INTRODUCTION

In diagnosing or staging cancer, conventional imaging techniques like CT scanning or MRI usually seem adequate in detecting tumor localizations. Difficulties are encountered, however, when patients harbour small tumors, especially in the abdomen, a site notorious for the lack of sensitivity that is achieved with even the most refined imaging modalities. For the localization of for instance neuroendocrine gastroenteropancreatic tumors, like carcinoids, insulinomas, and gastrinomas, sensitivities of CT and MRI are at most 50%, depending on the size and localization of the lesions. Therefore, much effort has been put into developing other means to visualize such tumors. Because both neuroendocrine and non-neuroendocrine tumors possess peptide hormone and/or growth factor receptors, radiolabeled peptides that bind to such receptors may be of potential use to be applied in tumor imaging and staging. The first of such peptides to be successfully applied in vivo was the radiolabeled somatostatin (SST) analogue $^{[11]}\text{In-DTPA}^6$-octreotide. Experience with in vivo SST receptor imaging (SRI) has been gained in many institutions, and will be summarized in this chapter.

SOMATOSTATIN AND SOMATOSTATIN RECEPTORS

SST receptors (SSTR) have been identified on many cells and tumors of neuroendocrine origin, like the somatotroph cells of the anterior pituitary, and pancreatic islet-cell tumors (1,2). Also cells and tumors not known as classically neuroendocrine of origin, such as activated lymphocytes, lymphomas and breast cancer, may possess these receptors (3,4). The SST analogue octreotide binds to SSTR subtypes str2, str3, and str5 on both tumorous and non-tumorous tissues (See Chapter 6).

Because of its relatively long effective half-life, $^{[11]}\text{In-DTPA}^6$-octreotide is a radiolabeled SST analogue which can be used to visualize SSTR-bearing tumors efficiently after 24 and 48 h, when interfering background radioactivity is minimized by renal clearance.
Scanning Protocol
The preferred dose of $^{[111]}\text{In-DTPA}^0$-octreotide is about 200 MBq. With such a dose it is possible to perform Single Photon Emission Tomography (SPET), which produces tomographic slices of the body. SPET may increase the sensitivity to detect SSTR-positive tissues and gives a better anatomical delineation than planar views. The acquisition of sufficient counts per view and also obtaining spot images with a sufficient counting time instead of performing whole-body scanning with a too low count density, are other important points that may make the difference between a successful localizing study and a disappointing one.

Planar images are obtained with a double head or large field of view gamma camera, equipped with medium-energy parallel-hole collimators. The pulse height analyzer windows are centered over both $^{[111]}\text{In}$ photon peaks (172 keV and 245 keV) with a window width of 20%. The acquisition parameters for planar images (preferably spot views) are 300,000 preset counts or 15 min per view for the head and neck, and 500,000 counts or 15 min for the remainder of the body. If "whole-body" acquisition is used, scan speed should not exceed 3 cm/min. Using higher scan speeds, like 8 cm/min, will result in failure to recognize small SSTR positive lesions and lesions with a low density of these receptors (5). For SPECT images with a triple-head camera the acquisition parameters are: 40 steps of 3 degrees each, 64 x 64 matrix, and at least 30 sec per step (45 sec for SPECT of the head). SPECT analysis is performed with a Wiener or Metz filter on original data. The filtered data are reconstructed with a Ramp filter. Planar and SPECT studies are preferably performed 24 h after injection of the radiopharmaceutical. Planar studies after 24 and 48 h can be carried out with the same protocol. Repeat scintigraphy after 48 h is especially indicated when 24 h scintigraphy shows accumulation in the abdomen, which may also represent radioactive bowel content.

Normal Scintigraphic Findings and Artifacts
Normal scintigraphic features include visualization of the thyroid, spleen, liver, and kidneys, and in part of the patients of the pituitary (Figure 1, panels a-c). Also, the urinary bladder and the bowel (to a variable degree) are usually visualized. The visualization of the pituitary, thyroid, and spleen is due to receptor binding, whereas the uptake in the liver and kidneys is for the most part due to metabolism, although SSTRs have been demonstrated in renal tubular cells and vasa recta (6). There is a predominant renal clearance of the SST analogue, although hepatobiliary clearance into the bowel also occurs, necessitating the use of laxatives in order to facilitate the interpretation of abdominal images.