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IMAGE OF THE MONTH

^{18}F-Labelled PSMA-1007 shows similarity in structure, biodistribution and tumour uptake to the theragnostic compound PSMA-617

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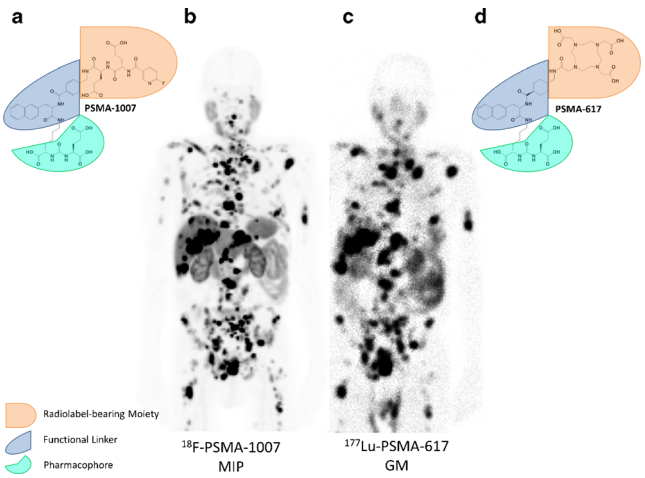
The biochemical and radiological responses to radionuclide therapy with ^{177}Lu-PSMA-617 targeting prostate-specific membrane antigen (PSMA) make it a promising approach to the treatment of patients with metastatic castration-resistant prostate cancer (mCRPC) [1]. However, PSMA-617 has been reported to have slower tumour accumulation and clearance kinetics than PSMA-11, and the latter is still therefore the preferred diagnostic agent when labelled with generator-produced ^{68}Ga which has a short half-life (68 min) [2]. A PSMA-targeting ^{18}F-labelled PET tracer could be produced with higher activity in a cyclotron and the half-life (110 min) would allow both late imaging beyond 1 h after injection and shipping to satellite institutions. However, the structure of the currently most-used ^{18}F-labelled PSMA tracer, ^{18}F-DCFPyl, is different from that of PSMA-617, and like PSMA-11 it might be a sub-optimal surrogate for stratifying patients according to their suitability for therapy with ^{177}Lu-PSMA-617 [3].

Based on the scaffold of PSMA-617, the novel compound ^{18}F-PSMA-1007 was developed. As shown in the image (**a**, **d**), PSMA-1007 shares the Glu-urea-Lys motif targeting the catalytic domain of PSMA and the naphthalene-based linker region considered to cotarget the hydrophobic accessory pocket [4], while in the radiolabel-bearing moiety glutamic acids were added to mimic the carboxylic acid groups of the DOTA chelator to retain the polar charge influencing clearance kinetics.



The image also shows a patient with mCRPC who was staged using ^{18}F-PSMA-1007 (**b** PET 1 h after injection, maximum intensity projection) and treatment with ^{177}Lu-PSMA-617 (**c** planar scan 24 h after injection, geometric mean). In analogy to the chemical structure, the uptake in tumour and normal organs is very similar with the two compounds.

Thus, ^{18}F-PSMA-1007 and ^{177}Lu-PSMA-617 seem to be a perfect theragnostic tandem. Due to the preferred physical characteristics of ^{18}F for PET imaging and the possibility for large-scale production in a cyclotron, ^{18}F-PSMA-1007 is also a promising alternative to ^{68}Ga-PSMA-11 for diagnostic purposes. However, non-inferior diagnostic accuracy has still to be proven in a larger cohort.

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Compliance with ethical standards

Ethical approval As this is a retrospective case report of a patient in regular clinical care but not a clinical trial, ethical approval was not needed.

Informed consent Written informed consent for imaging with an experimental tracer and publication of the individual patient history was obtained.

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References

1. Kratochwil C, Giesel FL, Stefanova M, Benešová M, Bronzel M, Afshar-Oromieh A, et al. PSMA-targeted radionuclide therapy of metastatic castration-resistant prostate cancer with Lu-177 labeled PSMA-617. J Nucl Med. 2016. doi:10.2967/jnumed.115.171397.
2. Afshar-Oromieh A, Hetzheim H, Kratochwil C, Benesova M, Eder M, Neels OC, et al. The theranostic PSMA ligand PSMA-617 in the diagnosis of prostate cancer by PET/CT: biodistribution in humans, radiation dosimetry, and first evaluation of tumor lesions. J Nucl Med. 2015;56(11):1697–705. doi:10.2967/jnumed.115.161299.
3. Szabo Z, Mena E, Rowe SP, Plyku D, Nidal R, Eisenberger MA, et al. Initial evaluation of [(18)F]DCFPyL for prostate-specific membrane antigen (PSMA)-targeted PET imaging of prostate cancer. Mol Imaging Biol. 2015;17(4):565–74. doi:10.1007/s11307-015-0850-8.
4. Barinka C, Byun Y, Dusich CL, Banerjee SR, Chen Y, Castanares M, et al. Interactions between human glutamate carboxypeptidase II and urea-based inhibitors: structural characterization. J Med Chem. 2008;51:7737–43.

[18]F-PSMA-1007 is the subject of a patent application (EP 15 002 800.9, DKFZ)