The optimized b value of Breast Diffusion Weighted MRI

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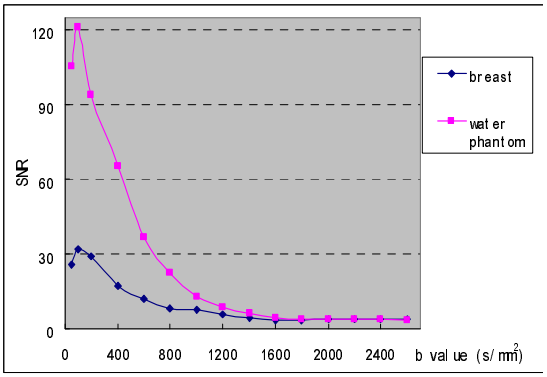
Purpose: To optimize the b value of breast Diffusion-weighted MRI at 1.5 T by comparing ADC value of benign and malignant tumors and disease-free contralateral breast tissue using different b value DWI in the same patient.

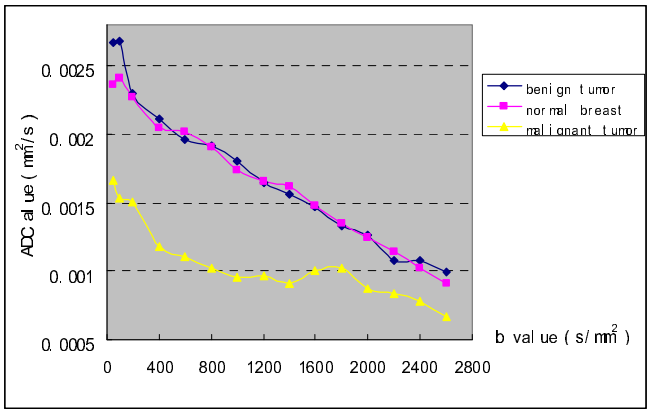
Materials and Methods: 32 women with confirmed malignant (18) and benign (14) tumors were examined using EPI-DWI with different b values at 1.5T MR scanner. DW images were acquired in the transverse plane covering both breasts, b= 0,50, 100, 200, 400, 600,800, 1000,1200, 1400,1600, 1800, 2000, 2200, 2400, 2600 s/mm^2;TR/TE=8400ms/73ms; FOV=30~35cm; matrix=128×128; slice thickness=4mm.The mean ADC values of malignant and benign tumors and the disease-free contralateral breast tissues were calculated from the ADC map for each patient. SNR was calculated on DW images with different b value on each patient and phantom. One-way analysis of variance was applied to compare the mean ADC of malignant tumors with benign tumors and disease-free contralateral breast tissues. For calibration of the sequence, DWI was also performed on phantoms (containing water and acetone) and pure water at 25℃.

Results: The ADC value of phantom and pure water stayed invariable when b value was in the range of 400~1400 s/mm^2, while the ADC of breast tissue dropped gradually as b value increased in the effect of perfusion in breast tissue. When b value <400 s/mm^2, ADC value changed with b value rapidly. When b value was in the range of 600 ~ 1200 s/mm^2, the ADC of malignant tumors stayed relatively invariable and was statistically different with benign tumor and normal breast tissue. When b value >1400 s/mm^2, the difference of ADC between benign and malignant tumor became smaller. At the same time, the SNR dropped markedly which responsible for the poor image quality.

Conclusion: For good image quality and valid differentiation between malignant and benign tumor, the optimized b value of DWI is in the range of 600~1200 s/mm^2 at 1.5T.



When b value >1400 s/mm^2, the SNR dropped markedly which responsible for the poor image quality.



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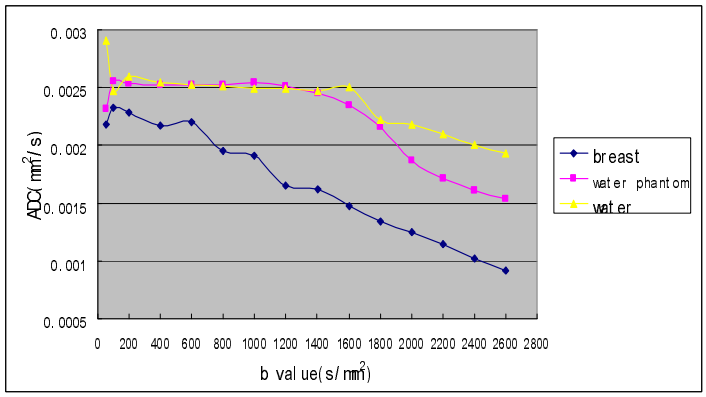

The ADC value of phantom and pure water stayed invariable when b value was in the range of 400~1400 s/mm^2 , while the ADC of breast tissue dropped gradually as b value increased in the effect of perfusion in breast tissue.

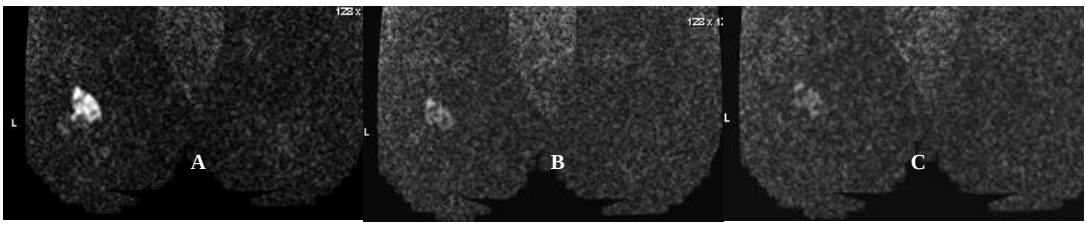

Figure: DWI of the same patient with malignant tumor and the b value is 600 s/mm^2 (A), 1400 s/mm^2 (B) and 2000 s/mm^2 (C) respectively.