tissue imaging technique and score it based on Ei-Ueno classification scoring system.

KEYWORDS : Breast elastography, shear wave elastography, Ei ueno classification scoring system

INTRODUCTION

Breast cancer is one among the most common malignancies in women. It is the second most common primary cause of cancer related death(Sigrist et al., 2017). Breast cancer if diagnosed at an early stage is completely curable. Detecting it at an early stage through screening is one of the methods to reduce the mortality rate that comes with it. The latest advancements in screening have made it possible to detect early stages of breast cancer.

However, the scenario is different in developing countries where financial constraints limit the use of screening tests which impedes the early detection of breast cancer. Most of the current methods of screening possess high sensitivity but lacks specificity which results in an alarming number of false positive results. This in turn results in high number of unnecessary biopsies. In some cases, sub centimetric lesions may go unnoticed even after regular screening tests which impedes its diagnosis at an early stage when it is curable.

Hence, there arises the need for development of a single screening test for breast cancer which will demonstrate high sensitivity as well as specificity(Stein & Chellman-Jeffers, 2009). Research on elastography as a screening tool for breast lesions has shown an exponential increase since the year 2000. Several published articles exist since the 21st century that assess the value of elastography as a screening and diagnostic tool in breast malignant.

It has been shown that breast elastography helps in characterization of lesions over conventional sonography and mammography by providing supplementary information. The technique of elastography which provides information on strain or hardness of tissues similar to clinical method of palpation has become a routine tool in evaluation of breast lesions over the last 5 years(Jayaraman et al., 2017).

The purpose of this study is to assess the diagnostic value of elastography in finding the severity of breast lesions, score it based on Ei-Ueno classification scoring system.

We conducted a prospective analysis of 95 consecutive patients who presented with palpable breast masses and underwent mammography and breast ultrasound followed by histopathological / cytological correlation.

MATERIALS AND METHODS

This is a prospective observational study in the department of Radiodiagnosis, Pondicherry institute of medical sciences from 2017-2019 with a sample size of 95 patients with palpable/ mammographically/sonographically detectable breast masses.

Inclusion criteria

- Patients with a palpable breast mass (unilateral and bilateral)
- Mammographically detected breast lesion
- Patients referred to USG for breast symptoms and masses detected.

Exclusion criteria

- Patients who refused to undergo FNAC/Biopsy following ultrasonography.

Study Technique

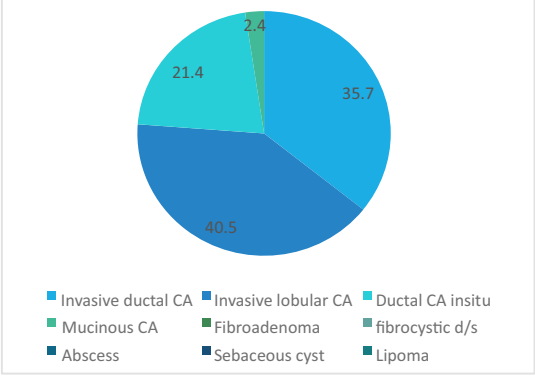
All Patients presenting to the Department of Radio-Diagnosis for Ultrasound Breast, fulfilling inclusion and exclusion criteria were evaluated in this study. The diagnostic procedure was explained to the patient in detail and informed consent was obtained. Routine Ultrasonography was performed with Linear High frequency Transducers on Ultrasound device SIEMENS ACUSON S 2000 Machine. For examination, the patient was made to lie down in supine position. First, routine ultrasound Breast was performed in these patients and breast masses identified. Elastography was then performed over these breast lesions using Elasticity tissue imaging technique.

Breast masses was scored using Ei-Ueno classification scoring system. FNAC/Core Biopsy was done after ultrasound examination and subsequently the breast masses were surgically removed. Ultrasound elastography scores was then correlated with Fine Needle Aspiration Cytology (FNAC)and/ or Histopathology findings in the same patients.

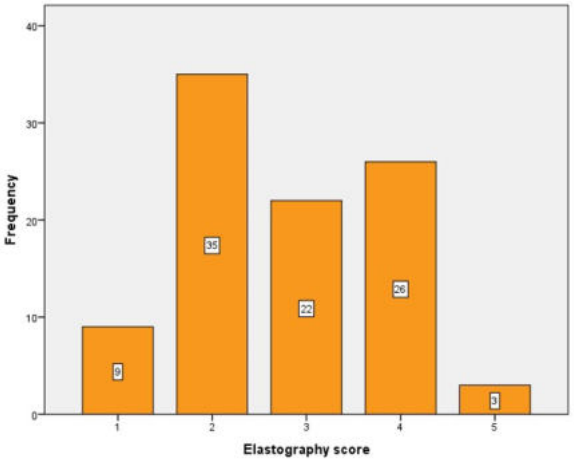
The data was entered in Microsoft Excel 2007 and analysed using SPSS 20.0 version software. The clinical characteristics of the study patients was described using mean and standard deviation for continuous variables and percentages for categorical variables. ROC curve analysis was done using Strain elastography values values to find sensitivity and specificity of ultrasound elastography in differentiating breast masses. False positive rate and False negative rate was also calculated. Chi-Square test was done to correlate ultrasound elastography scores with FNAC results.

RESULTS

During this study period 95 patients who has undergone mammography and ultrasonography of the breast followed by cytological / histopathological correlation were assessed.



Graph 1 : Distribution of diagnosis



Graph 2: Distribution of elastography scores

Table 1: Elasticity scores for benign and malignant lesions

			Elastography score					Total
			1	2	3	4	5	
final diagnosis	Malignant	Count	0	6	12	21	3	42
		% within final diagnosis	0.0%	14.3%	28.6%	50.0 %	7.1%	100.0%
	Benign	Count	9	29	10	5	0	53
		% within final diagnosis	17.0%	54.7%	18.9%	9.4%	0.0%	100.0%
Total		Count	9	35	22	26	3	95
		% within final diagnosis	9.5%	36.8%	23.2%	27.4 %	3.2%	100.0%

Chi-square test; p value<0.001; Degree of freedom=4

There was a statistically significant association between the groups.

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Table 2: Sensitivity and Specificity of elastography score at Cut of 3 for the Diagnosis of Benign and Malignant Lesions

	Point estimates and 95 % Confidence Intervals
True prevalence:	0.442 (0.34, 0.548)
Sensitivity:	0.857 (0.715, 0.946)
Specificity:	0.717 (0.577, 0.832)
Positive predictive value:	0.706 (0.562, 0.825)
Negative predictive value:	0.864 (0.726, 0.948)
Positive likelihood ratio:	3.029 (1.939, 4.73)
Negative likelihood ratio:	0.199 (0.093, 0.426)
Odds Ratio :	15.2 (5.315, 43.47)
Youden Index :	0.574 (0.291, 0.778)

DISCUSSION

Palpable breast lesion prompts immediate evaluation to diagnose potential breast malignancy. Early detection through screening is the single most important factor required to reduce deaths from breast cancer and the extent of treatment required (Kim et al., 2000).

Ultrasound elastography has become a popular tool for characterisation of breast lesions. With the use of strain elastography the principle of tissue response to an external pressure is being evaluated, harder the tissue lesser will be the distortion to external pressure than softer tissue. Elastography has proven to be highly specific in the evaluation of lesions situated in various organs: breast, prostate, thyroid, lymph nodes and testes. However, this technique is still new, and considering that there are several technological solutions, its role in clinical practice is still to be defined.

This study was conducted in Pondicherry institute of medical sciences, Puducherry.

This study included patients above 40 years of age with a palpable breast mass (unilateral and bilateral) / mammographically detected breast lesion/ patients referred to USG for breast symptoms and masses detected.

In our study, considering elastography scores of 1 to 3 as benign and 4 and 5 as malignant, the sensitivity of strain elastography was found to be 85.7 % and specificity of 71.7% with an accuracy of 95%.

We found that it had a positive predictive value of 70.6% and negative predictive value of 86.4%, a positive likelihood ratio of 3.0 and a negative likelihood ratio of 0.19.

In a similar study by Navarro et al(Navarro et al., 2011), considering scores of 1 to 3 as benign and, 4 and 5 as malignant, the sensitivity of elastography was 69.5%; specificity, 83.1% ; positive predictive value, 78.9%; and negative predictive value, 75.0%.

This is in close conformity with results reported by Schnitt SJ et al,((Themes, 2016))who found that when a cutoff point between 3 and 4 was used, elastography had 86.5% sensitivity, 89.8% specificity, and 88.3% accuracy.

Table 3: Comparison of sensitivity and specificity of Elastography score with other studies.

Serial No.	Author	Year	Cut off	Sensitivity	Specificity
1	Schnitt SJ et al	2004	ES : </= 3	86.5%	89.8%
2	Navarro et al	2011	ES : </= 3	69.5%	83.1%
3	**Current study**	**2019**	**ES : </= 3**	**85.7%**	**71.7%**

CONCLUSION

Mammography and ultrasonography (USG) shows the highest sensitivity in detecting breast cancer. However, they present with certain limitations. False-positive results may be yielded when mammography is performed in dense breasts. USG has good sensitivity in the detection of lesions, but specificity is poor as most solid lesions are benign.

USG elastography provides information on tissue elasticity by assessing the extent of its deformability and its non-invasiveness makes it a patient-friendly technique to follow. Strain elastography is a promising technique in differentiating benign from malignant breast lesions.

The technique of elastography adds valuable complementary information to B mode ultrasound, helping in assisting the decision for biopsy recommendations.

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