VALUE OF DTI AND DTT MAP TO DIFFERENTIATE PROSTATE CANCER IN CENTRAL GLAND FROM BENIGN PROSTATE HYPERPLASIA

Tao GONG[1], bin wang[2], guangbin WANG[3], and shuhui YUAN[4]

[1]*Shandong Medical Imaging Research Institute, Shandong University, Shandong, Jinan, China,* [2]*binzhou medical university, Shandong, yantai, China,* [3]*Shandong Medical Imaging Research Institute, Shandong University, jinan, China,* [4]*binzhou medical university, yantai, China*

Target audience： radiologist；urologist

Objectives to evaluate the ability of diffusion tensor imaging (DTI) related parameters of apparent diffusion coefficient (ADC) value, anisotropy (FA) value and diffusion n tensor tractography (DTT) map to different the central prostate cancer(PCa) from benign prostate hyperplasia (BPH).

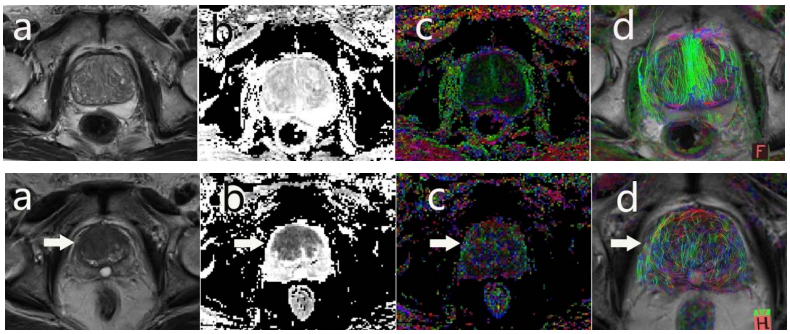
Methods The study was approved by local ethics committee and all patients gave an informed consent. Between February 2013 and February 2014, 46 consecutive patients underwent 3T prostate routine MRI and DTI, 16 cases of CG PCa and 30 BPH proven by Histopathologically. ROIs were defined on DTI fuses with FS-T2WI images by two observers in consensus. ADC value and FA value of CG PCa and BPH acquired. For DTT maps, two observers record the score using a four-point scale and compare the differences between two groups of lesions about fibers continuity and density. Each observer recorded the score using a four-point scale: 1 points, the fibers run orderly, continuously and arrange closely; 2 points, the fibers was less orderly and continuous than points 1; 3 points, the fibers was disorder and poor continuity; 4 points, the fibers was very disorderly, discontinuous(Figure 1-2).

Results ADC value of CG cancer found to be significantly lower compared with BPH ($p < 0.05$), While FA value of the two groups has not statistically significant differences ($p > 0.05$) (Figure 3, Table1). Interobserver agreement on the scale was good ($k = 0.723$) (Table2). The DTT map score between the two groups of two viewers was all statistically significant differences ($p < 0.05$). The ADC value and DTT map score revealed AUCs of 0.855 and 0.839 respectively, for the differentiation of CG cancer from BPH (Figure 4).

Discussions Our results show that DTI related ADC value of CG carcinoma decreases markedly compared with hyperplasia foci, which makes ADC value differentiate CG cancer from BPH significantly. Although FA value alone could not effectively distinguish CG cancer with BPH, the DTT map present differences between them. Combining the DTT map with ADC value shows the possibility of improving this differentiation compared with ADC value alone.

DTT imaging is currently the only method display the fibers bundle in living tissue. A few investigations have assessed tractorgraphy using DTI date of prostate, and they all relate to the peripheral of prostate or nerve fibers around prostate [1-3]. In CG cancer, the carcinoma will push the fibers bundle and show the arrangement of the bundle disorderly, and destruct fibers bundle because of aggressiveness of tumors and performance interruption of fibers bundle on DTT map. In BPH, the hyperplasia especially fibrous tissue hyperplasia, Fibers bundles on DTT map are arranged in dense, even though some of them show transposes disorderly because of hyperplastic nodule will also push fibers, when the patient with the heavier prostatitis, severe interruption phenomena of fibers bundle would also be seen in them. So the sensitivity of DTT map score (consider>2 as CG cancer) to differentiate CG cancer from BPH was 93.7%, while the specificity was only 56.7%.

Conclusions ADC value of CG cancer decreases commonly, with significantly differences with that of BPH, which makes ADC value significantly to differentiate CG cancer from BPH, while the FA value was not. DTT map can describe prostate more visual, providing a certain value of distinguishing CG cancer from BPH.



References

[1] Li C, Chen M, Li S, et al. Detection of prostate cancer in peripheral zone: comparison of MR diffusion tensor imaging, quantitative dynamic contrast-enhanced MRI, and the two techniques combined at 3.0 T. Acta Radiol. 2014 Mar; 55(2):239-47

[2] Panebianco V, Barchetti F, Sciarra A, et al. In vivo 3D neuroanatomical evaluation of periprostatic nerve plexus with 3T-MR Diffusion Tensor Imaging. Eur J Radiol. 2013 Oct; 82(10):1677-82

[3] Finley DS, Ellingson BM, Natarajan S, et al. Diffusion tensor magnetic resonance tractography of the prostate: feasibility for mapping periprostatic fibers. Urology. 2012 Jul; 80(1):219-23

Fig.1 A 70 years old patient with BPH, PSA:5.46 ng/ ml. **a.** Axial FS-T2 weighted MRI . **b.** ADC map. **c.** FA map. **d.** DTT map. The FS-T2 weighted MRI and ADC map showed multiple hypointense lesions in CG zone. DTT map demonstrated that fibers run orderly, continuously and arrange closely (rated 1 on four-point scale)

Fig.2 A 71 years old patient with biopsy-confirmed prostate cancer, a PSA level of 11.78 ng/mL. The FS-T2 weighted MRI and ADC map showed multiple apparent hypo-intense lesions in CG zone. DTT map demonstrated that fibers the fibers was disorder and poor continuity. (rated 3 on four-point scale)

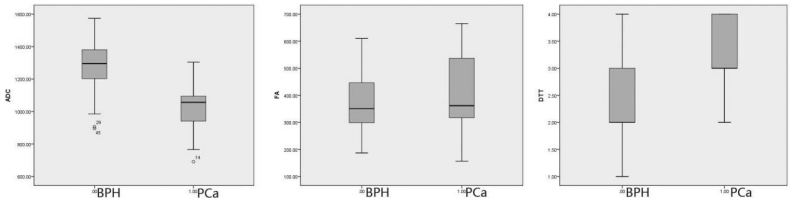


Fig.3 The box charts of ADC value (left), FA value (middle), and DTT map score (right), comparing BPH with PCa. The ADC value of BPH was significantly higher than that of PCa, and DTT map score was lower, while there were no significant differences between the FA value for BPH and PCa.

Fig.4 ROC curves of ADC, FA value, and DTT map score (viewer 1) in discrimination of CG cancer and BPH. ADC value and DTT map score revealed a high AUCs in differentiating CG cancer from BPH, ADC ROC area:0.855; DTT map score ROC area:0.839. And the AUC of FA value was only 0.579.

Table1 the ADC and FA value of CG cancer and BPH

Group	Number	ADC value （$\times 10^{-6}$ mm^2/s）	FA value （$\times 10^{-3}$）
CG cancer	16	1032±164	404±153
CG BPH	30	1275±171	362±114

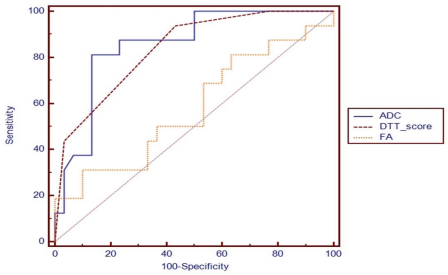


Table 2 the DTT map score of CG cancer and BPH

Group	Number	DTT map score (viewer 1)	DTT map score(viewer 2)
CG cancer	16	3.3±0.6	3.5±1.0
CG BPH	30	2.2±0.9	2.1±0.8