The effect of different b-values on the apparent diffusion coefficient in prostate cancerous and non-cancerous regions

F. Li[1], X. Wang[1], Y. Xu[1], J. Xiao[1], X. Jiang[1]

[1]Radiology department, Peking university first hospital, Beijing, Beijing, China, People's Republic of

PURPOSE: To investigate the changes of ADC with different b-values in cancerous and non-cancerous regions of prostate peripheral zone, and to determine if different b-values have a significant effect on the ADC difference between the two tissues.

METHODS AND MATERIALS: Twenty-six patients (mean age 69.3±8.1 years, range 54-85 years) with biopsy-proved prostate peripheral cancer were retrospectively evaluated in this study. The prostate peripheral zone was divided into 6 regions (left/right bottom, middle and tip). According to the pathological results obtained by ultrasound guided systemic biopsy, the locations of the prostate cancerous region were marked as one or more of the sextants. All patients were examined by single-shot diffusion-weighted echo-planar imaging (TR 3000 ms, TE 50 ms, field of view 24×24 cm, matrix size 96×96, section thickness 6 mm, no intersection gap, b-values=0, 300, 500, and 800 s/mm^2) at 1.5-T system (Twinspeed, GE Medical Systems). ADC maps were generated using the system software. ROIs of non-cancerous and cancerous regions in peripheral zone contained about forty pixels. The ADC values of cancerous and non-cancerous regions were measured and the difference of ADC between cancerous and non-cancerous regions (DADC) in each patient was calculated.

RESULTS: When b-values were defined as 300, 500 and 800 s/mm^2, the mean ADC values of all patients in non-cancerous regions (n=94) were 2.65±0.39×10^{-3} mm^2/s (mean ± SD), 2.37±0.39×10^{-3} mm^2/s and 2.22±0.30×10^{-3} mm^2/s, respectively, while they were 1.60±0.24×10^{-3} mm^2/s, 1.37±0.24×10^{-3} mm^2/s and 1.26±0.20×10^{-3} mm^2/s in cancerous regions (n=62). Statistically significant difference was detected among different b-value groups in both non-cancerous (F=14.836，P<0.01, one-way ANOVA) and cancerous (F=12.473，P<0.01, one-way ANOVA) regions (Fig 1). The DADC were 1.03±0.44×10^{-3} mm^2/s, 0.98±0.43×10^{-3} mm^2/s and 0.97±0.36×10^{-3} mm^2/s when b-values of 300, 500, 800 s/mm^2 were used. But no statistically significant difference were detected among different b-values (λ^2=3.308，P=0.191>0.05, Friedman Test) (Fig 2).

CONCLUSIONS: The ADC values are different when b-values changed in both prostate non-cancerous and cancerous regions, which show a negative correlation. But the difference of ADC between the non-cancerous and cancerous tissues seems to be stable in spite of the change of b-value (range 300-800 s/mm^2).

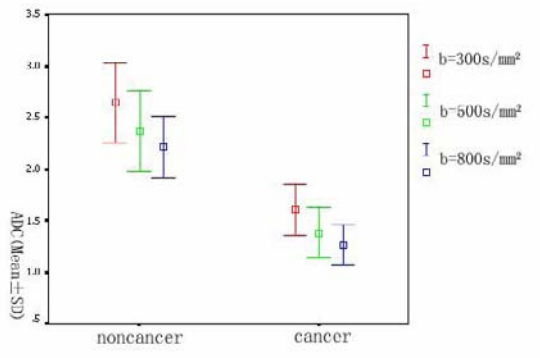

Fig 1: Comparison of ADC values in non-cancerous and cancerous regions when b-values were 300, 500, 800 s/mm^2.

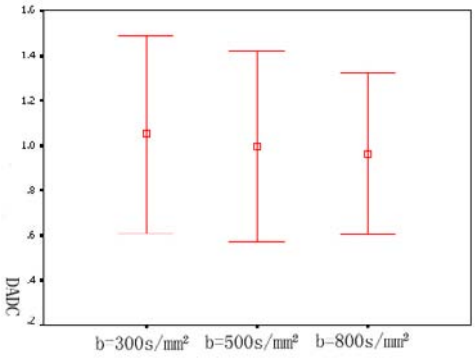

Fig 2: Comparison of DADC when b-values were 300, 500, 800 s/mm^2.

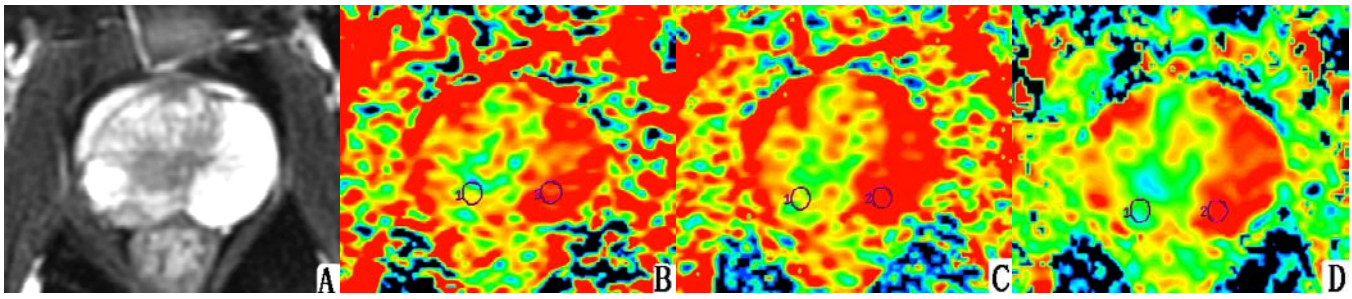

Fig 3 (A) T2 weighted image: low T2 signal was detected in the right lobe of peripheral zone, which was proved Pca pathologically. No Pca tissue was found in the left lobe; (B) ADC map (b =300 s/mm^2): ADC values in the ROIs that sampled cancerous and non-cancerous regions were 1.57×10^{-3} mm^2/s and 2.63×10^{-3} mm^2/s; (C) ADC map (b =500 s/mm^2): ADC values were 1.41×10^{-3} mm^2/s and 2.39×10^{-3} mm^2/s; (D) ADC map (b =800 s/mm^2): ADC values were 1.20×10^{-3} mm^2/s and 2.16×10^{-3} mm^2/s. The DADC were 1.05×10^{-3} mm^2/s, 0.99×10^{-3} mm^2/s and 0.96×10^{-3} mm^2/s, respectively.