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Comparative Diagnostic Accuracy of Sonographic Strain Elastography and FNAC in Breast Lesions

[1]Isma Shabbir, [1]Aniqua Saleem, [2]Misbah Durrani, [1]Umme Kalsoom, [3]Asma Qasim, [4]Hassan Mumtaz

[1]*Department of Radiology, Holy Family Hospital, Rawalpindi.*
[2]*Department of Radiology, Rawalpindi Institute of Cardiology, Rawalpindi.*
[3]*Department of Radiology, Advanced International Hospital, Islamabad.*
[4] *Maroof International Hospital, Islamabad.*

ABSTRACT

Introduction: Various sonographic techniques have been developed to study the relationship between different structures and tissue elasticity. Detecting malignant tumors using ultrasound elastography is quite useful. The mechanical properties of the tissue under examination can be examined in real time using elastography to detect pathological changes. A high-frequency ultrasonic scanner measures a tissue's modulus of elasticity to compute stretching changes in displacement.

Aims & Objectives: To determine the diagnostic accuracy of sonographic strain elastography in breast lesions keeping FNAC as gold standard.

Place and duration of study: Radiology Department of Benazir Bhutto Hospital from Aug 2019 to Jan 2020.

Material &Methods: The cross-sectional validation study was conducted at the Radiology Department of Benazir Bhutto Hospital, Rawalpindi Medical University, from Aug 2019 to Jan 2020. 259 patients were selected by consecutive non-probability sampling. After taking demographic information, all patients received sonographic elastography. Lesions were classified using the Ueno system and pressure bar, and FNAC was conducted. SPSS 20 was used to enter and evaluate the gathered data. The sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratio, and accuracy of strain elastography were calculated using FNAC as the gold standard.

Results: The sensitivity, specificity, PPV, NPV and accuracy of elastography to detect malignancy was 92.2 %, 96.2%, 91.0%, 96.7% and 94.98% respectively. Likelihood ratio was 215.449 (p value <0.0001). The results showed no significant impact of confounders.

Conclusion: The sensitivity, specificity, PPV, NPV and accuracy of elastography to detect malignancy was 92.2 %, 96.2%, 91.0%, 96.7% and 94.98% respectively. the likelihood ratio was 215.449 (p-value <0.0001).

Key words: breast neoplasms, biopsy, fine-needle, elasticity imaging techniques.

INTRODUCTION

Many different sonographic approaches have been developed to examine the link between different structures and tissue elasticity. Ultrasound elastography, a noninvasive method for detecting malignant tumours, is quite helpful. Using elastography, diseased tissue changes can be detected in real time by viewing the mechanical characteristics of the tissue in question. The modulus of elasticity is used to determine the mechanical properties of tissues using a high-frequency ultrasound scanner to calculate stretching changes in tissue displacement. [1] Elastic modulus is the link between applied pressures and the change in tissue length that occurs. In comparison to hard neoplastic tissue, healthy soft tissue has less modulus. Breast cancer is the most frequent kind of cancer in the globe.[2]

Breast cancer has a prevalence of 25.0 percent. Breast lesions that are either benign or malignant can be more accurately identified and differentiated using elastography. Real-time elastography appears to increase the specificity of diagnosing breast lesions in clinical studies.[3] For the diagnosis of malignant breast lesions, strain elastography and shear wave elastography are safe, noninvasive methods.[4] The sensitivity and specificity of sonographic elastography are both 92%.[5] Malignant breast masses were detected by strain sono-elastography with a sensitivity of 88.57 percent, specificity of 90.2 percent, and accuracy of 89.78 percent.[6] According to research, sonographic strain elastography enhanced the sensitivity and specificity

of the identification of breast lesions when compared to FNAC.[7]

Furthermore, there are only a few local studies that can assist in determining whether to use sonographic strain elastography for malignant breast tumors or not.

This study could help to prevent intrusive methods, excessive radiation exposures, and provide more information to alter breast imaging reporting and data systems (BIRADS). Sonographic strain elasto graphy in breast lesions is being studied to determine its diagnostic accuracy versus FNAC the gold standard. This would enable determining the local magnitude of breast malignancy and improve its management without any unnecessary delay and with no need for expensive, invasive, and radiation-hazardous diagnostic modalities.

MATERIAL AND METHODS

This cross-sectional validation study was carried out in the Radiology Department of Benazir Bhutto Hospital, Rawalpindi Medical University from August 2019 to Jan 2020. Sample size of 259 cases was calculated with 95% confidence level, and taking values from a study i.e., expected percentage of malignancy 25%, sensitivity of 96%, specificity of 92 % and absolute precision of 4% in sensitivity and 8% in specificity.[5] Consecutive nonprobability sampling technique was used.

Inclusion & Exclusion Criteria:

Female patients between 20 to 60 years of age and who were advised FNAC for breast lump by Surgical Department were included in the study. Patients who were already diagnosed as breast cancer, or who developed disease recurrence and who were lost to follow up were excluded from the study.

Data Collection:

Data was collected after the approval from Ethical Committee of Benazir Bhutto Hospital, Rawalpindi vide letter no CPSP/REU/RAD-2015-126-2062, Dated July 31st, 2019. Everyone who agreed to the procedure signed an informed consent form before being taken through the sonographic elastography procedure.

With curvilinear transducer elastography technique capability, an ultrasound machine was employed in real time. The lesion was diagnosed according to the Ueno classification after the probe was positioned centrally over the lesion and the borders of a 5 mm area were included.[7] Level 1-Unusually elastic lesion, green; level 2– fundamentally elastic lesion, mosaic pattern of light and dark green and blue; level 3– abnormally elastic lesion. At this level you can see elasticity in the lesion's periphery and a lack of elasticity in the lesion's center, as well as green in the periphery and blue in the center. Level 4 – Complete lack of elasticity throughout the lesion, a deep blue color, and in the lesion and surrounding tissues, a blue zone indicates a lack of elasticity at the Level 5 level. Levels 1 to 3 were seen as healthy, whereas levels 4 and 5 were regarded as potentially harmful. Following that, a FNAC was conducted. A consultant pathologist reviewed the cytological findings without being aware of the elastography findings.

Data Analysis:

The collected data was recorded through proforma & analyzed using SPSS 20. Age, parity, menstrual history, and duration of symptoms were presented as mean ± SD. Elastography and FNAC results were expressed as frequency and percentage. 2x2 tables were generated to calculate the sensitivity, specificity, PPV, NPV and accuracy of strain elastography taking FNAC as gold standard. Likelihood ratio was calculated. Effect modifiers like age & parity were controlled by stratification. Post stratification diagnostic accuracy was measured.

RESULTS

Our study included 259 patients showing the mean 39.71 ± 12.37 years (mean ± SD). For stratification, the age was divided into two categories. The duration of symptoms was 13.57 ± 7.22 months. The data was stratified according to age & parity. The results showed no significant of both parameters. Table-1

Sr. No	Characteristics	No. of Patients %	No. of Malingnancies %	No.of Benign Lesions %	Mean/ Median (±SD)
1.	Age (Year)	259	77 (29.7)	182 (70.3)	39.715 ± 12.374
2.	**Age Group (Year)**				
	20 to 40	139 (53.7)	46 (33.1)	93 (66.9)	---
	41 & Above	120 (46.3)	31 (25.8)	89 (74.2)	---
3.	**Parity**				
	<3	125 (48.3)	42 (33.6)	83 (66.4)	---
	>3	134 (51.7)	35 (26.1)	99 (73.9)	---

Table-1: Demographic characteristics of patients with ovarian carcinoma.

The elastography findings showed that 78 (30.1%) patients had features of malignancy while FNAC showed 77 (29.7%) cases of malignancy.

The sensitivity, specificity, PPV, NPV and accuracy of elastography to detect malignancy was calculated to be 92.2 %, 96.2%, 91.0%, 96.7% and 94.98% respectively and the likelihood ratio was 215.449 (p value <0.0001), as depicted in Table-2.

Parameter		FNAC Findings		Total
		Positive	Negative	
Elasto-Graph Scan	Positive	71 (TP)	07(FP)	78 (TP+ FP)
	Negative	06 (FN)	175 (TN)	181 (FN+ TN)
Total		77 (TP+FN)	182 (FP+TN)	259 (Total)

Table-2: FNAC and Elastography Scan Cross Tabulation

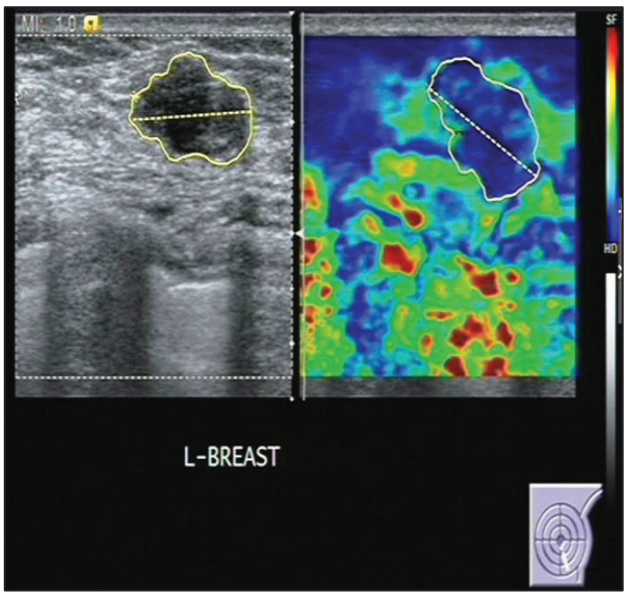

Fig-1: Sono Elastography, depicting a level 4 lesion showing blue color within the entire lesion.

DISCUSSION

Sonography's accuracy has been improved by the introduction of numerous modifications to the standard ultrasound. Various studies have indicated that elastography, rather than Sono-elastography, is a better method for detecting and categorising breast lesions than conventional ultrasonography.[8] When evaluating tiny tumours, Sono-elastography is more useful as a diagnostic tool.[9,10,11]

When elastography is utilised in conjunction with B mode sonography, the diagnostic accuracy is improved.[12] The B mode is commonly used as the first imaging tool for breast lesions in many locations. Elastography is used on any suspicious-looking lesions. [10] Compared to strain elastography and shear wave elastography, a meta-analysis found that Sono-elastography techniques improved specificity but decreasing sensitivity in B mode ultrasonography.[13]

Breast strain elasticity images were acquired with modest interobserver repeatability and good intraobserver agreement in image interpretation in another investigation.[14] A review of the available evidence reveals that discrepancies and differences between elastography methods are mostly the result of differences in technique, a steep learning curve, and method differences between vendors. When done correctly, breast elastography using strain and shear wave techniques yields high sensitivities.[15]

Histopathological data was used as a gold standard to evaluate the role of sonoelastography in the diagnosis of malignant breast lesions by Atabey et al. (2014). Researchers found that strain elastography's sensitivity was 83%, specificity was 89%, positive predictive value was 79%, and negative predictive value (NPV) was 91% in this investigation.[16] Elastography's malignancy detection sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were all 92.2 percent, 96.2 percent, 91.0 percent, 96.7 percent, and 94.98 percent in my research.

Strain elastography had a sensitivity of 88.57 percent, a specificity of 90.20 percent, a PPV of 75.61 percent, an NPV of 95.83 percent, and an accuracy of 89.78 percent when compared to histology as the gold standard. Malignancy was found in 25.55 percent of patients and overall 29.7% of the population was afflicted. [6]

A study by Zhi, H., et al. examined the use of strain elastography to diagnose breast lesions. This study found a significant difference between the benign and malignant strain ratios (P .00001). It had 92.4 percent sensitivity, 91.1% specificity, and 91.4 percent accuracy at the 3.05 cutoff threshold.[17] Using a cutoff point of 3.06, researchers found that the strain ratio had 87.7% sensitivity, 88.5 percent specificity, 88.2 percent accuracy, 76.6 percent positive predictive value, and a 94.3 percent positive predictive value (P>0.05).[18]

According to a 2013 study, different results can be interpreted in local situations by changing the cutoff value in ROC charting. Researchers found that, with a cutoff point of 2.0, the strain ratio had 90.7 percentage points of sensitivity and specificity, 58.2 percentage points of positive predictive value, and 85.1 percentage points of negative predictive value.[19] Furthermore, strain elastography ratios are linked with tumour grades.[20]

Limitations:
We did not study ultrasound features of breast lesions by combining with BI-RADS and further prospects for BI-RADS grading of breast lesion elastography is underprocess. Secondly lesion depth and breast glandular density affect lesion elasticity and would have provided useful data but remained undetermined.

CONCLUSION

Elastography had a malignancy detection sensitivity, specificity, PPV, NPV, and accuracy of 92.2 percent, 96.2 percent, 91.0 percent, 96.7 percent, and 94.98 percent respectively. The outcomes of the present study could be bolstered by larger studies with a larger sample size.

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The Authors:
Dr. Isma Shabbir
Post Graduate Trainee,
Radiology Department,
Holy Family Hospital, Rawalpindi

Dr. Aniqua Saleem
Senior Registrar
Radiology Department
Holy Family Hospital, Rawalpindi

Dr. Misbah Durrani
Associate Professor,
Department of Radiology,
Rawalpindi Institute of Cardiology, Rawalpindi

Dr. Umme Kalsoom
Assistant Professor
Department of Radiology,
Holy Family Hospital, Rawalpindi.

Dr. Asma Qasim
Consultant Radiologist,
Advanced International Hospital, Islamabad.

Dr. Hassan Mumtaz
Clinical Research Associate,
Maroof International Hospital
Public Health Scholar: Health Services Academy
Islamabad.

Corresponding Author:
Dr. Hassan Mumtaz
Clinical Research Associate,
Maroof International Hospital
Public Health Scholar: Health Services Academy
Islamabad
Email: hassanmumtaz.dr@gmail.com