Potential impact of ^{68}Ga-PSMA-11 PET/CT on prostate cancer definitive radiation therapy planning

Nicholas G. Nickols[1,2], Jeremie Calais[3], Amar U. Kishan[2], Minsong Cao[2], Wolfgang P. Fendler[3,4], Matthias Eiber[3], Ken Herrmann[3,4], Francesco Ceci[3],Robert E. Reiter[5], Matthew B. Rettig[5], John V. Hegde[2], Narek Shaverdian[2], Chris R. King[2], Michael L. Steinberg[2], Johannes Czernin[3]

[1]Department of Radiation Oncology, VA Greater Los Angeles Healthcare System, Los Angeles, CA, USA
[2]Department of Radiation Oncology, UCLA, Los Angeles, CA, USA
[3]Ahmanson Translational Imaging Division, Department of Molecular and Medical Pharmacology, UCLA, Los Angeles, CA, USA
[4]Department of Nuclear Medicine, University Clinic Essen, Germany
[5]Department of Urology, UCLA, Los Angeles, CA, USA.

Background/Objectives: Standard-of-care imaging for initial staging of prostate cancer (PCa) underestimates disease burden. Prostate specific membrane antigen (PSMA) positron emission tomography/ computed tomography (PET/CT) detects PCa metastasis with superior accuracy with potential impact on definitive radiation therapy (RT) planning for non-metastatic PCa. Objectives: i) To determine how often definitive PCa RT planning based on standard target volumes cover ^{68}Ga-PSMA-11 PET/CT defined disease, and ii) To assess the potential impact of ^{68}Ga-PSMA-11 PET/CT on definitive PCa RT planning.

Methods: This is a post-hoc analysis of an intention to treat population of 73 patients with localized PCa without prior local therapy who underwent ^{68}Ga-PSMA PET/CT for initial staging as part of an Investigational New Drug trial. 11/73 were intermediate-risk (15%), 33/73 were high-risk (45%), 22/73 were very high risk (30%), and 7/73 were N1 (9.5%). Clinical target volumes (CTVs) that included the prostate, seminal vesicles, and pelvic lymph nodes (LNs) using Radiation Therapy Oncology Group (RTOG) consensus guidelines were contoured on the CT portion of the PET/CT by a radiation oncologist blinded to the PET findings. ^{68}Ga-PSMA-11 PET/CT images were analyzed by a nuclear medicine physician. PSMA-positive lesions not covered by planning volumes based on the CTVs were considered to have a major potential impact on treatment planning.

Results: All patients had PSMA-positive primary prostate lesion(s). 25/73 (34%) and 7/73 (9.5%) had PSMA-positive pelvic nodal and distant metastases, respectively. The sites of nodal metastases in decreasing order of frequency were external iliac (20.5%), common iliac (13.5%), internal iliac (12.5%) obturator (12.5%), perirectal (4%), abdominal (4%), upper-diaphragm (4%), and presacral (1.5%). The median size of the nodal lesions was 6 mm (range 4-24 mm). RT planning based on the CTVs covered 69/73 (94.5%) of primary disease and 20/25 (80%) of pelvic nodal disease, on a per-patient analysis.

Conclusion: ^{68}Ga-PSMA-11 PET/CT had a major impact on intended definitive PCa RT planning in 12/73 of patients (16.5%) when RT fields covered the prostate, seminal vesicles and the pelvic LNs, and in 25/66 of patients (37%) when RT fields covered only the prostate and seminal vesicles (without pelvic LNs).

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