

Diffusion weighted MRI of the prostate: which tumours are we able to detect, and how reliably?

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Introduction/Purpose: Despite a growing interest in the use of DW MRI and apparent diffusion coefficient (ADC) for prostate cancer detection¹ and estimation of tumour aggressiveness², clinically realistic validation and reproducibility studies are needed. The purpose of this investigation was to assess the inter-reader reliability of DW MRI for the detection of primary prostate cancer in bladder and prostate cancer patients using histopathology as a gold standard.

Methods: 111 male patients with biopsy proven primary prostate (n=78) or bladder (n=18) cancer or both (n=15) underwent DW MRI at 3 T prior to prostatectomy (and

cystectomy, n=33). Three independent readers with 5-10 years of clinical MRI experience assessed DW MRI for the presence of prostate cancer. Readers were blinded to pathology and clinical findings but were aware that these patients were scheduled for radical prostatectomy and cystectomy. Sensitivity, specificity, and diagnostic accuracy were calculated using histopathology as a gold standard, for all cancers and for intermediate and high grade cancers (Gleason ≥ 7) separately. Fleiss' κ was used as a measure of inter-reader reliability between the three readers.

Results: Sensitivity and positive/negative predictive value (PPV, NPV) for the detection of prostate cancer were high overall (Table 1) with an inter-reader agreement of $\kappa = 0.57$ (good/moderate). High grade cancers were detected with a better sensitivity and PPV than low grade cancers, with only 4 FN (6%), and no FP (Table 2). Of the 12 patients with one or more FP readings, 10 had prostatic hyperplasia (PH), prostatic intraepithelial neoplasia (PIN), prostatitis, or all of the above, 2 had urothelial carcinoma in the prostate, and 2 had no abnormal findings. Only one patient was reported as FP by all 3 readers; 4 patients were FN by all 3 readers. 73% (11/15) of FN readings were reported in patients with Gleason score 6 or lower, and 53% had the largest tumour smaller than 10 mm in diameter (8/15).

Discussion and Conclusions: Primary prostate cancers were detected with excellent sensitivity, and similar inter-reader agreement to that reported in other literature³ using DW MRI. High grade cancers were detected with no false positives and a low percentage ($\leq 5\%$) of false negatives. In conclusion, DW MRI is a reliable method for the detection of primary prostate cancer, and is particularly sensitive for the detection of cancer with Gleason score ≥ 7 . False positive readings were often related to the presence of PH, PIN, or prostatitis, while FN were related to low Gleason score and small tumour foci.

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References: [1] Seitz et al. Eur Urol. 2009 ; 55(4):801-14 [2] Yerram et al. BJU Int 201 [3] Doo, et al. Eur Radiol. 2012; 22(8):1812-9.

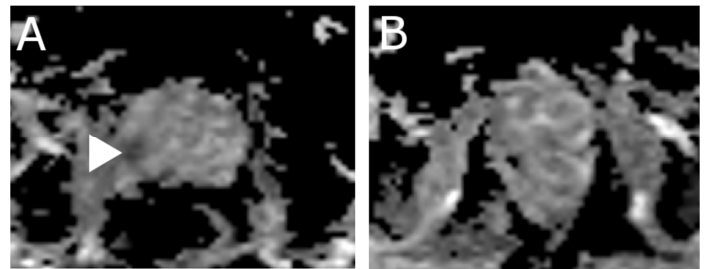


Fig 1 ADC maps showing A) Gleason 9 tumour (5+4; white arrow) detected by all readers, and B) a prostate with foci of PH and PIN reported as FP.

Table 1. Summary statistics for all 3 readers

		Reader A	Reader B	Reader C
All (n=111)	Sens	0.91	0.88	0.90
	Spec	0.56	0.67	0.72
	PPV	0.91	0.93	0.94
	NPV	0.56	0.52	0.59
High grade (n=64)	Sens	0.98	0.95	0.98
	Spec	-	-	-
	PPV	1.00	1.00	1.00
	NPV	-	-	-
Low/no grade (n=47)	Sens	0.76	0.72	0.72
	Spec	0.56	0.67	0.72
	PPV	0.73	0.78	0.81
	NPV	0.59	0.60	0.62

Table 2. True positive (TP), true negative (TN), false positive (FP), and false negative (FN) readings. *Note that 2 patients with FP readings had urothelial carcinoma in the prostatic urethra.

		Reader A	Reader B	Reader C
All (n=111)	TP	85	82	84
	FP	8	6	5
	FN	8	11	9
	TN	10	12	13
High grade (n=64)	TP	63	61	63
	FP	0	0	0
	FN	1	3	1
	TN	0	0	0
Low/no grade (n=47)	TP	22	21	21
	FP	8	6	5
	FN	7	8	8
	TN	10	12	13