Preliminary data on biodistribution and dosimetry for therapy planning of somatostatin receptor positive tumours: comparison of ^{86}Y-DOTATOC and ^{111}In-DTPA-octreotide

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Introduction: The somatostatin analogue ^{90}Y-DOTATOC (yttrium-90 DOTA-D-Phe^{1}-Tyr^{3}-octreotide) is used for treatment of patients with neuroendocrine tumours. Accurate pretherapeutic dosimetry would allow for individual planning of the optimal therapeutic strategy. In this study, the biodistribution and resulting dosimetric calculation for therapeutic exposure of critical organs and tumour masses based on the positron emission tomography (PET) tracer ^{86}Y-DOTATOC, which is chemically identical to the therapeutic agent, were compared with results based on the tracer commonly used for somatostatin receptor scintigraphy, ^{111}In-DTPA-octreotide (indium-111 DTPA-D-Phe^{1}-octreotide, OctreoScan).

Methods: Three patients with metastatic carcinoid tumours were investigated. Dynamic and static PET studies with 77-186 MBq ^{86}Y-DOTATOC were performed up to 48 h after injection. Serum and urinary activity were measured simultaneously. Within 1 week, but not sooner than 5 days, patients were re-investigated by conventional scintigraphy with ^{111}In-DTPA-octreotide (110-187 MBq) using an equivalent protocol. Based on the regional tissue uptake kinetics, residence times were calculated and doses for potential therapy with ^{90}Y-DOTATOC were estimated.

Results: Serum kinetics and urinary excretion of both tracers showed no relevant differences. Estimated liver doses were similar for both tracers. Dose estimation for organs with the highest level of radiation exposure, the kidneys and spleen, showed differences of 10.5%-20.1% depending on the tracer. The largest discrepancies in dose estimation, ranging from 23.1% to 85.9%, were found in tumour masses. Furthermore, there was a wide inter-subject variability in the organ kinetics. Residence times (τ_{organs}) for ^{90}Y-DOTATOC therapy were: τ_{liver} 1.59-2.79 h; τ_{spleen} 0.07-1.68 h; and $\tau_{kidneys}$ 0.55-2.46 h (based on ^{86}Y-DOTATOC).

Conclusion: These data suggest that dosimetry based on ^{86}Y-DOTATOC and ^{111}In-DTPA-octreotide yields similar organ doses, whereas there are relevant differences in estimated tumour doses. Individual pretherapeutic dosimetry for ^{90}Y-DOTATOC therapy appears necessary considering the large differences in organ doses between individual patients. If possible, the dosimetry should be performed with the chemically identical tracer ^{86}Y-DOTATOC.

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