

Prospective impact of the additional use of an endorectal coil for 3 T prostate MRI on image quality and cancer detection rate

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Introduction and Purpose

Multiparametric magnetic resonance imaging (MRI) of the prostate combines morphologic and functional data and has become a reliable technique for the detection, staging and characterization of prostate cancer (PCa). So far, however, there is no consensus about the minimal MR equipment and imaging protocols needed for adequate PCa diagnostics. The purpose of this study was to compare MR image quality and performance in PCa localization with and without the use of an endorectal coil (ERC) by using the MR prostate imaging reporting and data system (PI-RADS) for the categorization of cancer-suspicious lesions.

Materials and Methods

After obtaining IRB approval, 41 patients with biopsy-proven PCa underwent fast spin-echo T2-weighted (T2w) imaging (in-plane resolution IPR = $0.57 \times 0.57 \text{ mm}^2$, TR/TE: 4400-4600 / 126 ms, ST = 3 mm, 19-22 sections, FOV = $110 \times 110 \text{ mm}^2$) covering the whole prostate and seminal vesicles in transverse and coronal planes and diffusion-weighted (DWI) imaging in transverse planes (in-plane resolution: $1.0 \times 1.0 \text{ mm}^2$, TR/TE: 3000/85 ms, ST: 3 mm, FOV: $250 \times 250 \text{ mm}^2$) using b-values of 50, 500, 800 and $1,500 \text{ sec/mm}^2$ at 3 T (Magnetom Tim Trio, Siemens, Erlangen, Germany). Imaging was performed (1) with surface coils consisting of a 6-channel body matrix coil (ventral) and selected channels of a 24-channel spine matrix coil integrated in the patient table and (2) with an additional ERC (eCoil, Medrad, Pittsburgh, USA) filled with 30-40 mL perfluoro polyether (Fomblin; Solvay Solexis, Milan, Italy). T2w and DWI data were then obtained with the same sequence parameters as before. In two separate sessions, two readers with different experience in prostate 3-T MRI evaluation (reader A and B with 70 and 160 diagnostic prostate MRI cases, respectively) evaluated all blinded and randomly selected MR data of each patient with and without ERC. Scores related to the image quality for localization and staging, respectively, and to the presence of artifacts were assigned by using a five-point probability scale (1 very poor, 2 poor, 3 moderate, 4 good, 5 very good) [1]. The MR PI-RADS classification system for T2w and DWI was used to assign cancer-suspicious lesions to categories 1–5 [2]. The standard of reference was provided by whole-mount step-section analysis of the prostatectomy specimens with tumor foci marked by a senior pathologist (Fig. 1).



Figure 1: Whole-mount step-section of a 59 y.o. patient with pT2c and GS 7 (3+4) PCa at the level of the mid prostate. Tumor foci were highlighted by a senior pathologist.

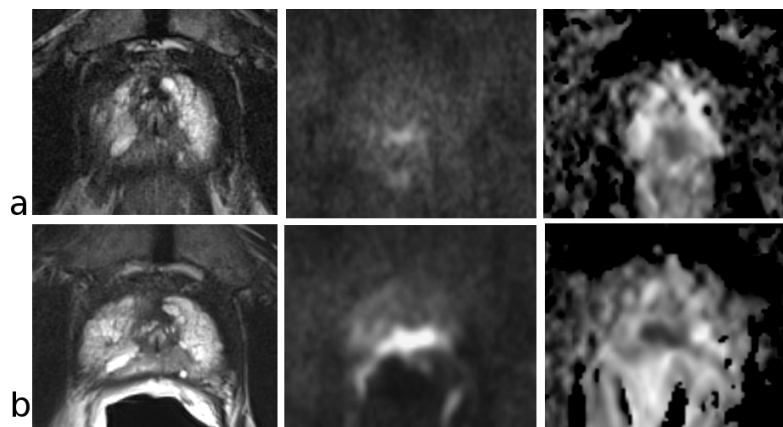


Figure 2: The regions of histopathologically proven cancer (Fig. 1) were matched to the nearest T2WI and DWI/ADC slice. Readers A and B assigned a mean quality score of 4.1 (A+B) without the use of an ERC (a) and 4.3 (A) and 5 (B) with the use of an ERC (b). Both independently assigned a PI-RADS score of 5 (T2w) and 5 (DWI) without as well as 4 (T2w) and 5 (DWI) with the use of an ERC.

Results and Discussion

Patients in our group were 48-74 (mean 64) years old. Median PSA level and median postoperative GS were 11.5 ng/mL (range 0.6-56 ng/mL) and 6.7 (range 5–8), respectively. The mean scores of image quality were 3.9 (A) and 4.5 (B) with the use of an ERC, and 3.4 (A+B) without ($p < 0.05$). Cancer-suspicious lesions (PI-RADS ≥ 3) were assigned in 62 (A) and 64 (B) cases with ERC and in 49 (A) and 48 (B) cases without (Figure 2). Corresponding detection rates per lesion were $47/62=76\%$ (A) and $56/64=88\%$ (B) with ERC as well as $38/49=78\%$ (A) and $34/48=71\%$ (B) without. Per patient, PCa was correctly identified by T2WI and DWI in 36 (A, 88%) and 40 (B, 98%) patients with ERC and in 32 (A, 78%) and 30 (B, 73%) patients without ERC.

Conclusion

The number of suspicious lesions (PI-RADS ≥ 3) that require further diagnostic follow-up, such as a biopsy, was higher when an ERC was used. Per patient, false-positive rates were lower for images obtained with ERC, which suggests an improved PCa detection rate in a clinical setting.

Acknowledgements

Grant support under BMBF 13N10360 is also greatly acknowledged.

References

- [1] Heijmink SW, et al., Radiology 2007
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