3a

Receptor scintigraphy for imaging GEP tumours

E. Bombardieri (Milan)

In these recent years nuclear medicine has contributed to the impressive development of the knowledge in the field of neuroendocrine tumours. This in the field of biology (receptor scintigraphy) and pharmacology (development of new tracers). At present it is impossible to plan any management of a patient with a neuroendocrine tumour, without performing a nuclear medicine study. GEP tumours include a series of neoplasms that origin from the neuroendocrine cells distributed in the gastro-intestinal tract epithelium (carcinoids, islet cell tumours, gastrinomas, insulinomas, glucagonomas, VIPomas). These tumouirs express five distinct somatostatin receptor types (sstr). These receptors have been cloned and cronologically termed sstr1, sstr2 (with two splice variants sstr2A and sstr2B, sstr3, sstr4, sstr5. ^{111}In-labelled pentetreotide specifically binds with high affinity to sstr2. Among the large variety of tracers/nuclear medicine modalities today available the clinical experience and the literature confirm that pentetreotide is the most interesting radiopharmaceuticals of current clinical use. Several new somatostatin analogues are under investigation with different affinity for these receptors: ^{111}In-DOTA lanreotide (MAURITIUS), ^{99m}Tc Vapreotide (RC-160), ^{99m}Tc-Depreotide (P829), ^{123}I Vasointestinal peptide (VIP)

The overall results from the literature and the current experience indicate that ^{111}In-pentetreotide scintigraphy is particularly useful for patients who have small-bowel carcinoids, which may be difficult to localise by conventional methods. SPECT imaging can visualize more lesions than planar imaging or radiological procedures, so it is mandatory in case of clinical doubts. Imaging of carcinoids is indipendent of tumour site or hormonal hypersecretion, and may show distant metastases on whole body scanning. Due to its high sensitivity SST receptor imaging may be particularly useful for localising tumour site when surgery is planned.

Clinical evidences demonstrate that somatostatin receptors have been shown in high concentrations in most malignant islet cell carcinoma. Islet cell tumours arise from endocrine pancreatic cells and are named according to their secreted hormone (gastrinoma, VIPoma, insulinoma); 15 % of these tumours are not associated with the hypersecretion syndrome. Gastrinoma is the most prevalent form of islet cell tumour, accounting for 10 % of all GEP tumours. Reported data on the sensitivity of ^{111}In-pentetreotide scintigraphy vary from 70 to 90 %, and part of the discrepancy is likely be due to non correct scanning techniques and failure to perform SPECT studies.

The SST scintigraphy revealed also high accuracy in detecting VIPomas and glucagonomas, where the sensitivity is about 75 %. The sensitivity of ^{111}In-pentetreotide imaging for the detection insulinomas is generally lower than that found for other islet cell tumours; this is probabily due to a reduced number of somatostatin receptors that bind pentetreotide. Some trials confirm that the sensitivity of ^{111}In-pentetrotide imaging for localizing insulinomas was not so good as for other GEP tumours.

Several large multicentric studies on patients affected by GEP tumours were carried out part of them for staging purposes and part during the follow-up. Whole body and SPECT images were obtained in all patient who were examined also with CT, US and other conventional procedures. The results confirm the diagnostic importance of SST receptor scintigraphy in visualizing these tumours, since it demonstrated to be sometimes superior to the radiological conventional modalities. In particular ^{111}In-pentetreotide imaging reavealed to be very useful for the detection of the site of occult primary GEP tumours, when clinical examination and conventional radiological imaging had failed to do so.

Other investigations evaluated the diagnostic effectiveness of SST scintigraphy by using different protocols of imaging: a qualitative visual method and a semi-quantitative protocol based on the analysis of the tumour/background ratio calculated on SPECT transaxial slices, acquired 4 and 24 hours after administration of the radiolabelled analogue. The diagnostic sensitivity of the two approaches was similar but it is interesting to note that the quantitative method could increase the specificty of the detection. The calculation of the ^{111}In-pentetreotide uptake showed also to have a prognostic value,

since the tumours with poor uptake of the tracer, showed a worse prognosis in terms of response to the therapy and survival.

With respect patient management, ^{111}In-pentetreotide scintigraphy showed to be able to detect previously unknown lesions that were confirmed afterwards in 37 of the 131 patients (28 %).

References

1. Seregni E, Chiti A, Bombardieri E. Radionuclide imaging of neuroendocrine tumours: biological basis and diagnostic results. Eur J Nucl Med 1998; 25: 639-658
2. Virgolini I. Peptide imaging. In: Schiepers C ed. Diagnostic Nuclear Medicine. Springer-Verlag Berlin Heidelberg 2000: 135-158
3. Bombardieri E, Maccauro M, De Deckere E, Savelli G, Chiti A. Nuclear medicine imaging of neuroendocrine tumours. Ann Oncol 2001; 12: S51-S61
4. Chiti A, Briganti V, Fanti S, Monetti N, Masi R, Bombardieri E. Results and potential of somatostatin receptor imaging in gastroenteropancreatic tract tumours. Q J Nucl Med 2000; 44: 42-49
5. Savelli G, Lucignani G, Seregni E, Marchiano A, Serafini G, Aliberti G, Villano C, Maccauro M., Bombardieri E; Feasibility of somatostatin receptor scintigraphy in the detection of occult primary GEP tumours. Nucl Med Commun 2004, 25: 445-449