

Abstract

Purpose: To evaluate the potential of quantitative breast diffusion MRI as a biomarker of low grade ductal carcinoma *in situ* (DCIS).

Materials and Methods: This retrospective study was approved by an Institutional Review Board, with waiver of informed consent. Twenty-two female patients (36-75 years, mean 56.4 years) with pure DCIS (7 low-grade; 5 intermediate-grade; 7 high-grade), and 3 with microinvasion underwent breast MRI examinations at 1.5T between January 2008 and November 2010. MRI scans included contrast-enhanced (Gadoteridol) T1-weighted and diffusion-weighted images (DWI) with b values of 0 and 1000 sec/mm². Apparent Diffusion Coefficient (ADC) maps were calculated. The distributions of the ADC values in regions of interest (ROI) covering the lesions were compared among the three grades using a linear mixed-model analysis and the discriminatory power of the lesion minimum ADC value was determined with a Receiver Operating Characteristic (ROC) analysis.

Results: The mean ADC values (95% confidence intervals) were 1.42 (1.31-1.54)×10⁻³ mm²/sec, 1.23 (1.10-1.36)×10⁻³mm²/sec, 1.19 (1.08-1.30)×10⁻³ mm²/sec, and 2.06 (1.94-2.18)×10⁻³ mm²/sec, for low-, intermediate-, high-grade DCIS and normal breast tissues, respectively. The mean ADC value of high-grade and intermediate-grade DCIS were significantly lower than that of low-grade DCIS ($p < 0.01$ and $= 0.03$, respectively), and the low-grade DCIS ADC value was significantly lower than in normal tissue ($p < 0.001$). The lesion minimum ADC value of low-grade DCIS was also significantly higher than that of high-grade and intermediate-grade DCIS ($p < 0.01$). A threshold of 1.30×10⁻³ mm²/sec for the minimum ADC for the diagnosis of low-grade DCIS had 100% (12/12) (confidence interval: 73.5-100) specificity, 100% (4/4) (confidence interval: 39.8-100) positive predictive value.

Conclusion: These preliminary results suggest that quantitative DWI could be used to identify patients with low-grade DCIS with very high specificity. If confirmed, this approach could potentially spare those patients from invasive approaches, such as mastectomy or axillary lymph node excision.

Keywords: DCIS, Diffusion-Weighted MRI, ADC, breast MRI, breast cancer