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Differentiation of prostatitis and prostate cancer using the Prostate Imaging—Reporting and Data System (PI-RADS)

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ABSTRACT

Purpose: To determine if prostate cancer (PCa) and prostatitis can be differentiated by using PI-RADS.
Materials and methods: 3T MR images of 68 patients with 85 cancer suspicious lesions were analyzed. The findings were correlated with histopathology. T2w imaging (T2WI), diffusion weighted imaging (DWI), dynamic contrast enhancement (DCE), and MR-Spectroscopy (MRS) were acquired. Every lesion was given a single PI-RADS score for each parameter, as well as a sum score and a PI-RADS v2 score. Furthermore, T2-morphology, ADC-value, perfusion type, citrate/choline-level, and localization were evaluated.
Results: 44 of 85 lesions showed PCa (51.8%), 21 chronic prostatitis (24.7%), and 20 other benign tissue such as hyperplasia or fibromuscular tissue (23.5%). The single PI-RADS score for T2WI, DWI, DCE, as well as the aggregated score including and not including MRS, and the PI-RADS v2-score were all significantly higher for PCa than for prostatitis or other tissue ($p < 0.001$). The single PI-RADS score for MRS and the PI-RADS sum score including MRS were significantly higher for prostatitis than for other tissue ($p = 0.029$ and $p = 0.020$), whereas the other parameters were not different. Prostatitis usually presented borderline pathological PI-RADS scores, showed restricted diffusion with ADC $\geq 900\,mm^2/s$ in 100% of cases, was more often indistinctly hypointense on T2WI (66.7%), and localized in the transitional zone (57.1%). An ADC $\geq 900\,mm^2/s$ achieved the highest predictive value for prostatitis (AUC = 0.859).
Conclusion: Prostatitis can be differentiated from PCa using PI-RADS, since all available parameters are more distinct in cases of cancer. However, there is significant overlap between prostatitis and other benign findings, thus PI-RADS is only suitable to a limited extent for the primary assessment of prostatitis. Restricted diffusion with ADC $\geq 900\,mm^2/s$ is believed to be a good indicator for prostatitis. MRS can help to distinguish between prostatitis and other tissue.

1. Introduction

One of six men will be diagnosed with prostate cancer (PCa) in his lifetime accounting for an incidence of approximately 360,000 new cases per year in Europe [1,2]. Transrectal ultrasound (TRUS)-guided biopsy is recommended in patients with an elevated prostate specific antigen (PSA) above 4 ng/ml and with a suspect finding in digital rectal examination [3]. Multiparametric magnetic resonance imaging (mpMRI) can accurately detect prostate cancer [4,5] and is indicated when TRUS-guided biopsy does not show malignancy [1].

In 2012, the European Society of Urogenital Radiology (ESUR) has developed a structured reporting system for prostate MRI (Prostate Imaging—Reporting and Data System, PI-RADS) [1]. Every lesion inside the prostate is given a PI-RADS-score for T2 weighted imaging (T2WI), diffusion weighted imaging (DWI), dynamic contrast enhancement (DCE) and magnetic resonance spectroscopy (MRS). The scoring ranges from 1 to 5, with 1 being most probably benign and 5 being most probably malign.

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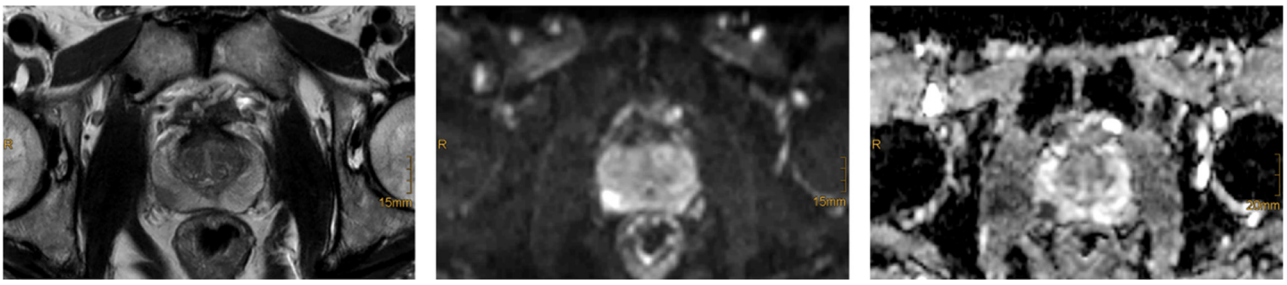

Fig. 1. MR-images of prostate cancer (Gleason-Score 4 + 4 = 8). Left: Transversal T2 weighted image with well marginated hypointense lesion in the right posterior peripheral zone. Middle: Transversal diffusion weighted image (DWI) with hyperintense lesion on b-800 images. Right: Corresponding hypointensity in the apparent diffusion coefficient (ADC) map.

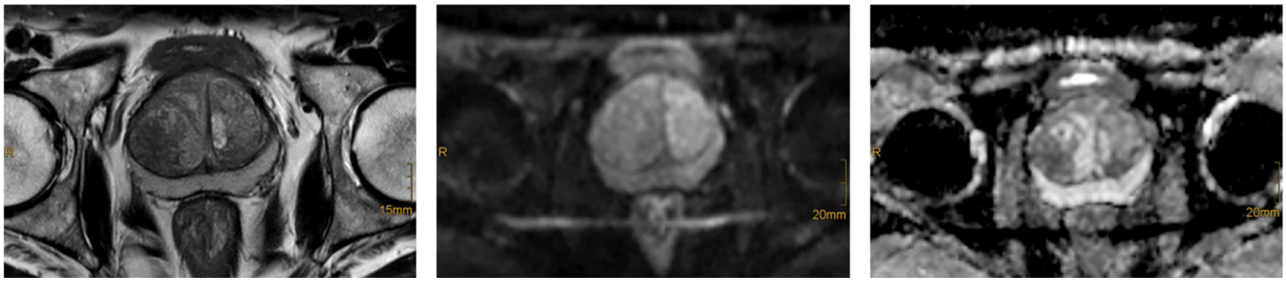

Fig. 2. MR-images of prostatitis. Left: Transversal T2-weighted image with indistinct hypointensity in the right transitional zone. Middle: Transversal diffusion weighted image (DWI) with isointensity in the right transitional zone on b-800 images. Right: Hypointensity in the right transitional zone in the apparent diffusion coefficient (ADC) map.

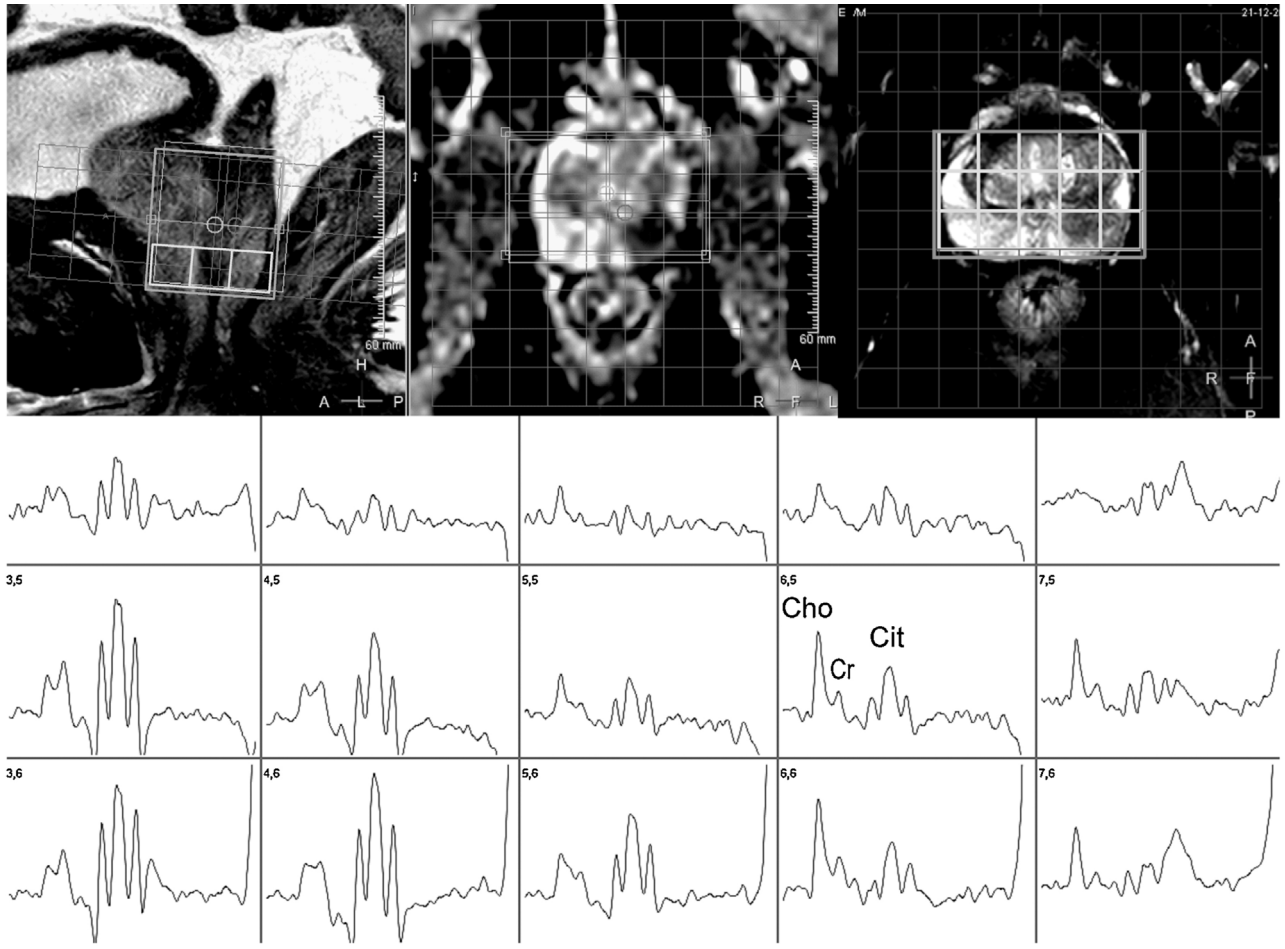

Fig. 3. 3D MR spectroscopic imaging (3D-MRSI) of prostate cancer (Gleason 5 + 4 = 9) in the apical peripheral zone posterior left. Acquisition with 3 slices and isotropic 1 cm^3 voxels. Overlay of MRSI grid and PRESS volume selection on sagittal sag T2w FSE, on ADC image from transversal DWI, and on transversal fat-suppressed T2wFSE (above). Selected 1H MR spectra from 15 voxels in the most apical MRSI slice arranged in a 3×5 array (below) corresponding to their position in the marked voxel grid. Strongly increased choline (Cho) and reduced creatine (Cr) and citrate (Cit) in the spectra from the hypointense area on transversal DWI and FSE indicate tumor metabolism.