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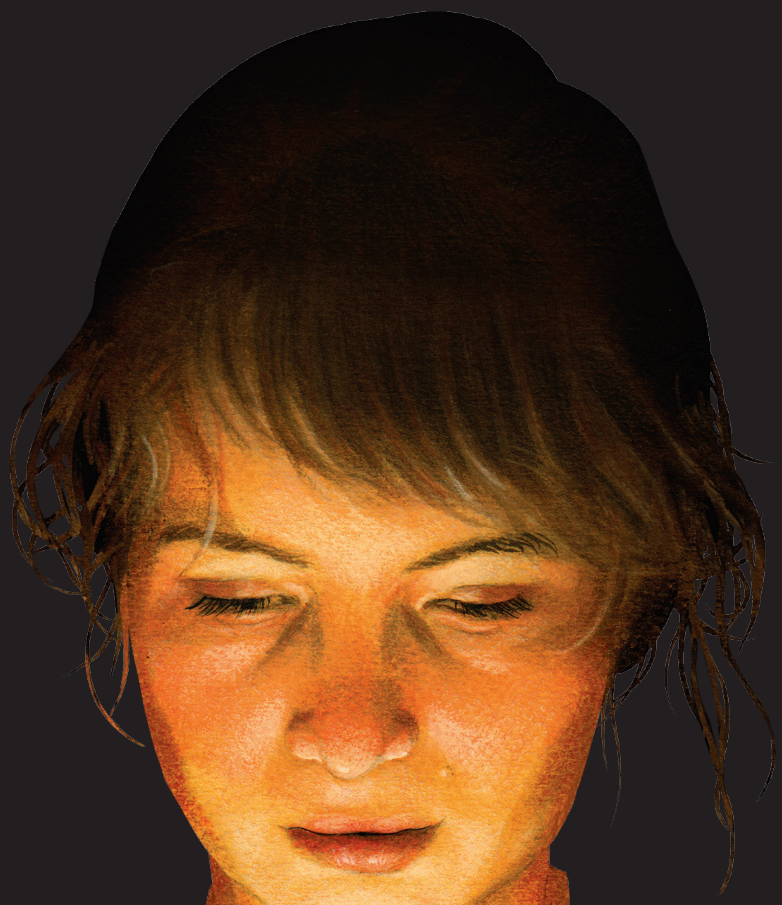
CONTENTS



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Scientific Programme

Clinical Trials in Radiology (CTiR)
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Research Presentation Sessions (RPS)
Student Sessions (S)

Results: 253 patients harboured 392 MR lesions (302 in the peripheral zone), of which 129 lesions were csPC positive. The univariate model ROC area under the curve (AUC) was 0.66 for mADC and 0.68 for entropy. Variable selection retained only mADC and entropy in the final model, while none of the other radiomic parameters contributed further. The combined model had ROC AUC of 0.73 (p<0.001 LRT compared to the univariate mADC model).
Conclusion: Entropy provides important additional information to mADC, thereby improving quantitative assessment of prostate MRI.
Limitations: All patients were examined on a single scanner system, limiting the generalisability of our results, however, providing a highly standardised mADC measurement which entropy was able to provide added value to.
Ethics committee approval: Approved by an ethics committee with written informed consent waived (S-156/2018).
Funding: No funding was received for this work.
Author Disclosures:
D. Bonekamp: Speaker at Profound Medical Inc.
P. D. A. Stenzinger: Consultant at Astra Zeneca,BMS, Novartis, Roche, Illumina, Thermo Fisher, Board Member at Astra Zeneca, BMS, Novartis, Thermo Fisher
X. Wang: nothing to disclose
V. Schütz: nothing to disclose
M. Görtz: nothing to disclose
D. Tichy: nothing to disclose
M. Hohenfellner: nothing to disclose
H.-P. Schlemmer: Consultant at Siemens, Curagita, Profound, Bayer, Board Member at Curagita, Grant Recipient at BMBF, Deutsche Krebshilfe, Dietmar-Hopp-Stiftung, Roland-Ernst-Stiftung

RPS 307-7 14:36

Added-value of dynamic contrast-enhanced (DCE) MRI in a lesion-based quantitative analysis of multiparametric prostate MRI in consecutive at-risk patients

A. A. Tavakoli[1], P. Badura[1], T. Tubtawee[2], V. Schütz[1], D. Tichy[1], A. Stenzinger[1], M. Hohenfellner[1], H.-P. Schlemmer[1], D. Bonekamp[3]; [1]Heidelberg/DE, [2]Songkhla/TH, [3]Hirschberg/DE*

Purpose: To examine the added-value of DCE in multi-parametric prostate MRI with a region-of-interest based quantitative evaluation.
Methods and materials: Clinical lesions reported in 3 Tesla MR exams from 315 consecutive patients with suspicion for prostate cancer were retrospectively segmented on ADC maps and a visually identified early DCE time-point. DCE was normalised to minimally enhancing parenchyma (DCEnorm). Multiple heuristic and pharmacokinetic parameters were determined, including the difference in bolus arrival time between the femoral artery and lesion (BATlesdiff) and normalised lesion AUC (AUCnorm). A basic logistic regression model included mean ADC and DCEnorm while a second model was extended by heuristic and pharmacokinetic parameters. The binary outcome was a Gleason grade group (GGG) >=2 from a targeted biopsy core for lesion-based analysis and maximum targeted GGG for patient-based analysis.
Results: Of 308 patients with successful exams, 274 had 454 MR lesions that served as biopsy targets. 211 patients had a total of 275 MR lesions in the PZ. In the PZ, the model was simplified to ADCmean, DCEnorm (both p<0.001), BATlesdiff (p=0.04), and AUCnorm (p=0.15) by variable selection. This model performed significantly better (patient-based: AUROC 0.84 vs 0.80, p=0.04; lesion-based: AUROC 0.80 vs 0.76, p=0.03) than the ADC-only model. In the TZ, the model was reduced to the ADC-only model and no added benefit of any DCE-parameter was found.
Conclusion: In a comprehensive quantitative ROI-based analysis, DCE demonstrates the ability to improve MRI assessment in the peripheral zone but not the transition zone.
Limitations: Our results provide data on a typical PI-RADS compliant DCE protocol, however, cannot provide information on how to best trade off spatial for temporal resolution.
Ethics committee approval: Approved by an ethics committee with written informed consent waived (S-156/2018).
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A. A. Tavakoli: nothing to disclose
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D. Tichy: nothing to disclose
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M. Hohenfellner: nothing to disclose
H.-P. Schlemmer: Consultant at Siemens, Curagita, Profound, Bayer, Board Member at Curagita;, Grant Recipient at BMBF, Deutsche Krebshilfe, Dietmar-Hopp-Stiftung, Roland-Ernst-Stiftung
P. Badura: nothing to disclose

RPS 307-8 14:42

Texture analysis on multiparametric prostate magnetic resonance imaging (mpMRI) for evaluation of prostate cancer (PCa) aggressiveness

I. Ruggirello[1], M. Gatti[1], A. Motta[1], V. Giannini[2], M. Petracchini[1], S. Cirillo[1], D. Regge[2], P. Fonio[1], R. Faletti[1]; [1]Turin/IT, [2]Candiolo/IT (ireneruggirello@gmail.com)*

Purpose: To develop and validate a classifier system for the prediction of prostate cancer (PCa) aggressiveness using MRI texture analysis.
Methods and materials: 106 patients with histologically confirmed PCa were included in this retrospective study for model development and internal validation. Another 51 patients were included for independent external validation. A total of 64 first-order parameters and second-order texture parameters derived from the grey-level co-occurrence matrix were extracted from manually segmented tumours on T2w MRI and ADC maps. Data was analysed with a parametric test and Lasso logistic regression was used for feature selection and developing radiomics signatures to discriminate tumours with 4+3 vs > 3+4 GS high- and low-grade disease respectively (HG and LG). The predictive performance of the signature was evaluated via a receiver operating curve (ROC).
Results: A total of 25 radiomics features significantly different between the two groups (highest correlation for ADC entropy: r=0.33, p<0.001) in the training group. We developed two radiomics signature based on 6 (l=min) and 1 (l=1.SE) features, respectively. The signatures resulted in AUC of 0.74 (0.65-0.84), p<0.001 and AUC of 0.73 (0.63-0.82), p<0.001, in the training group, and 0.64 (0.48-0.80), p<0.001 and AUC of 0.65 (0.49-0.80), p<0.001, in the validation set.
Conclusion: MRI texture features could serve as potential diagnostic markers in assessing PCa biological aggressiveness.
Limitations: A retrospective analysis, the absence of evaluation of contrast-enhanced sequences and maps, and relatively poor AUC values.
Ethics committee approval: n/a
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R. Faletti: nothing to disclose
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A. Motta: nothing to disclose
M. Petracchini: nothing to disclose
S. Cirillo: nothing to disclose
P. Fonio: nothing to disclose

RPS 307-9 14:48

Radiomics in DW-MRI detects non-clinically significant prostate cancer and reduces overtreatment

A. Bevilacqua[1], M. Mottola[1], F. Ferroni[2], G. Gavelli[2], D. Barone[2]; [1]Bologna/IT, [2]Meldola/IT (margherita.mottola@unibo.it)*

Purpose: To assess to what extent radiomic features computed on high b-value DWI sequences (b=2000s/mm^2) could reliably detect non-clinically significant (NCS) prostate cancer and reduce overtreatment.
Methods and materials: This study retrospectively enrolled 25 patients of our institution, randomly extracted from PACS with a clinical suspicion of PCa who underwent prostate 3T-mpMRI. 10 patients reported NCS-PCa after TRUS biopsy, with a Gleason Score (GS)≤3+3, 15 were CS-PCa. PCa regions of interest (ROIs) were outlined in all slices by two experienced radiologists in consensus and reported on the DWI sequences, when needed, where 84 radiomic features with the corresponding ROC curves were computed. In order to prevent overfitting, a one-only feature was selected yielding the highest AUC and p-value<0.001 at the one-tail Wilcoxon rank-sum test.
Results: The dispersion of local skewness (LS) of DWI values is higher for CS-PCa (p-value~10^{-4}) and AUC=0.92 (95%CI, 0.70-0.99). Sensitivity and specificity for NCS were 90% and 87%, respectively (1 FN and 2 FP), with a false omission rate (FOR) equal to 7%, this representing a very low risk of overtreatment. Moreover, the two FPs have GS=3+4, the CS-PCa group closest to NCS one.
Conclusion: Radiomic features extracted from high b-values DWI sequences allows highlighting non-visible image properties related to the complexity of the tumour habitat. The higher variability of LS hints at increasing heterogeneity of tumour micro-environment for CS-PCa. In addition, this excellent performance stresses the promising role of DWI-based radiomics in discriminating CS-PCa from NCS-PCa.
Limitations: No clinical parameters were considered for differentiation. However, at most, they could improve these results. In addition, the number of patients is limited, but uneven in their characteristics, since not derived from any dedicated study.
Ethics committee approval: IRB approval, written informed consent was waived.
Funding: No funding was received for this work.

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M. Mottola: nothing to disclose
A. Bevilacqua: nothing to disclose
G. Gavelli: nothing to disclose
D. Barone: nothing to disclose
F. Ferroni: nothing to disclose

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The role of dynamic contrast-enhanced sequences on the learning curve in prostate MRI interpretation: a comparison with biparametric examinations in readers with different experiences

L. Panebianco, M. Martino, A. Izzo, G. Bianchi, F. Formiconi, C. Gianneramo, A. Pace, R. Manetta, C. Masciocchi; *L'Aquila/IT (aivlim@hotmail.it)*

Purpose: To assess the value of dynamic contrast-enhancement (DCE) use in detecting prostatic index lesions when evaluating the performance of two radiologists with different experience with biparametric (bpMRI) and multiparametric (mpMRI) examinations.
Methods and materials: A retrospective study of 150 patients was performed including 3 Tesla prostate mpMRI.
Two radiologists, with advanced and limited experience, respectively, blinded to clinical and histological data, classified each index lesion using PI-RADS v2. Images were revisited with a reading, including diffusion-weighted imaging (DWI), apparent diffusion coefficient (ADC) maps, T2-weighted (T2W) imaging, and, after 3 months, DCE.
Results were matched with Gleason patterns. The performance was quantified by sensitivity (SNS), specificity (SPC), and area under the curve (AUC) of the ROC (receiver operating characteristics).
Results: Concordance was good for the expert reader: weighted Cohen's k ≈ 0.809 (95% CI 0.707-0.912), unlike the performance of the inexperienced reader, which resulted in a Cohen's k 0.396 (95% CI 0.241-0.551). The expert reader performed as well in bpMRI as in mpMRI (SNS=0.73–0.70, AUC=0.744–0.819; p=0.087). The inexperienced reader performed well in mpMRI, but significantly worse in bpMR: SNS=27.94 versus 64.71 and AUC=0.634 versus 0.807 (p=0.0024).
Conclusion: Results based on the expert reader showed no substantial differences between the performance with bpMRI and mpMRI. The experience gained in mpMRI could advantage the reader in the transition to bpMRI.
Quite differently, the outcome for the inexperienced reader in mpMRI was similar to the expert reader, but in the absence of DCE, the performance dropped significantly.
Limitations: The involvement of one radiologist for each category (experienced and non-experienced) could be limiting in the evaluation of results.
Ethics committee approval: n/a
Funding: No funding was received for this work.
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M. Martino: nothing to disclose
A. Izzo: nothing to disclose
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R. Manetta: nothing to disclose
C. Masciocchi: nothing to disclose
C. Gianneramo: nothing to disclose
A. Pace: nothing to disclose
G. Bianchi: nothing to disclose

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A multicentre-multivendor study to evaluate the generalisability of a radiomics model for classifying prostate cancer

J. M. Castillo[1], M. P. A. Starmans[2], M. Arif[1], W. J. Niessen[2], S. Klein[2], I. G. Schoots[2], J. Veenland[2]; [1]*Rotterdam, Zuid-Holland/NL,* [2]*Rotterdam/NL (j.castillotovar@erasmusmc.nl)*

Purpose: Radiomics applied to magnetic resonance imaging (MRI) has shown promising results in classifying prostate cancer (PCa). However, the effects of these models on unseen data from different centres have rarely been addressed. Our goal is to evaluate the generalisability of radiomic models in the context of PCa classification and to compare the performance between our models and radiologists using prostate imaging reporting and data system (PIRADS) v2.
Methods and materials: The data comprised multiparametric MRI, histology of radical prostatectomy, and pathology reports of 107 patients from three centres. By correlating the MRI with histology, 204 lesions were identified. From each lesion, radiomics features were extracted. Radiomics models for discriminating between high-grade and low-grade lesions were automatically developed using machine learning, either single-centre through cross-validation, or multicenter. For comparison with the multicentre setting, a subset of the dataset was classified by two expert radiologists using PIRADS.
Results: The single-centre models obtained a mean AUC of 0.75 for the internal cross-validation; when testing on unseen data, the mean AUC decreased to 0.54. In the multicentre setting, the radiologists obtained a mean AUC of 0.47, while the radiomics model obtained a mean AUC of 0.75.
Conclusion: Radiomic models may obtain a decent performance when tested in a single-centre setting. However, there can be a considerable drop in classification performance when testing these models on data from different centres. On a multicenter dataset, our radiomics model outperformed PIRADS and may represent a more accurate alternative for malignancy prediction.
Limitations: Despite developing a multicenter-multivendor study, our cohort size is limited.
Ethics committee approval: The Medical ethics review committee of Erasmus MC (NL32105.078.10). The national Dutch trials register (ID: NL2368).
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J. M. Castillo: nothing to disclose
M. P. A. Starmans: nothing to disclose
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S. Klein: nothing to disclose
I. G. Schoots: nothing to disclose
J. Veenland: nothing to disclose

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Multi-parametric magnetic resonance imaging of prostate cancer: correlation between Ktrans, a Gleason score, and a PI-RADS score

E. Lucertini[1], D. Caruso[1], M. Zerunian[1], D. de Santis[1], T. Biondi[2], N. Panvini[3], A. Laghi[1]; [1]*Rome/IT,* [2]*Belvedere Marittimo/IT,* [3]*Latina/IT (elena.lucertini@gmail.com)*

Purpose: To measure K^{trans} and correlate it with a Gleason score (GS) and a PI-RADS score in patients with prostate cancer.
Methods and materials: This retrospective study included patients with pathologically proven prostate cancer who had undergone clinically indicated 1.5 Tesla multi-parametric magnetic resonance imaging (MRI) examination. T2 weighted (T2w) images, diffusion-weighted images (DWI), and dynamic contrast-enhanced (DCE) sequences were obtained. A PI-RADS score was calculated for all tumour lesions. From a DCE-MRI dataset, K^{trans} was computed and compared between patients with clinically insignificant (GS≤6) and clinically significant (GS≥7) prostate cancer. The Spearman rank-order correlation coefficient (ρ) was used to assess the correlation strength between K^{trans} and GS and between K^{trans} and a PI-RADS score.
Results: 21 patients (age: 67±12 years; BMI: 26.63±4.04 Kg/m^2) with a PSA of 7.91±3.01 were included in the study. 7 patients (33.3%) had clinically insignificant prostate cancer while 14 patients (66.7%) were diagnosed with clinically significant prostate cancer. The mean K^{trans} value was 0.42±0.20 min^{-1} (range: 0.15–0.75). K^{trans} was significantly higher (0.52±0.14 min^{-1}) in clinically significant prostate cancer compared to clinical insignificant prostate cancer (0.23±0.15 min^{-1}; P=0.016). K^{trans} showed moderate significant correlation with GS (ρ=0.575, P=0.006), while it showed no significant correlation with PI-RADS (ρ=0.386, P=0.069).
Conclusion: K^{trans} may discriminate between clinically insignificant and significant prostate cancer and show a moderate correlation with GS. This MP-MRI may serve as an imaging biomarker in prostate cancer.
Limitations: Limitations of this study are the small sample size and the inclusion of only patients with proven prostate cancer, despite its design requiring a selected patient population to assess the correlation between K^{trans} and GS.
Ethics committee approval: Written informed consent obtained.
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A. Laghi: nothing to disclose

RPS 307-13 15:12

A comparison between biparametric and multiparametric prostatic MRI: added value of DCE in PCa detection using new PI-RADS v 2.1 classification

A. Grecchi, M. C. Ambrosetti, A. Mazzaro, G. Zamboni, G. Mansueto; *Verona/IT (annamaria.grecchi88@gmail.com)*

Purpose: The indiscriminate use of contrast-enhanced MRI for the detection of PCa has been questioned in the new PIRADS v2.1. Our purpose is to compare