APPLICATION OF SONOELASTOGRAPHY IN REDUCING THE INVASIVE INVESTIGATIONS TO DIAGNOSE BREAST MALIGNANCY

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ABSTRACT

BACKGROUND
Breast cancer is the most common malignant lesions in female population and which is diagnosed reliably with the help of imaging along tissue biopsy. In recent times, sonoelastography can minimize the chance of invasive investigation to diagnose breast cancer.

METHODOLOGY
The study was conducted for the period from August 2015 to December 2015 over 200 patients, of which 50 had got breast lesions. Fifty patients were evaluated by HRUS, Colour Doppler (CD), Sonoelastography (SE) and FNAC. The findings of SE were correlated with FNAC results.

RESULTS
Non-malignant cystic lesions were represented by Blue-Green-Red mosaic pattern on SE. SE score IV and V are indicative of malignancy in almost all the cases. The Sensitivity and Specificity of Sonoelastography of our study in predicting breast malignancy are respectively 87.5% and 92.85%.

CONCLUSION
Elastography could save thousands of women from the waiting, cost, discomfort and anxiety of a Biopsy.

KEYWORDS
High Resolution Ultrasonography (HRUS), Colour Doppler (CD), Sonoelastography (SE), FNAC, Breast Malignancy, Space Occupying Lesions (SOL).

INTRODUCTION
Breast cancer is the most common diagnosed malignancy in women worldwide (22%) and in India it accounts 18.5% of total female malignancy.[1] Increasing trend in incidence is reported from various registries of national cancer registry project and now India is a country with largest estimated number of breast cancer deaths over worldwide.[2,3] The available investigations to characterize the breast lesion into benign and malignant are mammography, Ultrasonography, Colour Doppler flow, USG elastography, FNAC, Core-Biopsy, etc. USG characterization of breast lesions using BIRADS-US criteria to be highly accurate.[4] Although, it may be impossible to distinguish all benign from all malignant solid breast nodules using USG criteria. USG elastography seems to be quite promising.[5] The recent introduction of Sonoelastography (SE) has increased the specificity of USG and enabled earlier diagnosis of breast cancer.[6]

SE detect benign lesion as having similar elasticity to normal tissue of the surroundings, while malignant lesion having more rigid than adjacent tissue.[7] Benign lesions on SE appear similar to the adjacent tissue and have a smaller diameter than on B-mode USG images.[8] Malignant tumors have reduced elasticity and also display larger dimensions on elastography due to accompanying desmoplastic reaction.[9] The purpose of this study was to evaluate the diagnostic utility of SE in differentiating benign from malignant breast lesions in peripheral part of West Bengal.

METHODOLOGY
This was an observational type study designed prospectively, which was conducted in Malda town of West Bengal for the period from August 2015 to December 2015. We have selected only 50 patients by simple random sampling aged above 20 years from the 200 female patients having Breast complaints and those were referred by the clinician for ultrasonographic examination of breast. These 50 patient's breast SOL were studied both radiologically and pathologically after explaining about the purpose of this study and taking consent from each of them. We have studied breast lesions by high frequency linear broad-band transducer (8-12MHz) of standard machine having Colour Doppler (CD) and Sonoelastography (SE) with the same equipment. In Sonoelastogram the radio-frequency impulses coming from the lesion and displays in real time and in colour scale the degree of tissue strain in the region of interest.

SONOELASTOGRAPHIC METHOD

After HRUS detection of the lesion of interest, the patient was examined in supine position and given light constant pressure on a wide area of skin surface by probe minimizing the lateral movement of it. Then sonoelastographic examination was done in real time with the B-mode US image of the lesion on the left side and the same image with colour coded elasticity features superimposed on the right side. The image of SE exam usually obtained by applying a light constant pressure with the probe in contact with the skin perpendicular to the chest wall in a clockwise manner around the nipple areolar complex and medial end of the probe is over the areola. Findings are graded as per UENO score.[10]

All the 50 patients underwent High Resolution Ultrasonography (HRUS), Colour Doppler (CD), Sonoelastography (SE) and FNAC. The findings were tabulated and processed in Microsoft Excel 2013 software and were analysed manually.

RESULTS

In our study, we found 80% of breast lesions are of benign in nature and 20% are of malignant.

Among 50 patients, 7 had shown lesions having well-defined, anechoic cystic lesions without any definite solid component on HRUS, CD. No colour flow or spectral pattern were depicted on SE. They show mosaic Blue-Green-Red pattern. On FNAC, these are all constant with benign cystic lesions having serous fluid.

Another 7 patients having hypoechoic lesions with irregular tracts (finger-like projections) and subcutaneous edema on HRUS shows increased flow with PSV <40cm/s on CD. Sonoelastographic findings (Score II) of these lesions show mixed pattern consistent with benign lesion. They are proved abscess and malignant lesion respectably 6 and 1 in number by FNAC.

About 14 patients show multiple cystic areas interspersed with increased fibrous tissue, which on CD no significant colour flow and they are similar to normal breast tissue on sonoelastography, which having predominant green color (Score I) pattern consistent with benign breast lesions. In FNAC, these lesions are diagnosed as fibroadenosis.

Another 14 patients having well-defined hypoechoic SOLs with posterior enhancement noted on HRUS. CD show minimal colour flow with PSV <40cm/sec. SE findings are Green-Blue mosaic (Score II) and central blue-peripheral green (Score III). On FNAC twelve cases found to be fibroadenoma and another two found to be malignant. Eight patients show irregular hypoechoic lesions on HRUS, on CD 7 patients show PSV >40cm/sec and only 1 patient shows PSV <40cm/sec. On SE these lesion were appeared as mostly blue (Score IV) in central area and one patient shows blue in centre, periphery and in surroundings (Score V). On FNAC out of 7 patients having Score IV, 6 patients were diagnosed as malignant and remaining one was fibro-adenoma. One patient having Score V was proved to be malignant lesion.

USG	No.	Color Doppler	Sonoelastography		FNAC Character
			Character	Frequency	
Cyst	7	No Colour flow	BGR	7	Non-Malignant (Cyst)
Hypoechoic lesion with tracts and overlying Sub-Cutaneous Edema	7	Increased flow & PSV <40cm/sec	Score II (Blue-Green Mosaic)	6	Non-Malignant (Abscess)
			Score III (Central-Blue, Peripheral-Green)	1	Non-Malignant (Abscess)
				1	Malignant Tumor
Solid < Cystic, Areas with Increased Fibrous tissue	14	Absent/ Minimal Flow & PSV <10cm/sec	Score I (Green)	14	Non-Malignant (Fibroadenosis)
Hypoechoic well-defined lesion with or without lobulation & with or without posterior enhancement, Transverse Diameter > AP Diameter	14	Minimal flow & PSV <40cm/sec	Score II (Blue-Green Mosaic)	11	Non-Malignant (Fibroadenoma)
			Score III (Central-Blue, Peripheral- Green)	1	Non-Malignant (Fibroadenoma)
			Score III (Central-Blue, Peripheral-Green)	2	Malignant Tumor
Hypoechoic lesion having ill-defined/ irregular margin with or without posterior attenuation, Transverse Diameter < AP Diameter	8	Increased flow & PSV > 40 cm/sec	Score IV (Lesion-Blue)	6	Malignant Tumor
			Score V (Lesion + Surrounding - Blue)	1	Malignant Tumor
		Increased flow But PSV < 40 cm/sec	Score IV (Lesion-Blue)	1	Non-Malignant (Fibroadenoma)
Table 1: Findings of Breast Lesions by Radiological & Pathological Investigations					

In our study the Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) of Sonoelastography in predicting breast malignancy are respectively 87.5%, 92.85%, 70% and 97.5%.

Screening Test: Sonoelastography	
Validity	Value
Sensitivity	87.5%
Specificity	92.85%
PPV	70%
NPV	97.5%
Table 2: The statistical values of sonoelastography in predicting malignancy among breast lesions in our study	

DISCUSSION

We found 20% malignant lesions, which is quite high from other standard report from West Bengal because our study population was taken from a part of remote area of West Bengal, which differ from the previous study.[11]

Study reveals Blue-Green-Red mosaic pattern on sonoelastography indicate non-malignant cystic lesions.

As per our study SE Score IV, V almost always but not exclusively indicate underlying malignant lesion. Gheonea IA et al. also found the same findings in their study. "Differential diagnosis of breast lesions using ultrasound elastography."[12]

The Sensitivity and Specificity data in our study are very similar to a study by Aly AM, et al. in detecting breast malignancy.[13] The PPV in this study is 70%, but in other research articles it is around 90%.[14,15] The NPV of SE in our study is comparatively similar to many other papers on SE.[14,15] On the other hand SE is of limited usefulness in very dense fibrous parenchyma, breast hematoma and breast implants. Some studies have also demolished the value of elastography in the benign and malignant differentiation of lymph nodes.

CONCLUSION

In conclusion, breast SE is a very simple and rapid method that can improve the sensitivity and specificity of USG. USG combined with SE is a rapid technique with the lowest cost-efficiency ratio. It is the most non-invasive and accessible imaging method with high accuracy. Elastography could save thousands of women from the waiting, cost, discomfort and anxiety of a Biopsy and it is quite appropriate for the remote areas where other facilities are sometimes unavailable.

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