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The added value of E-Breast™ ultrasound elastography for differentiating between benign and malignant lesions

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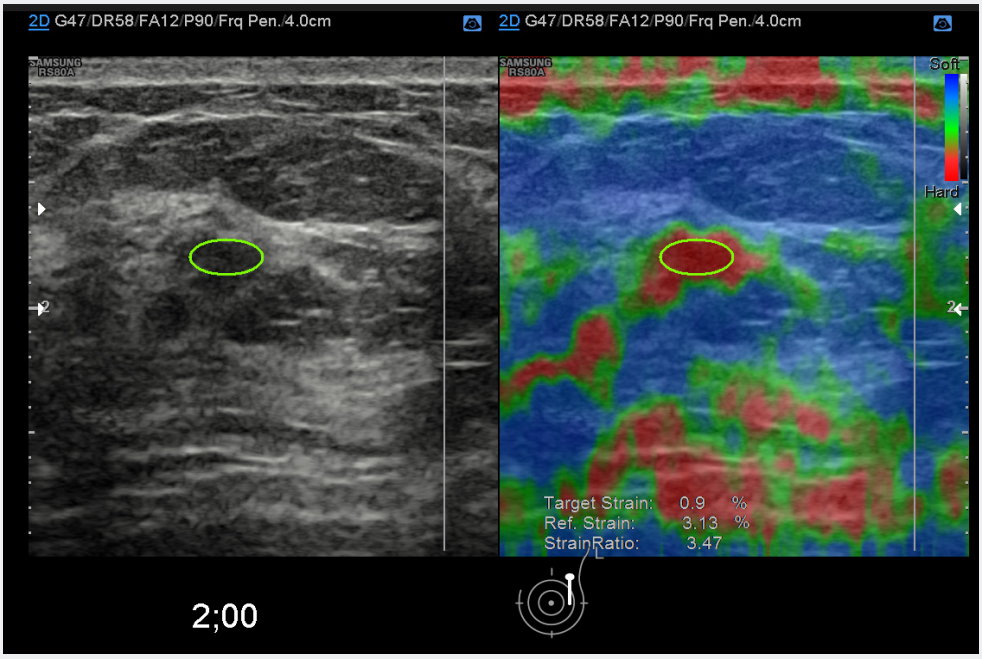

"E-Breast™ (Elastoscan™ for Breast) is a semi-quantification technique for breast elastography that calculates the mean strain ratio with only one drawing of ROI for the target lesion and improves diagnostic performance."

Introduction

Ultrasound elastography is a complementary imaging technique for characterization of breast lesions. Strain elastography is a qualitative method and involves application of a compressive force by a conventional transducer to the breast tissue and measuring the lesion stiffness compared to that of surrounding tissues.[1] Although the absolute stiffness of the tissue is not known, the image demonstrates the relative stiffness of the tissues. This relative stiffness can be expressed as a color scale. According to the 5-point color scale by Tsukuba, loss of strain, observed as blue color throughout the entire lesion or even in the surrounding area, indicates a high probability of cancer.[2]

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However, the accuracy of the results using the five-point elasticity score might be affected by subjective factors such as operator experience or inter-observer variability.[3] Accessing lesion-to-normal tissue strain ratio would provide a more objective way to differentiate benign from malignant breast lesions than a five-point scoring system. However, there is still subjective factor in selecting the normal reference tissue and drawing a region of interest (ROI) area.

Recently developed E-Breast™ (Elastoscan™ for Breast) is a semi-quantification technique for breast elastography. This automatically calculates the mean strain ratio with only one drawing of ROI for the target lesion. Reference strain from fat is automatically calculated without selection of ROI. This may help improving the process of getting strain ratio and decreasing subjective factor. In this study, we investigate the added value of breast ultrasound elastography using E-Breast™ combined with conventional sonography for differentiating between benign and malignant breast lesions.

Material and Method

In our prospective study, 135 non-palpable breast lesions (92 benign and 43 malignant) from 115 women (mean age, 52.9 years; range, 23-77 years) were evaluated by conventional sonography as well as E-Breast™. Both 5 point color scale and lesion-to-fat strain ratio were evaluated. A radiologist with 9 years of experience independently reviewed the obtained images. At first, each lesion captured by 2D sonography with video was scored on a cancer probability scale of 0% to 100% and was evaluated on BI-RADS at the same time. They were rescored on the same cancer probability scale and re-evaluated on BI-RADS after addition of color scale strain images. The diagnostic performance was compared using the area under the receiver operating characteristic (ROC) curve for each result and strain ratio. The cut off value of each strain ratio was determined.

Results

The diagnostic performance was significantly higher when using conventional sonography images plus color scale images of elastography or lesion-to-fat strain ratio than when using conventional images alone (Table 1, Figure 1).

Variable	AUC**	95% CI b
2D alone	0.720	0.636 to 0.794
2D+ elastography visual assessment	0.819	0.743 to 0.880
Strain ratio	0.818	0.743 to 0.879

Table 1. Diagnostic Performance of 2D breast US and different elasticity parameters

**AUC: Area under the Curve

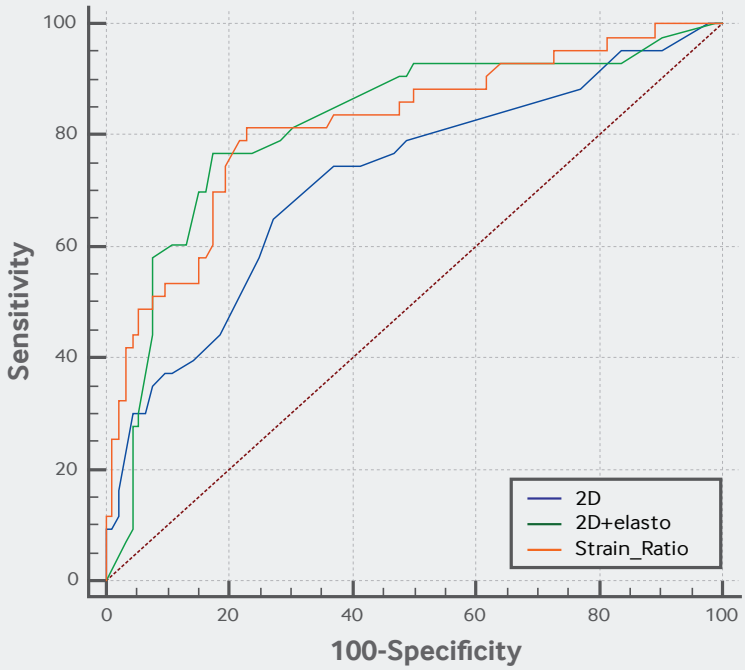


Figure 1. Receiver operating characteristic curves for the 2D breast US and different elasticity parameters.

The mean strain ratio for malignant masses (4.09±1.54:mean±standard deviation, 95% CI 3.62 to 4.57) was significantly higher than benign masses (2.41±1.03:mean±standard deviation, 95% CI 2.19 to 2.62)(p=0.002) (Figure 1, 2). The cut-off values of lesion-to-fat strain ratios were > 2.93 with 81.4% sensitivity and 77.2% specificity.

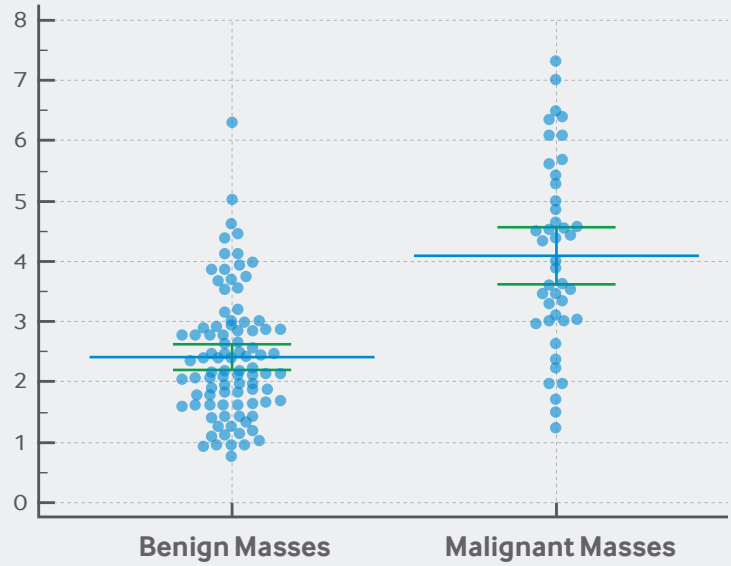
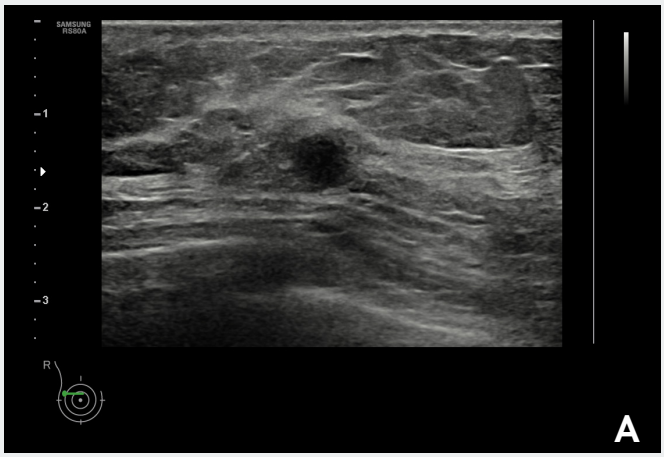


Figure 2. Graphs show the significant difference in the strain ratio values between malignant and benign breast masses.

Discussion

In this study the differentiation of benign and malignant masses by using E-Breast™ improved both elasticity parameters: visual scoring and strain ratio. Also the diagnostic performance was similar in both elasticity parameters. Therefore, assessing the strain ratio using E-Breast™ would provide a more objective way to differentiate benign from malignant breast masses.



Ultrasound shows an indistinct irregular isoechoic mass in the 10 o'clock area in right breast which categorized as C4a-low suspicion of malignancy (A).

At elastography the mass presents a color map score of 5 according to the Tsukuba score (B). Strain ratio was 4.57 (C).
US core biopsy confirmed as an invasive ductal carcinoma.

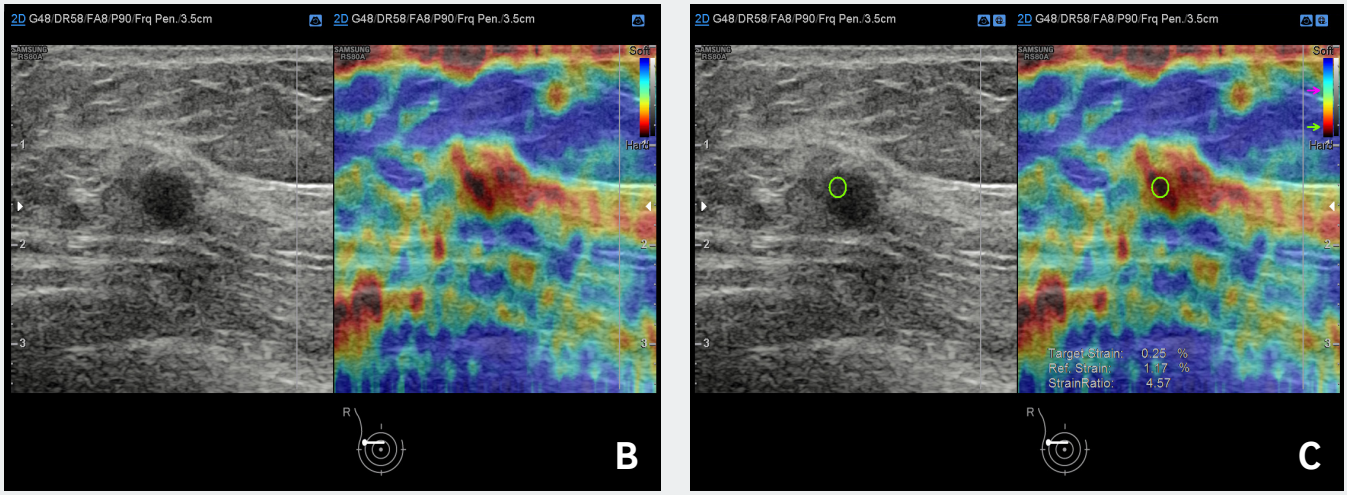


Figure 3. A 71-year-old woman with screening mammographic abnormity detected on her right breast.

Conlcusion

The addition of either color visual assessment or strain ratios of elastography using E-Breast™ to conventional sonography may improve diagnostic performance.

Supported Systems

- RS80A with Prestige
- RS80A
- WS80A with Elite
- WS80A
- HS70A

References

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