Diagnostic performance of the ESUR PI-RADS scoring system for multiparametric MRI of the prostate: systematic comparison of four parameters versus three parameters for detection and grading of prostate cancer

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Introduction

The current study was undertaken to compare the diagnostic performance of the European Society of Urogenital Radiology Prostate imaging-reporting and data system (ESUR PI-RADS) scoring system for multiparametric magnetic resonance imaging (MP MRI) of the prostate using either three or four MRI parameters for the detection and grading of prostate cancer (PCa).

Material and Methods

From May 2012 to June 2013 64 consecutive patients without contraindications to MRI or MRI contrast agents were included in this prospective institutional review board approved single-center study. Indications for referral were: elevated PSA levels >4.0 ng/ml (n=56 of 64), suspicious findings at digital rectal examination (n=32 of 64), positive TRUS biopsy for staging (n=32 of 64). Informed consent was obtained from each patient. All examinations were performed using a 3T MRI system (Tim Trio, Siemens Healthcare, Erlangen, Germany) using a combined spine array and body array receive-only coils. No endorectal coil was used. The total examination time of the MP MRI examination was approximately 40 minutes. The MRI sequence protocol included a high-resolution T2-weighted, a dynamic contrast-enhanced (DCE) T1-weighted, a diffusion-weighted (DWI) and a 3D proton MR spectroscopic imaging (3D ^{1}H-MRSI) sequence. Lesions were classified according to the revised ESUR guidelines (1,2) by 2 readers independently. For each index lesion in the prostate a PI-RADs sum score was defined: PS3sum (ranging from 3-15) including three MRI parameters (T2w, DCE,DWI); PS4sum (ranging from 4-20) including 4 MRI parameters (T2w, DCE,DWI, 3D ^{1}H-MRSI). The liklehood of PCa increases with the sum score. Receiver Operating Characteristics (ROC) analysis was performed to determine the overall classification accuracy of the ESUR sum scores as defined above (PS3sum, PS4sum). Sensitivity, specificity and their 95% confidence intervals (CI) were calculated at appropriate cut-off levels. Interrater variability for ordinal parameters was assessed by quadratic κ coefficients. Spearman correlation analysis was performed to explore the association of PSsum scores with histopathological Gleason scores. P value ≤0.05 was considered a significant result. Histopathology was used as the standard of reference.

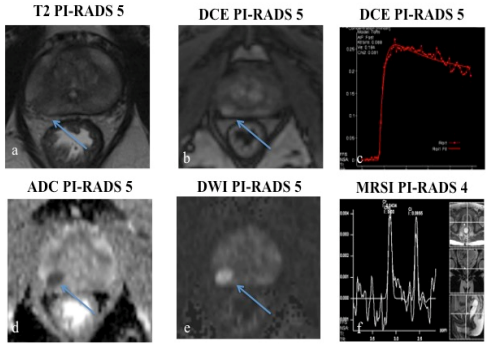

Fig.1: Seventy-one year-old patient with a PSA level of 6.4 ng/ml and a Gleason Score 7(4+3). **a.** Axial T2-w image shows a cancer-suspicious region hypointense lesion in the right peripheral zone segment 4p.
b,c. In DCE the lesion demonstrated a fast initial enhancement followed by a wash out.
d.e. The lesions demonstrates decreased apparent diffusion coefficient values and restricted diffusivity
f. 3D ^{1}H-MRSI shows elevated Choline/Citrate ratio in the suspicious region.

Histopathology confirmed cancer GS 7 (4+3) in the corresponding area. MP MRI was rated for all four parameters. PIRADS 5-5-5 = P3Sum 19 T2 –DCE – DWI, PIRADS 5-5-5-4 = P4Sum 19 T2 –DCE – DWI-3D ^{1}H-MRSI.

Results

In 52 out of 64 (81.3%) patients histopathology confirmed PCa (44.2% low grade PCa and 55.8% high grade PCa). The diagnostic performance of ESUR PI-RADS scoring system for MP MRI using three MRI parameters (PS3sum O1: 92.8%, O2: 92.2%, P>0.05) was equal to MP MRI using four MRI parameters (PS4sum O1: 91.7%, O2: 91.3%). Prediction of high grade PCa by MP MRI using three MRI parameters (PS3sum O1: 75.1%, O2: 72.8%, P>0.05) was as good as with MP MRI with four parameters (PS4 sum O1: 75.1%, O2: 74.7%). Inclusion of 3D ^{1}H-MRSI data did not increase diagnostic accuracy. Kappa agreement between the two readers was substantial (0.734 PS4sum) to moderate (0.558 PS3sum).

Conclusion

Diagnosis with MP MRI of the prostate using three MRI parameters is as accurate as MP MRI of the prostate using four MRI parameters. Adding 3D ^{1}H-MRSI as a fourth parameter did not increase diagnostic accuracy for differentiation of benign and malignant lesions or of high-grade and low-grade PCa. These results indicate that 3D ^{1}H-MRSI can safely be omitted as data acquisition. Interpretation of 3D ^{1}H-MRSI is time consuming and is not beneficial in terms of examination costs and reading time.

References

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