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Diagnosis, staging and restaging of NET in patients undergoing peptide receptor radionuclide therapy using receptor PET/CT – state of the art

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Background: Gallium-68 labelled somatostatin analogues (e.g., DOTA-NOC, DOTA-TATE or DOTA-TOC) can be used for the specific detection of neuroendocrine tumours (NET) and receptor positive metastases with high sensitivity (>95–100 %) and very high specificity, allowing a whole-body diagnosis by PET/CT in one diagnostic procedure.

Clinical Indications: If there is strong suspicion of a GEP tumour, or if a NET has been proven by immunohistochemistry, receptor PET/CT (or SMS scintigraphy) should be the first diagnostic procedure for staging (before CT and MRI). Even very small primary tumours and metastases (< 5 mm), which are difficult to diagnose by CT, MRI or sonography, can be detected if the receptor density is high. Further indications are the follow-up after surgery and the diagnosis of recurrences in case of increasing specific tumour markers; the evaluation of therapy response after chemotherapy or biological therapy; and the differential diagnosis of neuroendocrine tumour vs. non-endocrine tumour in case of a space occupying mass, if a final diagnosis can not be obtained by biopsy or operation. The radiolabelling of somatostatin analogues with beta emitters like Yttrium-90 or Lutetium-177 enables an internal peptide receptor radionuclide therapy (PRRT). Especially those patients with slowly growing hepatic and extrahepatic metastases (which are a poor target for chemotherapy) and those, where all surgical options have been used, are good candidates for PRRT as well as patients who are progressing under octreotide therapy or under combined biotherapy and those with persisting symptoms (diarrhoea, flushs) despite high dose hormonal therapy. Patients should be selected for PRRT based on high SSTR expression by Ga-68 SSTR receptor PET/CT. Before each new cycle, restaging is performed in our center by receptor PET/CT (and if needed additionally FDG- or fluoride PET/CT), MRI, and tumour markers (CgA, serotonin).

Conclusions : From the results of more than 1,500 receptor PET/CT studies using different Ga-68 labelled DOTA-SMS-analogues performed in over 400 patients during the last 3 years in our center, we conclude, that there is an essential role for receptor PET/CT in the pretherapeutic evaluation (receptor density) and in the follow-up after treatment. Receptor PET/CT using Ga-68-labelled DOTA-NOC or other SMS analogues enables the molecular imaging of neuroendocrine tumours with very high diagnostic sensitivity and specificity and is becoming the gold standard for imaging of neuroendocrine tumours.

Future Perspectives: In the future, longer lived positron emitters (e.g. Cu-64 or Sc-44 labelled SMS analogues) could enable an accurate patient-specific pretherapeutic dosimetry before peptide receptor radionuclide therapy (individualised therapy).

References

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