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IMAGE OF THE MONTH

First-in-human ^{18}F-SiFA*lin*-TATE PET/CT for NET imaging and theranostics

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The over-expression of somatostatin receptors (SSTR) on the cell surface of NET is the basis for SSTR-targeted PET imaging and radionuclide therapy. The visualization of SSTR-positive tumor lesions by SSTR-PET/CT or ^{111}In-pentetreotide imaging (OctreoScan) is a mandatory prerequisite for peptide receptor radionuclide therapy (PRRT) using ^{177}Lu-DOTA-TATE [1]. SSTR-targeted PET/CT with ^{68}Ga-DOTA-conjugated somatostatin analogs, such as ^{68}Ga-DOTA-TATE or ^{68}Ga-DOTA-TOC, is considered as the gold standard for imaging of well-differentiated NET [2] and has been approved by the FDA and EMA, recently. While the synthesis of ^{68}Ga-DOTA-conjugated peptides for NET imaging is well-established and reliable with relatively simple chemistry, the requirement of a cost-intensive ^{68}Ge-/^{68}Ga-generator, low activity amounts after single elution, and the short half-life of ^{68}Ga-labeled compounds constitute certain disadvantages. The development of cyclotron-derived, ^{18}F-labeled compounds for NET imaging might solve these drawbacks. In this context, ^{18}F-SiFA*lin*-TATE has been introduced as a promising agent for imaging of NET lesions in AR42J tumor-bearing mice [3].

This article is part of the Topical Collection on Image of the month

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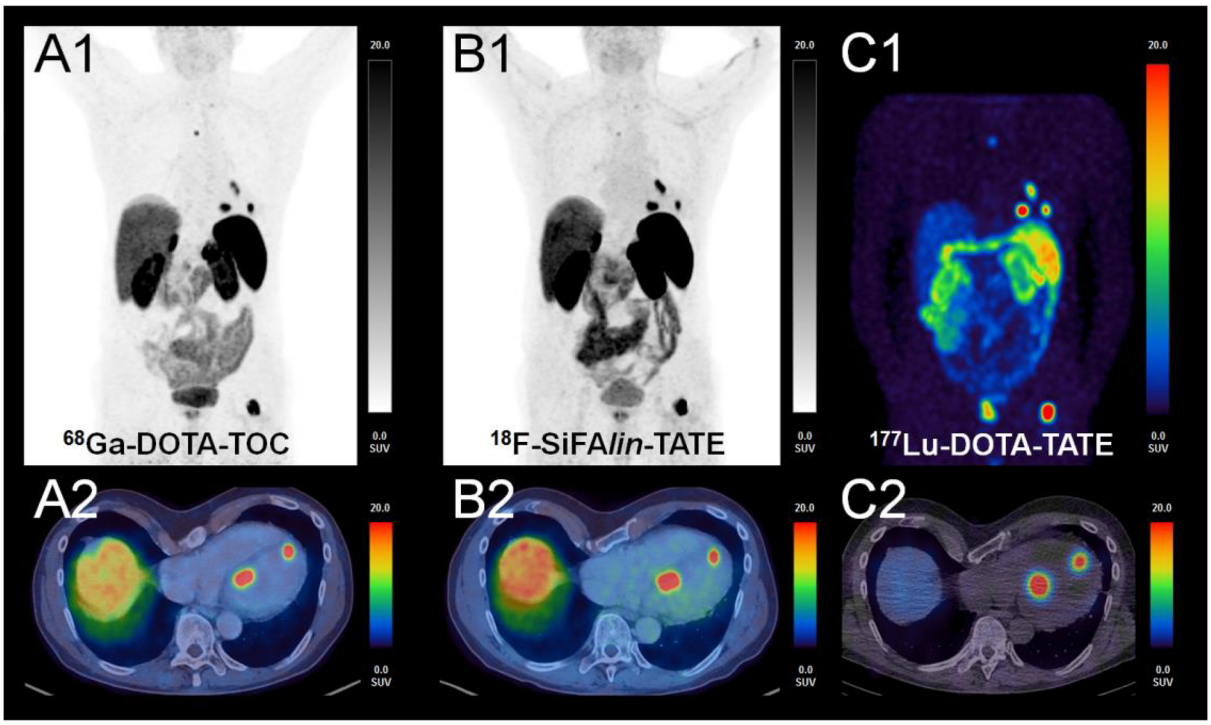
Here, we present the first-in-human ^{18}F-SiFA*lin*-TATE PET/CT scan of a 69-year-old male patient with metastatic NET CUP. The patient presented with liver metastasis with a Ki-67 proliferation index of 5% at the time of initial diagnosis in 2006 and was treated with hemihepatectomy. In 2017, ^{68}Ga-DOTA-TATE PET/CT follow-up revealed a single liver metastasis which was treated by brachytherapy. Additionally, in the multidisciplinary tumor board (MDT), active surveillance was decided for newly diagnosed cardiac and bone metastases. ^{68}Ga-DOTA-TOC PET/CT follow-up was performed in August 2018 (A1 and A2) and showed the progression of cardiac metastases, which was confirmed in cardiac MRI in January 2019. Due to additional bone metastases, PRRT was planned according to the MDT decision.

^{18}F-SiFA*lin*-TATE PET/CT was performed prior to PRRT in February 2019 (figure B1 and B2). Tracer uptake of cardiac metastases and the bone metastasis in the left femur, as well as the uptake in healthy tissue, is highly comparable to the previously performed ^{68}Ga-DOTA-TOC PET/CT scan (SUVmax ^{18}F-SiFA*lin*-TATE vs. ^{68}Ga-DOTA-TOC for cardiac metastases 15.6 vs. 9.5, 16.4 vs. 15.4, 12.6 vs. 17.6, and for the femur metastasis 55.9 vs. 24.3). A single bone lesion in the spine shows a slightly lower tracer accumulation (SUVmax ^{18}F-SiFAlin-TATE vs. ^{68}Ga-DOTA-TOC 2.7 vs. 6.4), which might be caused by different SSTR binding affinities for both radiopeptides and heterogeneous expression of SSTR subtypes in single tumor lesions. Quantitative SPECT/CT after the first PRRT cycle performed at 3, 24, 48, and 72 h after application of 7.4 GBq ^{177}Lu-DOTA-TATE also showed high uptake in cardiac (SUVmax 10.4, 21.3 and 11.8, respectively) and femur metastases (SUVmax 32.4) but also in the small bone metastasis in the spine (SUVmax 2.8; C1 and C2, images at 48 h). Our initial experience with ^{18}F-SiFA*lin*-TATE PET/CT strongly supports its use for PET/CT imaging and PRRT evaluation in NET patients and warrants further studies.



Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Written informed consent was obtained from the patient.

References

1. Bodei L, Mueller-Brand J, Baum RP, Pavel ME, Horsch D, O'Dorisio MS, et al. The joint IAEA, EANM, and SNMMI practical guidance on peptide receptor radionuclide therapy (PRRNT) in neuroendocrine tumours. Eur J Nucl Med Mol Imaging. 2013;40:800–16. https://doi.org/10.1007/s00259-012-2330-6.
2. Pavel M, O'Toole D, Costa F, Capdevila J, Gross D, Kianmanesh R, et al. ENETS consensus guidelines update for the management of distant metastatic disease of intestinal, pancreatic, bronchial neuroendocrine neoplasms (NEN) and NEN of unknown primary site. Neuroendocrinology. 2016;103:172–85. https://doi.org/10.1159/000443167.
3. Niedermoser S, Chin J, Wangler C, Kostikov A, Bernard-Gauthier V, Vogler N, et al. In vivo evaluation of (1)(8)F-SiFAlin-modified TATE: a potential challenge for (6)(8)Ga-DOTATATE, the clinical gold standard for somatostatin receptor imaging with PET. J Nucl Med. 2015;56:1100–5. https://doi.org/10.2967/jnumed.114.149583.