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Rotating frame RAFF and T1rho imaging of prostate cancer: feasibility study

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Purpose/Introduction

To investigate the feasibility of Rotating Frame Relaxation along Fictitious Field (RAFF) (1) and continuous wave T_{1ρ} imaging of prostate cancer (PCa).

Subjects and Methods

Nineteen patients (mean age 55 ± 5, mean PSA 12 ± 8 ng/ml) with histologically confirmed PCa underwent 3T MRI (Philips, Ingenuity PET/MR) using 32 channel surface array coil and 2 channel volume whole body RF coil for RF transmission. Relaxation times T_{RAFF} and T_{1ρ} were measured using 3D T₁FFE sequence (TR/TE 3.2/1.5ms; FOV: 375x375; matrix size 150 x150) with centric coding and 500 Hz RF peak amplitude. The pulse train duration for RAFF was 0, 45, and 90 ms while 0, 20 ms, and 80 ms was applied for continuous wave T_{1ρ}. In order to measure B₁ variation across prostate, B₁ mapping was performed using the AFI method (2). The areas of PCa, normal peripheral zone (PZ) and normal central zone (CZ) were identified using results of 12-core systematic TRUS-guided biopsy and findings of anatomical MRI. T_{RAFF} and T_{1ρ} were calculated by fitting mono-exponential function to RAFF and T_{1ρ} weighted data. T_{RAFF} and T_{1ρ} values were compared using ANOVA with Bonferroni multiple comparisons test.

Results

Both T_{RAFF} and T_{1ρ} mappings were successful in all 19 patients with reasonably homogenous B₁ field across prostate. Mean T_{RAFF} value of PCa was 128±16 ms and differed significantly (p<0.01) from similar value of normal PZ (176±34 ms) while mean T_{RAFF} value of normal CZ (140±16 ms) differed significantly only from the mean T_{RAFF} value of normal PZ. Significant difference between mean T_{1ρ} values of PCa and normal PZ was present while the difference between PCa and normal CZ did not reach statistical significance. Mean T_{1ρ} values of PCa, normal PZ and normal CZ were 75 ± 11 ms, 101± 22 ms and 84 ± 11 ms, respectively.

Discussion/Conclusion

Rotating frame imaging (RAFF, and T_{1ρ}) of PCa was feasible using clinical 3T MRI scanner. Both T_{RAFF} and T_{1ρ} of PCa differed significantly from similar value of normal PZ. RAFF method demonstrated improved image quality compared to block pulse which together with smaller specific absorption rate (39%) compared to continuous wave pulse makes RAFF an attractive method for PCa imaging and perhaps for other body applications as well. Further studies are needed to establish the role of rotating frame imaging as a part of multiparametric prostate MRI.

References

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2. Yarnykh VL. Magn Reson Med 2007; 57:192-200.

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