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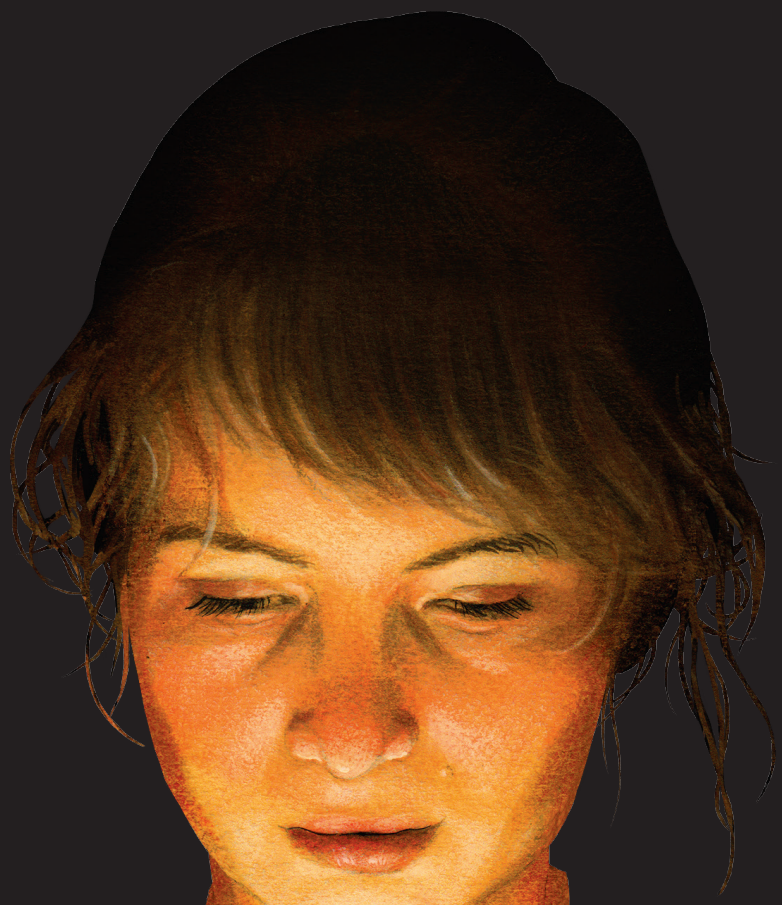

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Scientific Programme

Clinical Trials in Radiology (CTiR)
My Thesis in 3 Minutes (MyT3)
Research Presentation Sessions (RPS)
Student Sessions (S)

RPS 1307-5 08:54

Risk stratification of patients with prostate cancer: promising results with high b-value DWI radiomic features

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Purpose: To investigate the potential role of radiomic features computed on high b-value diffusion-weighted imaging (DWI) to perform risk stratification of patients with a clinical suspicion of prostate cancer (PCa).
Methods and materials: 42 patients of our institution, representing 7 risk levels, were retrospectively enrolled in the study and grouped into 4 classes of risk: (a) clinically significant (CS) PCa split over 4 levels (ISUP=2÷5), (b) non-clinically significant (NCS) PCa (ISUP=1) patients with a negative biopsy, and (c) positive mpMRI (NP) or (d) negative mpMRI (NN). After computing radiomic features on DWI b=2000s/mm^2, the correlation between radiomic features and risk level was investigated through two steps, (i) Spearman index (ρ) and (ii) Kruskal-Wallis and Wilcoxon tests ($p<0.05$), for multi- and pairwise- comparison of the 4 classes, respectively.
Results: The mean of the local coefficient of variation (CV_L-m), a measure of local dispersion of DWI values, resulted in the most discriminant radiomic features among the four classes ($p\sim10^{-6}$), able to rank the four increasing risk classes with ρ=0.81, with a high pairwise separability ($p\leq0.026$). ρ=0.81 was also achieved when correlating the CV_L-m with all 7 increasing risk level groups.
Conclusion: This study allows performing an early stratification of all 7 PCa risk levels. Increasing values of CV_L-m in DWI images describe a higher degree of local heterogeneity in accordance with tissue over-proliferation and, consequently, an increasing level of tumour aggressiveness.
Limitations: The number of patients could be low for a proper stratification of the cohort in 7 classes. However, the excellent results achieved when using CV_L-m values to correctly rank all risk levels give CV_L-m the most promising role in depicting PCa risk progression.
Ethics committee approval: IRB approval and written informed consent was waived.
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RPS 1307-6 09:00

Why a b-value of 1,400 s/mm2 or higher is optimal for evaluating prostatic index lesions on synthetic diffusion-weighted imaging

S. Y. Cha, S. Y. Park*; Seoul/KR*

Purpose: PI-RADS recommends the use of high-b-values of 1,400 s/mm2 or greater for diffusion-weighted imaging (DWI) interpretation. However, lesion signal intensity on DWI decreases as b-values increase. Thus, the fundamental reasons regarding optimal b-value range are still unclear. We qualitatively and quantitatively analysed the optimal b-value range for calculated DWI (cDWI) in the prostate.
Methods and materials: 92 patients who underwent DWI and targeted biopsy for index lesions were retrospectively included. We generated cDWI for a range of b-values, 1,000-3,000 s/mm2, using dedicated software and true DWI data of b-values of 0, 100, and 1,000 s/mm2. We assumed lesion conspicuity would be best when background (benign prostatic areas [bP] and periprostatic areas [pP]) signal intensities (SI) become homogeneous. We firstly analysed the b-value showing the best visual conspicuity (qualitative analysis) and then assessed the b-value showing same SI between bP and pP (quantitative analysis). The 95% confidence interval of a qualitative or quantitative b-value was considered as the optimal b-value range.
Results: Optimal b-value ranges for qualitative and quantitative analyses were 1,761-1,805 s/mm2 and 1,640-1,771 s/mm2 (med, 1,790 vs 1,705 s/mm2; p= 0.003) for reader 1, and 1,835-1,895 s/mm2 and 1,705-1,841 s/mm2 (med, 1,872 vs 1,763 s/mm2; p= 0.022) for reader 2, respectively. Bland-Altman plots consistently demonstrated the mean difference of less than 100 s/mm2 between qualitatively and quantitatively determined b-values for the two readers.
Conclusion: Calculated b-values showing homogeneous SI between bP and pP seem to be optimal for evaluating prostatic index lesions on cDWI. Our qualitative and quantitative findings consistently suggest the use of a b-value of 1,600-1,900 s/mm2.
Limitations: The data analyses were performed retrospectively. We evaluated patients of a single institution. Further prospective and external validation studies are required.
Ethics committee approval: n/a
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Accelerated, high-resolution quantitative T2 mapping at 3T for the detection of prostate cancer

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Purpose: To test the reliability of the latest-generation, fast, high-resolution T2-mapping prototype sequence supporting parallel imaging and model-based reconstruction ($T2_M$) in the detection of malignant prostate lesions of the peripheral zone.
Methods and materials: We included 350 image series (T2-weighted-imaging, diffusion-weighted-imaging, T1-weighted pre-contrast-imaging, dynamic contrast-enhancement, and $T2_M$) from 50 multiparametric MRI datasets at 3 Tesla (MAGNETOM Prisma^{fit}, Siemens Healthcare, Erlangen, Germany), clinically indicated for suspected prostate cancer (pCA). The standard multiparametric prostate protocol was rated for the occurrence of prostate lesions. In 22 cases, there was biopsy-confirmed pCA in the peripheral zone. Regions of interest (ROI) were drawn on axial $T2_M$ (0.7x0.7x3.0mm^3, 16 echoes with delta TE 10.8ms, TR 5000msec) for each examination: on 3 slices (apex, mid-base, and base) to measure healthy prostate tissue of the peripheral and transitional zone and for confirmed malignant lesions on the most representative slice. The average and minimum values of transverse relaxation time (T2) in each ROI were recorded.
Results: The average acquisition time for $T2_M$ was 4:36 min. Healthy prostate tissue had a mean T2 of 151.3±42.6ms in the peripheral zone and 95.1±22.5ms in the transitional zone. The mean T2 in the peripheral zone was significantly reduced for confirmed pCA (71.6±13.3ms, p=0.001). T2 measurements could differentiate infiltration of the transitional zone from peripheral pCA (p=0.001). When comparing minimal values of $T2_M$, we found a good distinction between healthy tissue and pCA (healthy: 99.4±19.9ms, malignant: 52.0±10.6ms; p=0.001).
Conclusion: The detection of malignant prostate tissue is feasible using quantitative measurements from high-resolution T2-mapping sequences with a good distinction of pCA. $T2_M$ could be added with an acceptable acquisition time.
Limitations: Results should be confirmed in a larger cohort.
Ethics committee approval: Ethics committee review granted approval and informed consent was waived.
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RPS 1307-8 09:12

Advanced postprocessing in diffusion-weighted imaging of the prostate: impact on image quality and lesion detectability

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Purpose: To investigate the effect of advanced postprocessing consisting of adaptive combination and motion correction of multiple acquisitions in diffusion-weighted magnetic resonance prostate imaging and its potential to improve image quality and prostate cancer detection.
Methods and materials: We retrospectively evaluated clinically indicated multiparametric 3T-MRI-examinations of 53 patients (mean age 68.8±10 years) including diffusion-weighted imaging of the prostate with and without prototypical advanced postprocessing for the extraction of trace-weighted images from the original diffusion-weighted acquisitions. Two readers rated image quality, artefacts, distortion, and detectability of lesions in high b-value images (b=1000/calculated 2000 s/mm²) of both datasets using a 4-point Likert scale (1=poor, 4=excellent). Measurements of signal intensity of the peripheral zone and lesions were carried out. This enabled us to calculate the ratio of signal intensity of lesions to the peripheral zone and therefore produce a quantitative comparison of lesion detectability. Lesions were assessed according to PI-RADS V2.
Results: With advanced postprocessing, image quality was rated significantly better for b1000 (4 vs 3, p=0.0001) and b2000 (3 vs 2, p=0.0006) while artefacts were rated significantly better for b2000 (3(IQR 3-3) vs 3(IQR 2-3), p=0.0005). No significant differences for distortion were found. Due to improved lesion/tissue contrast with advanced postprocessing, detectability of lesions was qualitatively and quantitatively better for b1000 (4 vs 3, p=0.0084; 1.36 vs 1.31, p<0.0001) and b2000 (4(IQR 4-4) vs 4(IQR 3-4), p=0.0003; 3.24 vs 2.92, p<0.0001). With advanced postprocessing, two additional lesions (overall 38 instead of 36) were found.