Clinical PET of Neuroendocrine Tumors Using 64Cu-DOTATATE: First-in-Humans Study

The use of positron emitter–labeled compounds for somatostatin receptor imaging (SRI) has become attractive because of the prospect of improved spatial resolution, accelerated imaging procedures, and the ability to quantify tissue radioactivity concentrations. This paper provides results from first-in-humans use of 64Cu-DOTATATE, an avidly binding somatostatin receptor ligand linked to a radioisotope with intermediate half-life and favorable positron energy (half-life, 12.7 h; maximum positron energy, 0.653 MeV).

Methods: In a prospective setup, 14 patients with a history of neuroendocrine tumors underwent both PET/CT with 64Cu-DOTATATE and SPECT/CT with our current routine imaging agent 111In-diethyleneetriaminepentaacetic acid–octreotide. After intravenous injection of 193–232 MBq of 64Cu-DOTATATE, whole-body PET scans were acquired at 1 h (n = 14), 3 h (n = 12), and 24 h (n = 5) after administration. Tissue radioactivity concentrations for normal organs and lesions were quantified, and standardized uptake values were calculated for the early (1 h) and delayed (3 h) scans. Using the data for 5 patients, we assessed the radiation dose with OLINDA/EXM software. Furthermore, the clinical performance of 64Cu-DOTATATE with respect to lesion detection was compared with conventional SRI. Results: SRI with 64Cu-DOTATATE produced images of excellent quality and high spatial resolution. Images were characterized by high and stable tumor-to-background ratios over an imaging time window of at least 3 h. Compared with conventional scintigraphy, 64Cu-DOTATATE PET identified additional lesions in 6 of 14 patients (43%). In 5 patients, lesions were localized in organs and organ systems not previously known as metastatic sites, including the early-stage detection of a secondary neuroendocrine tumor in a patient with a known mutation in the multiple endocrine neoplasia type I gene. All major additional findings seen only on PET could be confirmed on the basis of a clinical follow-up interval of 18 mo. Calculated radiation dose estimates yielded an effective dose of 6.3 mSv for an injected activity of 200 MBq of 64Cu-DOTATATE, with the liver being the organ with the highest absorbed radiation dose (0.16 mGy/MBq).

Conclusion: This first-in-humans study supports the clinical use of 64Cu-DOTATATE for SRI with excellent imaging quality, reduced radiation burden, and increased lesion detection rate when compared with 111In-diethyleneetriaminepentaacetic acid–octreotide.
Scopus rating (2013): CiteScore 4.66 SJR 2.315 SNIP 1.982
Web of Science (2013): Impact factor 5.563
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5 SJR 2.787 SNIP 2.16
Web of Science (2012): Impact factor 5.774
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.08 SJR 2.642 SNIP 2.092
Web of Science (2011): Impact factor 6.381
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.631 SNIP 2.29
Web of Science (2010): Impact factor 7.022
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.994 SNIP 2.159
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.299 SNIP 2.108
Scopus rating (2007): SJR 2.656 SNIP 2.32
Scopus rating (2006): SJR 2.208 SNIP 1.814
Scopus rating (2005): SJR 1.605 SNIP 1.8
Scopus rating (2004): SJR 1.637 SNIP 2.107
Scopus rating (2003): SJR 1.475 SNIP 2.051
Scopus rating (2002): SJR 1.254 SNIP 1.646
Scopus rating (2001): SJR 1.549 SNIP 1.725
Scopus rating (2000): SJR 1.633 SNIP 1.548
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.432 SNIP 1.581
Original language: English
Keywords: neuroendocrine tumors, 64Cu-DOTA-Tyr3-octreotate, positron-emission tomography, 111In-DTPA-octreotide, first-in-humans study
DOIs: 10.2967/jnumed.111.101469
Source: dtu
Source-ID: n:oai:DTIC-ART:highwire/367524850::18390
Research output: Research - peer-review › Journal article – Annual report year: 2012