Diffusion and Perfusion Coefficients Changes of Prostate Cancer after Endocrine Therapy: Using DWI Biexponential Model

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Target Audience Radiologists, MR technologists and clinicians

Purpose Some previous studies[1,2] shown that the diffusion and perfusion coefficients derived from the non-invasive intravoxel incoherent motion (IVIM) MRI had good diagnostic performance in the detection of prostate cancer. Therefore the purpose of this study was to assess the diffusion and perfusion coefficients changes of prostate cancer (PCa) and noncancerous areas after endocrine therapy using DWI biexponential model for IVIM analysis.

Methods The local ethics committee approved the study. Group A (12 patients with PCa after endocrine therapy) and Group B (12 patients with PCa prior to any treatment) were recruited into the study. The clinical information (stage, Gleason score and age) were comparable between the two groups. The median duration of hormonal therapy was 4.5 months (range 3~6 months). There was no patient with biomedical or imaging recurrent in the Group A. The study was performed on a 3.0-T MRI scanner (Achieva 3.0T TX, Philips Healthcare, Best, The Netherlands) with 32-channel SENSE cardiac coil. The IVIM protocol was performed with a single-shot spin-echo echo-planar imaging sequence (5 b-values 0, 188, 375, 563, 750 s/mm2; TR/TE 4114/75ms; FOV AP/RL/FH 160/180/66 mm; slices 22). Data were fitted with IVIM biexponential model using in-house software developed using IDL (Research Systems, Inc., USA) to obtain the diffusion coefficients (D) and perfusion fractions (f). The regions of interest (ROIs) were placed in the PCa and noncancerous areas both in the two groups. The average D and f for each region were computed respectively and compared（independent T-test）between the two groups.

Results Both mean D and f values of cancerous and noncancerous foci in the endocrine treatment group both showed statistical difference from those in the non-treatment group (All $P<0.01$). (Table 1, Figure 1).

Discussion The changes of the D and f were in accordance with the pathological and physiological degeneration of cells and vessels after endocrine therapy in the histopathologic study[3]. The difference of D and f between the Group A and Group B (both PCa and non PCa).

Conclusion The DWI biexponential model allows non-invasive characterization of biological changes (both diffusion and perfusion fraction) of prostate cancer after endocrine therapy, and it may be a promising technique in the evaluation of therapeutic effect and risk for recurrence.

Group	A (Endocrine Therapy) mean±SD		B (Non Therapy) mean±SD		t P	
	D($\times10^{-3}$mm^2/s)	f(%)	D($\times10^{-3}$mm^2/s)	f(%)	D (t,P)	f (t,P)
Cancerous	1.15±0.07	0.2±0.1	0.76±0.07	16.0±5.5	t=14.526 P<0.01	t=10.427 P<0.01
Non-cancerous	1.23±0.08	0.3±0.1	1.82±0.24	3.6±0.5	t=6.986 P<0.01	t=13.361 P<0.01

Table 1.and Figure 1: Comparison of D and f in the prostate cancerous and non-cancerous areas between the
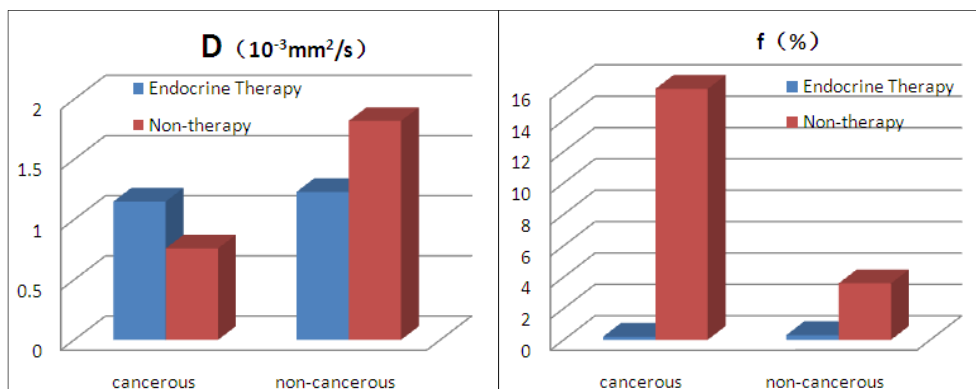
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