68 Ga-PSMA PET/CT prospective study in prostate cancer patients with occult recurrence: Diagnostic performance and impact on therapeutic decision-making and long-term benefits

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OP-640

Early BCR: in which patients is it worth performing a further PSMA scan?

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Aim/Introduction: to identify potential factors able to predict 68Ga-PSMA-11 PET/CT (PSMA-PET) positivity after a previous negative PSMA-PET performed in patients with early biochemical recurrence (BCR). ***Materials and Methods:*** from March 2016 to March 2020 we retrospectively reviewed patients with the following inclusion criteria: 1) diagnosis of prostate cancer treated with radical prostatectomy; 2) BCR defined by PSA measurement ≥ 0.2 ng/mL; 3) a negative PSMA-PET during early phases of BCR (PET1); 4) a subsequent PSMA-PET (PET2) within 20 months; 5) no treatment between PET1 and PET2, with exception of hormonal therapy (HT). Imaging dataset was evaluated by two independent experienced readers and in case of disagreement by the opinion of a third reader. We considered: PSA values at the time of the scans, PSAdt, PSAvel, ΔPSA and Δtime between PET1 and PET2. Mann-Whitney U test and Chi-Square test were used to compare the distribution of patients' characteristics across PET2 results. Regression analyses were employed to determine predictors of a positive PET2; ROC curves were calculated. ***Results:*** 431 patients had a negative PSMA-PET during early phases of BCR, 73/431 (17%) patients met all the inclusion criteria. 32/73 (44%) were T3a or grater, 14/73 (19%) were N1, 31/73 (42%) had a GS≥8. Mean-PSA1 was 0.88 ng/ml (median 0.5; range 0.2-9.5); mean-PSA2 was 2.5 ng/ml (median 1.13; range 0.23-43.8); mean-Δtime was 8.5 months (2-20); mean-ΔPSA was 1.65 ng/ml; mean-PSAdt was 14.1 months; mean-PSAvel was 2.2 ng/ml/years. 13/73 (18%) patients were on HT at the time of PET2. PET2 was positive in 29/73 (40%); 21/29 (72%) had loco-regional disease and 8/29 (28%) had distant metastasis. ΔPSA, PSAdt, PSAvel and HT were associated with a positive PET2 (all $p<0.05$). On univariate regression analysis PSAdt and being on HT were predictors of a positive PET2, but on multivariate only PSAdt was significant (OR 0.9, CI95% 0,886-0,998, p=0,044). PSAdt had an AUC of 0.69 and a 7.3 months cut-off showed a 69% sensitivity and a 70% specificity. PET2 was positive in 13/45 (29%) patients with PSAdt>7 months and in 16/28 (57%) patients with PSAdt≤7. ***Conclusion:*** this study shows that PSA kinetics and being on HT during PET2 are predictors of a positive PSMA-PET after a first negative in patients with early BCR. A cut off PSAdt of 7 months could be used to improve the selection of patients for a second scan, reducing the number of negative scans and increasing detection rate. ***References:*** None

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Aim/Introduction: The aim of this prospective study was to investigate the impact of 68Ga-PSMA-11 PET/CT on management of prostate cancer patients with occult biochemical recurrence (OBR). ***Materials and Methods:*** 130 hormone-naïve OBR (PSA from 0.05 to 1.5 ng/mL) patients were enrolled in the study (NCT03443609), whose design was described previously in preliminary results report[1]. PSMA detection rates were determined and correlated to various clinical variables using univariate and multivariable analyses (Cox regression analysis). ***Results:*** After pre-screening, 13 patients were excluded due to positive pelvic mpMRI (9 pts) or bone scan (4 pts). The median time from radical prostatectomy +/- radiotherapy to OBR was 5.2 y [0.2-17.1]. Ninety-two among the 130 patients (70.8%) had a positive PSMA PET/CT. One hundred eighty-four lesions were detected, 97/184 in lymph nodes (52.7%), 47/184 in bone (25.5%), 34/184 into prostate bed (18.5%) and 6/184 (3.3%) in peritoneal nodules. PSMA detection rates were 59.6 %, 73.9 % and 81.1% for patients with PSA value ranging from 0.05 to 0.29, 0.3 to 0.59 and 0.6 to 1.59 ng/ml respectively. Univariate analysis revealed PSA value before PSMA, PSA doubling time and PSA velocity as potential predictive factors for positive 68Ga-PSMA PET/CT ($p=0.008$ to 10^{-4}). In multivariate analysis, only PSA velocity was identified as significant independent predictor of positive 68Ga-PSMA PET (adjusted odd of 4.35 - 95%CI: [1.79-10.58], p=0.001). Thanks to PSMA PET/CT, therapeutic management changed in 71/130 patients (54.6%). Take the example of 33 patients, previously treated by surgery and bed prostate radiotherapy, who would have a surveillance due to low PSA increase: 23 of them (70%) were able to have stereotactic radiotherapy on PSMA positive areas. For 5/23 (21.7%) and 12/23 (52.2%) of them, a decrease of more than 90% or 50% of PSA level after treatment was observed respectively. Considered all the cohort, a major impact on PSA value was observed with a decrease of more than 90% or 50% of PSA level from few weeks after treatment in 34/130 (28.4%) and 62/130 (47.7%) respectively. This continues for 46/130 patients (35.5%) who were still in biochemical complete remission, after PSMA based treatment with a median follow-up of 23.4 months [14.5-30.5]. ***Conclusion:*** Results showed, in more than half of patients, a major impact of PSMA PET/CT on treatment

management allowing them to benefit very early from focal PSMA based therapy with a long-term biochemical complete response for 35.5% of them. ***References:*** Rousseau C et al., doi: 10.1002/pros.23869.

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Forced diuresis with furosemide increases diagnostic certainty in the assessment of local recurrence in prostate cancer patients with biochemical recurrence referred for [^{68}Ga]Ga-PSMA-11-PET/CT compared to patients without preparation

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Aim/Introduction: On [^{68}Ga]Ga-PSMA-11-PET/CT tracer accumulation in the bladder is reduced with furosemide. The purpose of the study was (a) to evaluate whether forced diuresis with furosemide has the potential to increase diagnostic certainty in the assessment of local recurrence (LR) in prostate cancer patients with biochemical recurrence in comparison with patients without preparation and (b) whether furosemide has an influence on biodistribution and uptake of [^{68}Ga]Ga-PSMA-11 in organs with physiologic tracer accumulation. ***Materials and Methods:*** two groups with 140 prostate cancer patients each, referred for [^{68}Ga]Ga-PSMA-11-PET/CT because of biochemical recurrence after primary were compared: group one (median PSA: 1.39 ng/ml) receiving no preparation prior to imaging, whereas patients in group two (median PSA: 0.87 ng/ml) were injected with 20 mg furosemide shortly after tracer injection. Evaluation of presence of LR was performed visually. In addition intensity of tracer accumulation in lesions suspicious of LR and in organs with physiologic tracer uptake was assessed using maximum standardized uptake value (SUV_{max}). ***Results:*** Lesions with pathologic tracer uptake judged as LR were found in 26 cases of group one (18.6%), compared with 39 cases in group two (27.9%), showing a median SUV_{max} of 9.3 (range: 3.9-37.0) and 8.0 (range: 3.2-52.7), respectively. In 21 cases of group one an equivocal finding was present (21%), compared with 17 cases in group two (12.1%). No LR was detected in 93 cases of group one (66.4%) and in 84 cases of group two (60%). Findings between both groups differed statistically significantly. Median SUV_{max} values of organs and tissues with physiologic uptake of [^{68}Ga]Ga-PSMA-11 in group one and two were: liver (10.3 vs 10.2), spleen (11.6 vs 12.1), parotid gland (19.7 vs 19.7), lacrimal gland (8.5 vs 10.2), small bowel (16.2 vs 17.0), bone (1.6 vs 1.7), vascular activity (2.2 vs 2.4), kidney (55.8 vs 55.7) and bladder (62.4 vs 9.7). Apart from bladder activity no statistically significant difference between the two groups was found. ***Conclusion:*** Forced diuresis with 20 mg furosemide increases detection rate of local recurrence in patients with biochemical recurrence referred for [^{68}Ga]Ga-PSMA-11-PET/CT in comparison with patients without preparation. Apart from a significant reduction in bladder activity injection of furosemide shortly after tracer administration did not influence intensity of tracer uptake in organs with physiologic tracer accumulation. ***References:*** None

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The influence of digital PET/CT on diagnostic certainty and interrater reliability in ^{68}Ga-PSMA-11 PET/CT for recurrent prostate cancer

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Aim/Introduction: To evaluate the influence of digital PET/CT on diagnostic certainty, sensitivity and inter-rater reliability. ***Materials and Methods:*** This retrospective study compared two cohorts of patients who underwent ^{68}Ga-PSMA-11 PET/CT on a digital PET/CT (dPET/CT) (n=82) or an analogue scanner (aPET/CT) (n=82) for recurrent prostate cancer (PC). Both cohorts were matched for clinical parameters. Four physicians (consultant nuclear medicine physician, two experienced residents and a junior resident) read each scan independently and were blinded to clinical details and each other's results. Lesions were rated according to PSMA-RADS criteria. The number of equivocal and pathological lesions as well as the frequency of discrepant findings and the interrater reliability for the two scanners were compared. ***Results:*** Overall dPET/CT detected greater numbers of all lesion types compared to aPET/CT (benign $p<0.001$, equivocal $p=0.005$, pathological $p=0.05155$). Likewise, a significantly higher patient-based sensitivity (number of scans rated by all four readers as pathological) was observed for dPET/CT (84% vs. 58%, $p<0.05$). The higher number of lesions detected resulted in a higher false discovery rate (proportion of non-pathological lesions as a total of all lesions detected) for dPET/CT compared to aPET/CT (60.7% vs 56.4%, $p=0.008$), but not at the cost of increased diagnostic uncertainty (equivocal lesions for dPET/CT 11.6% vs aPET/CT 12.6%. $p=0.4$). No significantly increased rate of discrepant scans (where one or more readers differed in opinion as to whether the scan is pathological) was observed for dPET/CT compared to aPET/CT (20% vs. 16% respectively, $p=0.18$). However, interrater reliability was slightly lower for dPET/CT (PET/CT Krippendorf's $\alpha=0.72$ substantial agreement,) compared to aPET/CT ($\alpha=0.82$ almost perfect agreement). Interrater reliability did not improve with reader experience and did not correlate with the number of, or discrepancies in, the finding of equivocal lesions. ***Conclusion:*** Our results demonstrate a higher rate of detection for pathological lesions and higher patient based sensitivity for dPET/CT compared with aPET/CT, in