# Differentiation between malignant and benign prostatic diseases: evaluated by MR diffusion tensor imaging at 3.0T

S. Li[1], C. Li[1], M. Chen[1], X. Zhao[2], and C. Zhou[1]
[1]Radiology, Beijing Hospital, Beijing, China, People's Republic of, [2]Philips Medical System, China, China, People's Republic of

*Purpose:* To investigate the characteristcs of diffusion tensor imaging (DTI) at 3.0T in differentiating prostate cancer and benign prostatic diseases, and to determine the apparent diffusion coefficient (ADC) and normative fractional anisotropy (FA )values of normal prostate tissue.

*Introduction*

The feasibility of diffusion tensor imaging of prostate has been confirmed by several studies. However, ADC and FA values of prostate with healthy or pathologic changes which may reflect the different microstructural organization of the gland **r**emains controversial. The diagnostic value of DTI in assessing prostate diseases at 3.0T need to be eluciated.

*Methods*

Thirty patients with 18 foci of prostate cancer and 20 foci of prostatitis and /or BPH in the peripheral zone of prostate confirmed by biopsies underwent MR examinations with a Philips 3.0 Tesla MR Achieva scanner using an eight-channel phased array coil. DTI with single-shot echo-planar imaging (ssEPI) was performed in the 30 patients. The DTI data of twenty healthy young volunteers (30±4.3ys) were also aquired in the study. ADC and FA values of the foci were measured using the software supplied by the manufacturer. The two values of the central galnd and peripheral zone in the healthy prostate were compared and analyzed. Analysis of variance (ANOVA) and ROC curve analysis were used to compare and determine the ability of ADC and FA values derived from DTI in differentiatinge prostate cancer from benign prostatic diseases.

*Results and discussion*

Decreased mean ADC value ($1.181\pm0.048\times10^{-3}mm^2/s$) and increased mean FA value ($0.368\pm0.046$) were found in the central gland , compared with the two values in the peripheral zone of the prostate ($1.696\pm0.104\times10^{-3}mm^2/s$, $0.196\pm0.065$, respectively) (P=0.027, P = 0.043, respectively). The ADC and FA maps for prostate cancer and prostatic benign diseases were observed in Fig 1. The mean values of ADC and FA with prostate cancer, benign diseases and normal peripheral zone of the prostate were shown in Table 1. The differences among the three groups were significant. Furtermore, ROC curve analysis shows that the areas under the ROC curves of ADC and FA were 0.866 and 0.722, respectively. The sensitivity and specificity of ADC and FA values for differentiation between prostate cancer and benign prostatic diseases were 94.4%, 81.1% and 70.3%, 66.7% respectively at the cutoff point of $1.079\times10^{-3}mm^2/s$ for ADC and 0.304 for FA value.

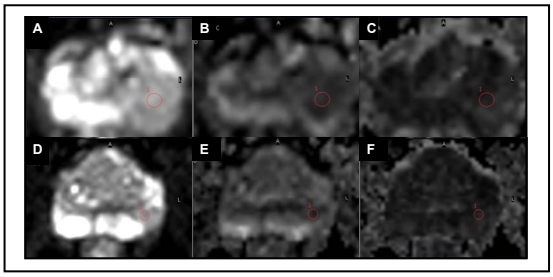


**Fig 1**, b=0 (A, D), ADC b=700 (B, E), and FA map (C, F) aquired by DTI.
A-C prostate cancer, D-F prostatitis/BPH confirmed by biopsies.

Table 1. ADC and FA values of prostate

| | ADC（$\times10^{-3}mm^2/s$） | FA |
|---|---|---|
| Pca | 0.887±0.214 | 0.343±0.070 |
| Benign diseases | 1.212±0.126 | 0.297±0.061 |
| Normal prostate | 1.696±0.105 | 0.197±0.065 |

The apparent diffiusion coefficient(ADC) and diffusion anisotropy of water provided by diffusion tensor imaging (DTI) demonstrate tissue microstructure at the level of micron which may reflect physilogical features and pathologic changes (1). Recently, several studies have addressed the feasibility of DTI to assess prostate tissue (2-5). However, ADC and FA values of prostate with healthy or pathologic changes remains controversial.Our preliminary results shows that lower ADC appear in the healthy central gland compared with the value in the peripheral zone. This result was concordance with the reports in the previous literature (2-4), which may attribute to the fact that higher diffusion values may appear in the peripheral zone with more glandular tissue. We also observe mean FA of the central gland was siginificantly higher, compared with the peripheral zone, which may be largely due to greater structrural organization of the central gland, the result was in agreement with the previous report (2). However, similar or slightly higher FA values in peripheral zone compared with the central gland were obtained by at least two of the previous studies(3, 4). This difference might be explained by that the values from different ROIs with different complex tissue ( glandual or stromal) positioning on central gland varied in the individual study. Moreover, while we agree with the previous reports of that reduced ADC appear to be indicative of cancer (3, 5), our preliminary results demonstrate significantly higer FA values in the the region of cancer than in BPH and/or prostatitis (p=0.019) and normal tissue (p=0.00) of the peripheral zone, which was concordance with the previous studies(5), but opposed to the results in Manenti's study(3). Manenti reported that the mean FA values in the neopastic lesion were significanly lower than in the normal peripheral zone of the prostate. This dicrepancy in the FA values might correlate with different grades of malignant changes and increased cellularity of areas with cancerous tissue. Furthermore, in our study, the ability of ADC and FA values in differentiating prostate cancer from benign prostatic diseases by means of ROC curve analysis was promising, however, further investigations with more samples are encouraged.

*Conclusion*

The ADC and normative FA values of central gland and peripheral zone of the normal prostate at 3.0T may be compatible with the microstructural organization of the gland. Furthermore, DTI may be a potential tool in defferentiating prostate cancer and benign prostatic diseases.

*References*

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