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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 116-7 09:16

Diffusion-weighted imaging in prostate cancer: a descriptor of tumour habitat differentiates high-risk and low-risk lesions

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

Purpose: To discriminate between patients with high-risk (HR) and low-risk (LR) prostate cancer (PCa) in order to support radiologists in deciding on the most proper therapy strategy.
Methods and materials: 42 patients with a clinical suspicion of PCa were consecutively selected from the database of our institution. All patients underwent 3T-mpMRI and TRUS biopsy and, based on their Gleason scores (GS), were assigned to the HR (GS≥3+4) or LR class, the latter including, besides patients with GS=3+3, patients with a negative biopsy, whether they have positive or negative mpMRI. 84 radiomic features were extracted on DWI sequences and related ROC curves computed. The feature showing the lowest p-value in discriminating HR from LR was selected.
Results: The mean of the local coefficient of variation (CV_L-m), representing local DWI variance, performed the best ($p \sim 10^{-6}$) and discriminated HR from LR with AUC=0.91 (95% CI, 0.75-0.97), specificity=85%, sensitivity=87% (4 FP and 2 FN), and all FPs were GS=3+3. These results yielded the probability of FDR=24% of the overtreatment for LR patients and the probability of FOR=8% that a HR patient is not treated.
Conclusion: One of our radiomic features derived from DWI sequences was enough to differentiate HR from LR PCa. Since the level of restriction to the motion of water molecules in the extracellular compartment affects tumour behaviour, radiomic features extracted from DWI sequences result in the best candidate to quantify relevant properties of tumour habitats needed to characterise the different tumour heterogeneities.
Limitations: Patients were not enough to reliably include clinical parameters in the PCa risk assessment. Although they could be crucial to help to improve the radiomic model, a higher number of parameters require a number of patients growing exponentially to have a representative sample size.
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RPS 116-8 09:22

Can PSMA PET CT rule out all relapses of prostate cancer?

M. Garcia Fontes, L. Valuntas, M. Rodríguez Parodi, G. Dos Santos, V. Gigirey, O. Alonso*; Montevideo/UY*

Purpose: To determine if a negative PSMA PET CT can ever rule out tumour recurrences in prostate cancer.
Methods and materials: In a period of 6 months, 246 PET CT PSMAs with biochemical relapse were performed. Those with negative or indeterminate findings were selected to be studied with a multiparametric prostate MRI. 12 patients, 58-75 years old, with a PSA between 0.9 and 22 ng/ml were included. Prostate multiparametric resonance was performed with a Discovery 750W General Electric 3 Tesla. The study protocol included axial T2 panoramic, axial and coronal T2 high resolution of the prostate, diffusion (DWI), and ADC focus and perfusion sequences.
PET CT acquisition was performed 60 minutes after intravenous administration of 2 MBq/Kg of 68Ga-PSMA with 64-slice equipment (General Electric Discovery 690 VCT) from the skull to mid-thigh. The images were corrected for "flight time" (TOF correction).
Results: Of the 12 included patients, 10 presented with local tumour recurrences at the level of the prostate, periprostatic region, or bladder wall. These lesions were not seen with PET PSMA due to the concentration of the radiopharmaceutical in the bladder.
All lesions presented a pathological signal in T2, restriction in DWI, and early enhancement in the perfusion sequence. This last sequence is essential for the detection of tumour recurrences due to the neoangiogenesis of tumoural tissue.
Conclusion: We can conclude that in cases of a negative PSMA PET CT, a multiparametric prostate MRI must be suggested. This study may show relapses in regions not seen with PET PSMA and may change patient management. The main sequence that represents the key of diagnosis is perfussion.
Limitations: Few patients.
Ethics committee approval: Written informed consent obtained.
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VERDICT MRI fractional intracellular volume assessment could help avoid unnecessary biopsies in men assessed for prostate cancer with multi-parametric MRI

S. Singh, H. Rogers, E. W. Johnston, B. Kanber, C. M. Moore, D. Atkinson, E. Panagiotaki, S. Punwani*; London/UK*

Purpose: To determine whether the quantitative fractional intracellular volume (FIC) from VERDICT MRI (vascular, extracellular, and restricted diffusion for cytometry in tumours) and/or ADC (apparent diffusion coefficient) can prospectively identify men undergoing prostate mpMRI with significant cancer.
Methods and materials: We previously demonstrated FIC has a higher ROC-AUC (0.93) than ADC (0.85) for differentiating clinically-significant from benign/non-significant prostate cancer. In this study, we derived and prospectively applied FIC and ADC thresholds based on Youden's index (from previous ROC-analysis using men with Likert≥3): FIC:0.41, ADC:1.12×10^{-3} to a cohort of 30 men with Likert≥3 mpMRI lesions who underwent targeted biopsy. The mean lesion FIC, ADC, sensitivity, and specificity of the derived thresholds were calculated.
Results: Biopsies revealed 16 clinically-significant (3+4=2, ≥4+3=4) cancers and 14 benign/non-significant cancers (benign=12, 3+3=2). Clinically-significant lesions had higher FIC (mean: 0.43±0.22) compared to benign/non-significant lesions (mean: 0.26±0.15) p=0.035. ADC was not significantly different between the two groups (significant: $1.06 \pm 0.16 \times 10^{-3}$ vs benign/non-significant: $0.93 \pm 0.33 \times 10^{-3}$, p=0.12).
The FIC threshold correctly classified 86% of men (n=12) with a benign/non-significant biopsy as negative for significant-cancer compared with 36% of men (n=5) for the ADC threshold. 62% of men with significant cancer (n=10) were classified as positive for significant cancer by the FIC threshold, compared with 81% of men (n=13) using the ADC threshold.
Combining Likert≥4 and FIC threshold, 12/14 men with benign/non-significant pathology could have avoided biopsy. However, 1/16 men with significant cancer would not have been biopsied. Combining Likert≥4 and ADC threshold, 4/14 men with benign/non-significant pathology could have avoided a biopsy and all men with significant cancer would have undergone a biopsy.
Conclusion: A combined Likert score and FIC thresholds could help avoid unnecessary biopsies in men being investigated for prostate cancer.
Limitations: n/a
Ethics committee approval: London–Surrey Borders REC approval, written informed consent obtained.
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Renal oncocytoma versus chromophobe renal cell carcinoma: radiomics uncovering the secrets in MRI images

N. Gündüz, M. B. Eser, A. Yıldırım, A. Kabaalioğlu*; Istanbul/TR (bilgineser@hotmail.com)*

Purpose: A preoperative distinction between renal oncocytoma (RON) and chromophobe renal cell carcinoma (cRCC) remains challenging based on the visual interpretation of multiparametric magnetic resonance imaging (mp-MRI) including apparent diffusion coefficient (ADC) or dynamic sequences. We aimed to evaluate the ability of radiomics, a recently emerged tool for mathematical tissue characterisation based on tumour heterogeneity, in differentiating both tumours.
Methods and materials: This single-centre retrospective study included 14 patients with histopathologically proven RON (n=6) and cRCC (n=8). All cases were imaged before surgery by mp-MRI. Axial MRI-ADC mapping images were used for the manual segmentation of the masses by two radiologists using open-source PyRadiomics software. The radiomics features were extracted from 3 categories: shape and size, histogram-based first-order texture, and high-order texture. Interobserver reliability was assessed using the intraclass correlation coefficient (ICC). Features with excellent (ICC>0.90) agreement were compared