

# EFFECT OF FIELD STRENGTH AND PERIPHERAL ZONE FRACTION ON T2 FROM TUMOR AND NON-TUMOR PROSTATE REGIONS

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**Introduction:** Tumor detection within the prostate is dependent on T2-weighted contrast, with imaging conventionally being performed using an endorectal technique at 1.5-T. Increasingly, with the availability of higher field strength systems, imaging is being performed at 3T. Data acquired at different field strengths are subject to differences in contrast and hence image interpretation, and pose difficulties when follow-up examinations are done at different field strengths. The purpose of this study therefore was to compare values for T2 from different regions of the prostate at 1.5T and 3.0T in order to establish whether significant differences exist between them.

**Method:** 40 men (mean age 70 ± 9 years) with biopsy-confirmed prostate cancer were studied using either a 3T Philips Achieva MR scanner (n=20) or a 1.5T Siemens Avanto (n=20) with an endorectal receiver coil, inflated with 60ml of air and an external phased array coil. All patients were imaged prior to any treatment. Gleason scores were (3+3(n=17), 3+4(n=2), 4+3(n=1) for the 3T cohort, (3+3(n=7), 3+4(n=10), 4+3(n=3) 1.5T cohort; PSA was 4.6-33.3ng/mL (mean 11.6 +/- 6.8) in 3T cohort, (2.3-34ng/mL (mean 11.0+/-8.5) in the 1.5T cohort. In addition to standard 3-plane imaging (TSE, TR/TE=3643/110, 20slices, 2.2mm thickness, 220X184matrix, 120mm FOV, a multi-echo sequence (TR=30000 TE=20/40/60/80/100, 20 slices, 2.2mm thickness, 120mm FOV, 132x105 matrix) was acquired and T2 maps generated using the scanner software. An experienced radiologist drew regions of interest (ROI) on the T2-weighted images around the whole prostate and the central gland (CG) and around areas of tumour (TU, identified as hypointense signal on the T2-weighted images in a biopsy positive octant). Normal peripheral zone (PZ) was defined as prostate tissue which was not identified as tumor or CG. ROIs were then transferred onto the T2 maps by matching slice positions. T2 values obtained at 3T and 1.5T were compared using a Mann-Whitney test for independent samples. T2 values also were compared between patients whose PZ volume was more than or less than 25% of the total prostate volume (Mann-Whitney test for independent samples).

**Results:** Measured values are tabulated for each field strength (Table 1). Differences between field strengths for mean T2 were not significant for any prostate region. T2 values from PZ were significantly lower in patients with low fractional PZ volume (p=0.03, Figure 1), whilst TU and CG values were not significantly different. (Table 2, Figure 2). T2 values could differentiate between TU and PZ values for patients with high fractional PZ volume (p=0.005) but not for those with low fractional PZ volume.

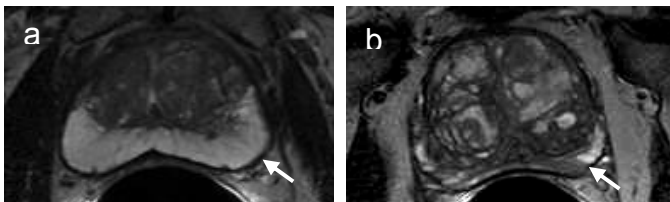


Figure 1: Prostate with high PZ fractional volume (a) compared to low PZ fractional volume (b) showing longer T2 in the PZ in a compared to b (arrows).

Field (T)	TU	PZ	CG
1.5	112±32	127 ± 29	106 ± 14
3.0	101± 34	116 ± 31	116±35
1.5 vs 3.0T (p-value)	0.282	0.282	0.254

Table 1: Measured values of T2 in tumor, peripheral zone and central gland of the prostate at 1.5T and 3.0T.

T2	High PZ volume PZ/PROS>0.25 (n=32)	Low PZ volume (PZ/PROS <0.25) (n=8)	Low vs High PZ volume (p-value)
TU	110 ± 35	96 ± 14	0.12
PZ	125 ± 33	106 ± 12	<b>0.03</b>
CG	110 ± 30	116 ± 16	0.15
TU vs PZ (p-value)	<b>0.005</b>	0.073	

Table 2: Comparison of T2 values with volume of PZ as a fraction of total prostate volume.

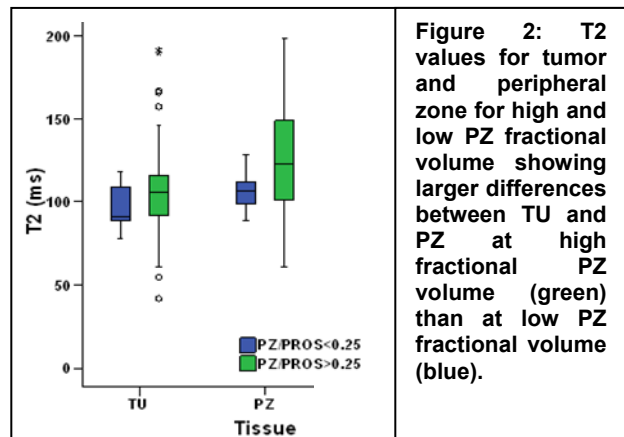


Figure 2: T2 values for tumor and peripheral zone for high and low PZ fractional volume showing larger differences between TU and PZ at high fractional PZ volume (green) than at low PZ fractional volume (blue).

**Discussion and Conclusion:** Values obtained for T2 in all prostate regions are comparable at 3T and 1.5T. In patients with a low fraction of PZ compared with total prostate volume, T2 values in the PZ are reduced likely due to compression of glandular ducts and reduction in their fluid content in this region by the enlarged central gland. In patients with low fractional PZ volume, therefore, the T2 values of PZ may be indistinguishable from tumor, reducing the ability to detect tumor within the PZ in these patients.

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