

Multiparametric 3T MR Imaging for detection of prostate cancer with surgical correlation

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Purpose: To determine the utility of T2W imaging at 3T in the detection of prostate cancer and to evaluate the additive diagnostic value of DCE-MRI and MR spectroscopy to conventional T2W images based on whole mount pathologic correlation.

Material and method: This prospective study includes 70 patients (mean age 60.4 years ranging between 40-75 years) with a mean PSA level of 5.47ng/mL (range, 1–19.9 ng/mL). All patients had biopsy proven prostate cancer and the Gleason score ranged from 6 to 9. MRI of the prostate was performed on a 3T scanner using both phased array surface and endorectal coils. Triplane T2 weighted turbo spin-echo (TR/TE: 8852/120, FOV:140x140, 3mm slice thickness), DCE MRI (TR/TE:5.5/2.1, FOV:262x262, 6mm slice thickness, obtained during a single-dose bolus injection of 0.1 mmol/kg gadopentetate dimeglumine), MR spectroscopy (3D CSI, PRESS TR/TE: 980/100, FOV:72x72, 6mm slice thickness) were obtained. MR images were reviewed by 2 radiologists blinded to pathology, prostatectomy specimens were reviewed by 2 pathologists who were blinded to the MRI. Correlation of whole MR image sets with pathologic specimens was performed by side-by-side comparison. Two different approaches (a raw stringent method and a neighboring method accounting for surgical deformation, shrinkage and non-uniform slicing factors) were used for the correlation.

Results: Sensitivity and specificity values obtained with the two different correlation approaches are summarized in Tables 1 and 2. The combined diagnostic accuracy of T2W, DCE MR, and MR spectroscopy for PZ tumors was examined by calculating predictive values (probability of cancer) under different combinations of imaging results without the neighboring approach in the peripheral zone and all three MR imaging modalities were found to provide an independent predictive value and were found to be statistically significant predictors by using generalized estimating equations, $P < 0.001$, $P = 0.02$, and $P = 0.002$ for T2W, DCE MR and MR spectroscopy, respectively (Table 3) (Figure 1).

	Sensitivity			Specificity		
	T2W	DCE-MRI	MRS	T2W	DCE-MRI	MRS
PZ+CG	0.42 (0.73)	0.18 (0.42)	0.13 (0.26)	0.83 (0.89)	0.96 (0.97)	0.97 (0.99)
PZ+CG without hem.	0.44 (0.75)	0.19 (0.44)	0.12 (0.25)	0.83 (0.90)	0.95 (0.98)	0.97 (0.99)
PZ	0.53 (0.91)	0.22 (0.53)	0.16 (0.35)	0.74 (0.83)	0.93 (0.96)	0.95 (0.98)
PZ without hem.	0.54 (0.94)	0.24 (0.55)	0.15 (0.32)	0.75 (0.84)	0.92 (0.97)	0.95 (0.99)

Table 1: Diagnostic performances of T2W, DCE MR and MR spectroscopy in peripheral zone (PZ) + central gland (CG) and PZ alone with and without hemorrhage (hem) (results of neighboring approach is presented in parenthesis).

Lesion characteristics	Sensitivity		
	T2W	DCE-MRI	MRS
≤3mm	0.40 (0.87)	0.12 (0.51)	0.07 (0.28)
>3mm	0.61 (0.94)	0.28 (0.56)	0.21 (0.39)
Gleason score≤7	0.48 (0.86)	0.20 (0.48)	0.16 (0.33)
Gleason score>7	0.67 (0.98)	0.36 (0.74)	0.25 (0.51)

Table 2: Diagnostic performances of T2W, DCE MR and MR spectroscopy in peripheral zone according to tumor size and grade (results of neighboring approach is presented in parenthesis).

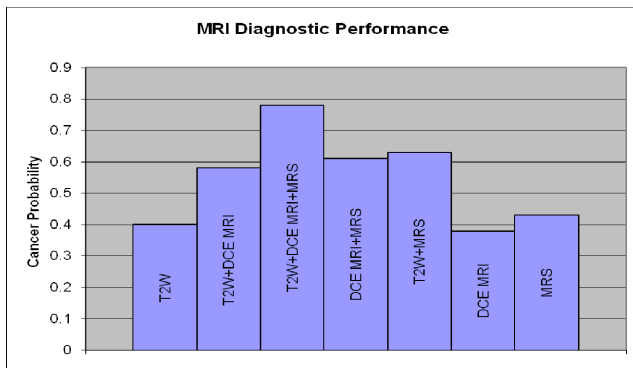


Table 3: Relative diagnostic performance of T2W, DCE MRI and MR spectroscopy for tumor detection in the peripheral zone.

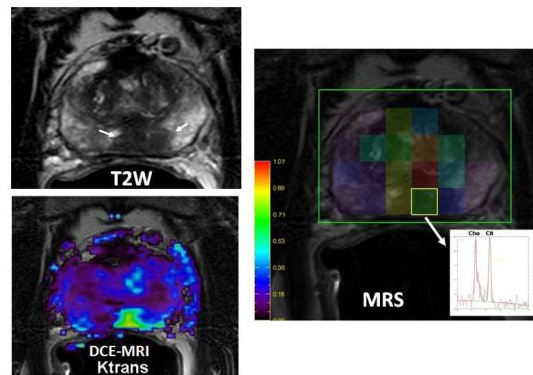


Figure 1: T2W, DCE-MRI with Ktrans map and MR spectroscopy images of a patient with prostate cancer demonstrate a tumor midline of the PZ (arrows).

Conclusion: While 3T endorectal MRI of prostate reveals comparable sensitivity and specificity to those reported for 1.5T the combined use of multiparametric MRI (DCE-MRI and MR spectroscopy) improves the positive predictive value for tumor detection.