The Utility of Prostate MRI using Diffusion and Dynamic Enhanced Imaging in the Evaluation of Patients Previously Biopsy Negative for Cancer

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Introduction: Prostate cancer has a high incidence and is often identified from an elevated PSA level and subsequent random prostate biopsies. However in many cases where there is an elevated PSA, no cancer is identified on biopsy (1). In this study, patients who had an initial set of negative biopsies were assessed by MRI and had subsequent repeat prostate biopsy. Several endpoints were evaluated including 1) the diagnostic accuracy of MRI at identifying prostate cancer 2) the negative predictive value of MRI for excluding cancer and 3) the difference in the number of biopsy samples performed in patients with cancer suspected by MRI and those unlikely to have cancer by MRI.

Methods: 24 consecutive patients with a prostate MRI performed following a set of negative biopsies were evaluated in this HIPPA compliant study (mean age 56.2 y). All patients underwent phased array coil 1.5T MRI (Avanto, Siemens Medical Solutions) using a dedicated axial oriented prostate imaging protocol: T2 (TR 4780; TE 105; FOV 150/150; slice 3.0mm; Resolution 192/64; 2 averages), EPI Diffusion (B values 50, 500, 1000; TR 4700; TE 95; FOV 334/230; slice 6.0mm; Resolution 192/100; 4 averages), DCE-dynamic contrast enhanced T1 performed at 10 time-points over 11 minutes (VIBE TR 4.65; TE 1.83; FOV 280/256; slice 3.0mm; Resolution 448/360; 3 averages). A single blinded reader interpreted all studies. Each study was classified as either “negative”, “low suspicion”, or “high suspicion” for cancer. Classification criteria included: negative (no focus of abnormal signal suggestive of cancer on any sequence), low suspicion (focus of abnormal signal on T2 which did not directly correlate with an abnormality on both Diffusion and DCE, and high suspicion (focus of abnormal T2 signal which directly correlated with a suspicious focus on both Diffusion and DCE. The interpretation of the MRI including the location of potential foci of cancer was conveyed to the urologist and all patients had a second subsequent set of biopsies performed, which was used as the reference standard.

Results: Following re-biopsy, 3 of the 24 patients had evidence of prostate cancer. All 3 patients with cancer identified had been interpreted as “high suspicion” by MRI. 2 additional patients had been read as “high suspicion” but no cancer was identified on biopsy, although both had very small lesions identified (5mm and 6mm). 11 patients had at least 1 foci of signal abnormality read as “low suspicion,” all of which were negative on biopsy. Of the 8 patients read as “negative,” none had prostate cancer identified. When considering only cases interpreted as “high suspicion” as positive, the sensitivity of MRI was 100%, specificity was 91%. The negative predictive value of MRI was 100%. Data regarding the number of biopsy passes is presented in the Table.

	Lesion size on MRI (mean/range)	Number of passes (mean/range)	Number positive on biopsy
High suspicion on MRI (n=5)	12.4 mm (5-32 mm)	7.8 mm (3-12 mm)	3 (60%)
Low suspicion on MRI (n=11)	8.8 mm (6-13 mm)	11.2 mm (8-12 mm)	0 (0%)
Normal on MRI (n=8)	N/A	13.0 mm (12-16 mm)	0 (0%)

Discussion: This study indicates the potential utility of prostate MRI in the standard work-up of patients with suspected prostate cancer but negative biopsies. MRI had a very high sensitivity for prostate cancer as well as a very high negative predictive value. This study also demonstrated that only foci which had abnormal imaging appearances on all sequences (T2, Diffusion, and DCE) were likely to represent cancer. Separately, MRI performed before repeat prostate biopsy may allow less biopsy passes to be performed. This has clinical relevance because surgery for prostate cancer is often more technically difficult in patients with a greater number of previous biopsies (2).

Conclusion: Prostate MRI including diffusion and dynamic contrast enhanced sequences should be considered in the routine evaluation of patients with initial negative biopsies.

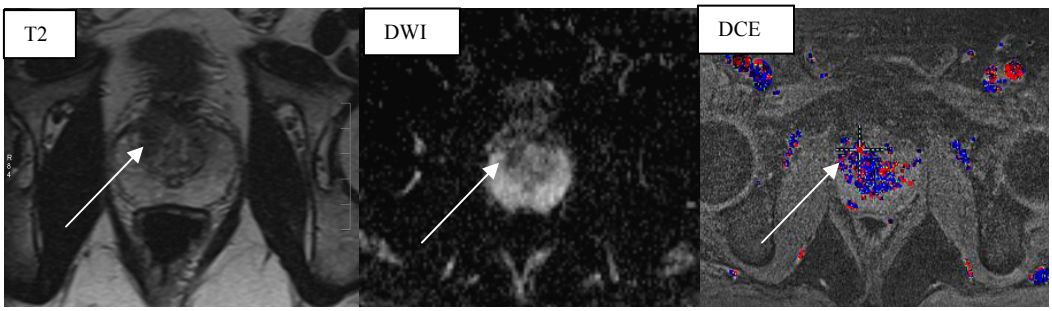

Figure : T2, Diffusion, and DCE (post processed) images demonstrate a foci of high suspicion for cancer in the right anterior central gland (arrows).

References:

1. Rochester MA et al. Urol Int. 2009; 155-9
2. Stamatiou K et al. Urol Int. 2007; 313-7