Characterization of breast tumors with functional imaging: Evaluation with real-time ultrasound elastography and diffusion-weighted MR imaging with apparent diffusion coefficient (ADC) value analysis

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Purpose

To evaluate the diagnostic values of real-time ultrasound elastography and diffusion-weighted MR imaging with apparent diffusion coefficient (ADC) value analysis as a noninvasive, functional imaging techniques in the characterization of benign and malignant breast tumors.

Methods and Materials

A total of 56 patients (mean age: 50.8 years, age range: 31-77 years) with breast tumors who underwent both breast MR imaging including diffusion weighted imaging (DWI) and real-time ultrasound elastography of the breast were included. All lesions were confirmed from the surgically excised specimens or core needle biopsy. Thirty three lesions were malignant while 23 were benign. DWI was performed with a single-shot SE EPI sequence using b-value of 0,800sec/mm2, and then, the computed mean ADC values of the breast lesions were measured. Real-time ultrasound elastography was performed to estimate a hardness ratio of the breast lesion to the subcutaneous fatty tissue (fat-lesion ratio; FLR). ADC values in DWI and FLR in ultrasound elastography was evaluated for the diagnostic utility in the characterization of benign and malignant breast tumors.

Results

The ADC values of malignant breast lesions (1.07 ± 0.16 x 10-3mm2/sec) were significantly lower ($p<0.0001$) than those of benign lesions (1.52 ± 0.16 x 10-3mm2/sec). FLR of malignant lesions (11.1+-10.8) in ultrasound elastography was significantly higher ($p<0.0001$) than those of benign lesions (2.6+-0.74). In the ROC analysis, there was no statistically significant difference between DWI and ultrasound elastography in the ability for characterizing benign and malignant breast lesions. When a cutoff level of the ADC value was set at 1.29 X 10-3mm2/sec, the sensitivity and specificity for the correct differentiation were 96.9% and 100% respectively. When a cutoff level of FLR was set at 3.9, the sensitivity and specificity were 93.9% and 95.6% respectively.

CONCLUSION

Both DWI and real-time ultrasound elastography are useful, noninvasive modality for the differentiation of benign and malignant breast lesions.