Original Research Article

Comparative study of elastography and histopathology findings of breast lump at a tertiary hospital

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Abstract

Background: Cancer breast has emerged as leading site of cancer in most urban populations of India. Breast sono-elastography is a non-invasive imaging technique which provides information on breast lesions. In present study we compared elastography and histopathology findings of breast lump and diagnostic accuracy of elastography. **Material and Methods:** Present study was a prospective observational study conducted in females patients, sonographically visible solid breast lesions, measuring less than 3 cm, classified as BI-RADS 3 and 4. **Results:** During study period 126 female patients underwent USG elastography, followed by biopsy/surgery and histopathology reports were available. As per histopathology, 52 (41.72 %) were benign while rest 74 (58.73 %) were malignant. Age, BIRADS, Elastography Score and Strain ratio were significantly higher in malignant cases as compared to benign cases and difference was statistically significant ($p<0.001$). According to Histopathological diagnosis, among benign lesions majority were fibroadenoma (77.03%) others were fibrocystic disease (9.46%), benign fibroepithelial lesion (6.76%), abscess (5.41%) and sclerosing adenosis (1.35%). while, among malignant cases majority were invasive ductal carcinoma (67.31%) followed by invasive mucinous carcinoma (13.46%), invasive poorly differentiated carcinoma (7.69%), ILC (5.77%), medullary ca (1.92%), papillary ca (1.92%) and phylloids (1.92%), Excellent scores were noted with combination of Ultrasound Score + Elastography Score + Strain Ratio as sensitivity, specificity, diagnostic accuracy, NPV, and PPV of 96.00 %, 96.05 %, 96.03 %, 94.12 % and 97.33 % respectively. **Conclusion:** Ultrasound elastography combined with strain elastography and ultrasound score have high sensitivity, specificity, and diagnostic accuracy in differentiating benign and malignant breast masses.

Keywords: breast lump, breast malignancy, elastography, histopathology

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INTRODUCTION

Cancer breast has emerged as leading site of cancer in most urban populations of India. It is rapidly replacing cancer of cervix as most important leading site of cancer among women.[1,2] Several etiological factors, such as age, genetics, family history, diet, alcohol, obesity, lifestyle, physical inactivity, endocrine factors, are implicated in pathogenesis of disease.[3] A biopsy is the "gold standard" method for detection of the breast lumps but it is an invasive method and has a high cost for diagnosis.[4] In the past few years, elastography has gained ground as a complementary method to ultrasonography in non-invasive breast cancer screening. Real-time elastography is used complementarily to conventional US, resulting in increased diagnostic accuracy.[5] Breast sono-elastography is a non-invasive imaging technique which provides information on breast lesions. It quantifies the hardness of a breast lesion in relation to surrounding tissue, being

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useful in differentiating between benign and malignant tissue.[6] Two techniques are now available for clinical use: strain (compression based) and shear wave elastography.[7] The lesions are quantified according to the colour scale in Sonoelastogram. Among various scoring methods, the Tsukuba elasticity score is the most known and commonly used scoring systems in elastography.[8] In present study we compared elastography and histopathology findings of breast lump and diagnostic accuracy of elastography.

MATERIAL AND METHODS

Present study was a prospective observational study conducted in Department of Radio Diagnosis, MIMSR Medical College, Latur, Maharashtra. Study period was from June 2019 to June 2020 (1 year). Institutional ethical committee approval was taken.

Inclusion criteria: Females patients, sonographically visible solid breast lesions, measuring less than 3 cm, classified as BI-RADS 3 and 4.

Exclusion criteria: Cystic lesions, solid lesions classified as BIRADS category 2 or 5, Lesions located near the skin surface or the chest wall or Lesions without cytologic/histopathologic diagnosis

A written informed consent was obtained from all participants before being included in the study. Real-time ultrasound followed by SE was performed using a 3–12 MHz linear array transducer on a Samsung RS80A unit (Samsung Medison BLDG., 42 Teheran-ro 108-gil, Gangnam-gu, Seoul 135-851, South Korea) by one of the two radiologists with 8 and 10 years of experience in breast ultrasounds and training in elastography.

Demographic data, past history, clinical examination findings were noted. The lesions were first assessed by conventional B-mode ultrasonography using a radial scanning pattern with patients lying in a supine position. Each lesion was assigned a BI-RADS category using conventional ultrasound features like shape, echotexture, margin, orientation, and posterior acoustic characteristics. It was followed by elastogrphy The Elastography score (ES) was determined on a five-point Tsukuba classification proposed by Itoh *et al.*[8]

Table 1: 5-score system for Elastography images

Score	Characteristic
1	Whole lesion is evenly shaded in green, indicating that the entire lesion is soft with homogeneous strain throughout
2	Mixed pattern of green and blue suggesting that the greater part of the lesion is soft with a few interspersed areas of stiffness
3	Lesion shows strain at the periphery represented by green shade, with central stiffness represented in blue
4	Lesion shows homogeneous shading in blue indicating that the entire lesion is stiff
5	entire lesion and surrounding area shows blue shading indicating stiffness in and around the lesion

Lesions with ES 1–3 were considered benign, and lesions with ES 4 and 5 were suspected to be malignant. Strain ratio (SR) was calculated by placing first the region of interest (ROI) in target lesion and second ROI in lateral subcutaneous fat tissue of similar size and at the same depth as the target lesion. Histopathological results obtained for biopsy or surgical specimen were used as the reference standard for comparison of conventional ultrasound and elastography findings. The sonographic and elastographic parameters for benign and malignant lesions were compared relative to the histopathological diagnosis using the Mann–Whitney U test. The level of significance was set at a P value of 0.05.

RESULTS

During study period 126 female patients underwent USG elastography, followed by biopsy/surgery and histopathology reports were available. As per histopathology, 52 (41.72 %) were benign while rest 74 (58.73 %) were malignant. Age, BIRADS, Elastography Score and Strain ratio were significantly higher in malignant cases as compared to benign cases and difference was statistically significant ($p<0.001$).

Table 1: Mean values of variables with respect to histopathological diagnosis

Variants	Benign	Malignant	P
Age	39.97 ± 10.81	55.87 ± 14.69	<0.001
BIRADS	3.37 ± 0.49	4.65 ± 0.66	<0.001
Elastography Score	2.42 ± 0.62	4.67 ± 0.62	<0.001
Strain Ratio	1.82 ± 0.85	4.67 ± 1.31	<0.001

According to Histopathological diagnosis, among benign lesions majority were fibroadenoma (77.03%) others were fibrocystic disease (9.46%), benign fibroepithelial lesion (6.76%), abscess (5.41%) and sclerosing adenosis (1.35%). while, among malignant cases majority were invasive ductal carcinoma (67.31%) followed by invasive mucinous carcinoma (13.46%), invasive poorly differentiated carcinoma (7.69%), ILC (5.77%), medullary ca (1.92%), papillary ca (1.92%) and phylloids (1.92%),

Table 3: Histopathological diagnosis amongst malignant and benign lesions

HPE RESULTS	Number Of Cases	Percentage (%)
Benign (n=74)		
Fibroadenoma	57	77.03%
Fibrocystic disease	7	9.46%
Benign fibroepithelial lesion	5	6.76%
Abscess (ABS)	4	5.41%
Sclerosing adenosis	1	1.35%
Malignant (n=52)		
Invasive ductal carcinoma	35	67.31%
Invasive mucinous carcinoma	7	13.46%
Invasive poorly differentiated carcinoma	4	7.69%
ILC	3	5.77%
Medullary Ca	1	1.92%
Papillary Ca	1	1.92%
Phylloids	1	1.92%

We compared sensitivity, specificity, diagnostic accuracy, NPV, and PPV for elastography score, strain ratio, ultrasound score, combined elastography score and strain ratio, and combined scores, though scores were good but excellent scores were noted with combination of Ultrasound Score + Elastography Score + Strain Ratio as sensitivity, specificity, diagnostic accuracy, NPV, and PPV of 96.00 %, 96.05 %, 96.03 %, 94.12 % and 97.33 % respectively.

Table 4: Comparison of sensitivity, specificity, diagnostic accuracy, NPV, and PPV for elastography score, strain ratio, ultrasound score, combined elastography score and strain ratio, and combined scores

Parameter	Elastography Score	Strain Ratio	Ultrasound Score	Elastography Score + Strain Ratio	Ultrasound Score + Elastography Score + Strain Ratio
Sensitivity (%)	83.72	86.05	88.64	93.88	96.00
Specificity (%)	92.77	93.98	92.68	94.81	96.05
Positive Predictive Value (%)	85.71	88.10	86.67	92.00	94.12
Negative Predictive Value (%)	91.67	92.86	93.83	96.05	97.33
Accuracy (%)	89.68	91.27	91.27	94.44	96.03

DISCUSSION

Sonoelastography is an advanced sonographic technique being used in the assessment of suspicious breast masses in complement with the conventional B-mode Ultrasonogram. Sonoelastography quantifies elasticity of the tissues by means of pressure exerted on them. In studies by Thomas A *et al.*,[9] and Lee JH *et al.*,[10] the sensitivity of sonoelastography were ranging from 67% to 83% and specificity from 86.7% to 90%. Studies by suggested that addition of elastographic findings to conventional B mode USG can improve the sensitivity and specificity. In study by ElSaid NA*et al.*,[11] on sonoelastogram vs dynamic MR Mammogram on BIRADS III and above categories lesions had sensitivity of 84% for Sonoelastography and 88 % for MR Mammogram. The study had specificity of 84% for Sonoelastography and 80 % for MR Mammogram. Combined use of ultrasound features and elastography parameters (ES and SR) yielded better results than individual parameters in each category in agreement with some of the previous studies.[12,13] In study by Kumar AMS *et al.*,[14] out of 90 patients, 46 lesions were benign and 44 were malignant. The sensitivity, specificity and diagnostic accuracy of B-mode USG was calculated to be 71.74%, 90.91% and 81.11% and that for elastography was 95.65%, 68.18% and 82.22% respectively. They concluded that, elastography may complement conventional B-mode USG to improve the diagnostic performance. Similar findings were noted in present study. Sinha R *et al.*,[15] studied 120 breast lump patients, sensitivity of 97.0% and specificity of 86.7% was observed when a cut off value of 3 was used for elasticity score. A specificity of 95.5% and a sensitivity of 93.3% was observed when a cut off of 3.8 was used for strain ratio (SR). In all cases, the extent of the pathology, the local or contiguous spread and vascular involvement, predicted by ultrasound elastography examination corroborated well with the cytological findings. Jishan.Ahmed[16] studied 106 patients, 74(70.48%) benign and 31(29.52%) malignant lesions were found on HPE. Sensitivity, specificity, positive and negative predictive values of USE and FNAC in diagnosing malignant breast lump were 88%, 98.57%, 95.65%, 95.79% and 89.28%, 100%, 100%, 96.05% respectively. Similar findings were noted in present study. Among diagnostic modalities, ultrasound elastography method is a superior method for the detection of breast cancer. Compared to biopsies, ultrasound elastography had 0.9907 and contrast ultrasound had 0.9 sensitivities.[17,18] Elastography improved the AUC value of breast cancer ultrasound

screening, starting from 0.77 for classical ultrasound and improving to 0.86 when adjusting the classical ultrasonography BIRADS score by upgrading or downgrading based on both qualitative and semiquantitative elastographic results ("BIRADS TM").[19] Quantitative elastography with SR shows increased specificity of USG and enabled early diagnoses of subcentimetre breast cancer and decreased need for biopsies. In clinical setting, strain elastography is useful for deciding whether to follow-up patients with imaging or to intervene.[20,21] Limitations of elastography are, as it is influenced by the extent of tissue compression. Strong pressure can lead to misdiagnosis, hence light pressure should be maintained for tissue diagnosis. Large malignant lesions can cause necrosis, hemorrhage or sarcomatous components which can affect the elasticity score.

CONCLUSION

Ultrasound elastography combined with strain elastography and ultrasound score have high sensitivity, specificity, and diagnostic accuracy in differentiating benign and malignant breast masses.

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