3b

Current status of PET in GEP tumors

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FDG (18 F deoxyglucose) imaging is a well established and powerful tool, that has already been successfully utilized in numerous oncological fields of metabolic imaging. Different transport mechanisms and varying metabolism of several amino acids, commonly seen in cancers, have been evaluated thus representing useful physiological alterations for imaging with PET (positron emission tomography) and PET – CT.

Neuroendocrine tumors (NET´s) are able to express cell membrane neuroamine uptake mechanism and/or specific receptors (eg somatostatin receptors). The most common gastrointestinal neuroendocrine tumors, arising from enterochromaffin cells of the gastrointestinal tract are carcinoids, being clinically less aggressive than the more common intestinal adenocarcinoma; usually they are well circumscribed round submucosal lesions.

Diagnostics of this heterogeneous group of tumors involve blood, urine and biochemical examination as well as imaging modalities. For staging of gastro – enteropancreatic (GEP) tumors, conventional imaging modalities (CIM) like computerized tomography (CT), magnetic resonance imaging (MRI), ultrasonography, angiography and endoscopy are used for precise localization.

For metabolic imaging established nuclear medicine techniques with 123 I metaiodobenzylguanidine (MIBG), somatostatin receptor scintigraphy (SRS), vasoactive intestinal peptide receptor scintigraphy (VIPRS) and PET has become most effective. FDG has also been used for diagnostic purposes, but it has not yet demonstrated a significant uptake in well differentiated neuroendocrine tissues.

On the contrary for the detection of other NET's, other PET tracers such as 11 C dihydroxyphenylalanine (for carcinoids and endocrine pancreatic tumors), 11 C hydroxyephedrine (for phaeochromocytomas) and 11 C metomidate (for adrenal cortical tumors) have been developed and introduced as routine procedures. Also 5 – hydroxytryptophan (5 HTP) - a serotonin precursor – was labelled with 11C, showing an increased selective uptake in carcinoids than CT or octreotide.

Finally fluorinated dihydroxyphenylalanine (18 F DOPA), a precursor for the neurotransmitter dopamine is commonly used in the imaging of neurology metabolism and cell process, especially in clinical studies of Parkinson´s disease. 11C labelled 1 - DOPA was evaluated as an alternative tracer, especially for endocrine pancreatic tumors, which usually do not demonstrate enhanced urinary serotonin metabolites. Based on reports in the recent literature DOPA seems also to be useful as a new functional imaging procedure for gastroenteropancreatic, neuroendocrine tumors and medullary thyroid carcinoma providing better results than SRS (somatostatine receptor scintigraphy) and FDG PET. To further improve the method especially to reduce the high renal excretion of the tracer producing streaky artefacts in the area of interest, orally premedication by the decarboxylase inhibitor carbidopa was introduced in order to block the aromatic amino acid decarboxylase enzyme. Thus was leading to a six fold decreased renal excretion while the tumor uptake increased three fold, hence improving the visualization of these tumors.

Functional imaging with PET and/or PET – CT using these compounds is now being employed to complement rather than replace other imaging modalities. For in vivo detection of tumor biological properties, such as malignant potential and responsiveness to treatment, we now face the challenge of establishing new and other PET radiopharmaceuticals that can move us from research towards customized imaging.

Nevertheless, no single imaging technique identifies all the metastatic sites of NET's. The best results may be obtained with a combination of functional imaging such as PET or/and SRS and morphologic imaging with CT and/or MR imaging. Many molecular imaging and therapy modalities for NET's are recently under investigation or being developed, the usefulness of these modalities, however, has to be evaluated by well – designed and multicenter studies.

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