Acta Oncologica 28 (1989) Fasc. 3

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RADIOLOGIC DIAGNOSIS OF NEUROENDOCRINE TUMORS

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Abstract

The radiologic work-up of a patient with a pancreatic endocrine tumor should follow a strict course. Ultrasonography as the first procedure should be followed by angiography, if possible. Negative ultrasonography should be followed by computed tomography (CT), which, whether positive or negative, is supplemented by angiography. Negative CT and angiography is followed by transhepatic venous sampling. In patients with suspected liver metastases from intestinal and pancreatic endocrine tumors, angiography may reveal more metastases than CT and ultrasonography.

Key words: Neuroendocrine tumors, radiological diagnosis, ultrasonography, CT, angiography, transhepatic venous sampling.

The radiologist is not involved in the work-up of pancreatic endocrine tumors until clinical and laboratory findings indicate the presence of such a tumor. The radiologic approach is continuously changing, with the refinement of diagnostic modalities.

Ultrasonography (US) is used as the first screening technique and may be able to localize tumors down to 1 cm in diameter under favorable conditions (1). However, parts of the pancreas are often obscured by gas-filled loops of the bowel.

Whether negative or positive, US is in most cases followed by computed tomography (CT), plain and after intravenous contrast enhancement. The success rate in localizing a tumor in this way is unfortunately low (Table) but CT may be useful in order to support the findings made with US. Whatever technique is used to identify a tumor one has to be aware of the fact that radiological methods can never give a histologically specific diagnosis. US and CT can only show the presence of a tumor or tumor-like lesion and the findings may be identical for an islet cell tumor, a pancreatic carcinoma, cystadenoma and pancreatitis. Even if clinical history and laboratory tests indicate an islet cell tumor, one has to consider the possibility of two different lesions. However, percutaneous biopsy can often easily be performed in the light of the radiological findings and offers the possibility of cytologic, histologic and histochemical examination of the aspirated material.

If a tumor is localized with the aid of US, CT, or both, most surgeons usually prefer to have an angiography performed prior to surgery in order to chart the vascular anatomy. This examination may reveal an additional tumor and the diagnostic accuracy may be even more improved by angio-CT (CT scan during injection or contrast into the celiac and superior mesenteric artery). We have in this way detected tumors not otherwise visualized.

Angiography in a patient with an endocrine pancreatic tumor has to be performed with extreme care with selective catheterization of at least the splenic and gastroduodenal arteries in addition to contrast injected into the celiac and superior mesenteric arteries. Incidentally we have found that contrast injection into the superior mesenteric artery during balloon occlusion of the splenic artery can further improve the diagnostic possibilities.

If US, CT, and angiography are all negative, percutaneous transhepatic venous sampling is performed. Depending on the angiographic experience available, this venous sampling is done from the major venous branches around the pancreas, i.e. the splenic vein, the portal vein and the upper part of the superior mesenteric vein. Selective sampling from pancreatic veins draining into these major veins increase the accuracy of the localization of a tumor (2). Simultaneous sampling of blood from hepatic veins is of importance to detect a gradient over the liver indicating liver metastases.

Presented at the Kettilö meeting, June 12–15 1988.

Table 1

Success rate in diagnosis of islet cell tumors (see ref. 1)

Ultrasound	12/20 (60%)
CT	9/21 (42%)
Angiography	20/31 (65%)
Venous sampling	13/16 (81%)
Intraoperative ultrasound	9/9 (100%)

Regardless of the findings at preoperative diagnostic examinations, intraoperative US should be performed to check the previous findings and perhaps disclose additional tumors (1).

Liver metastases from neuroendocrine tumors can also be diagnosed by US, CT and angiography. US is usually used as a screening method followed by CT with unenhanced and contrast enhanced scans. Metastases from neuro endocrine tumors are usually rather vascular which increases the chance for angiographic detection and angiography has been shown to be more accurate than CT for detection of small metastases (3). A new liver specific contrast material for CT will markedly improve diagnostic accuracy and may reduce the need for angiography in the future unless embolization is planned (4).

It is rather pointless to compare reports of success rates in the radiological diagnosis of neuroendocrine tumors from different institutions, as the techniques are so different. Contrast enhanced CT can be done after intravenous injection of the contrast prior to the scanning of the whole pancreas, bolus injection of the contrast immediately before each scan, and finally the scans can be done after arterial contrast injection. Moreover, venous sampling in major veins is not as accurate as sampling in pancreatic veins draining into these larger veins. Angiography with injection of contrast material into the main trunk of the celiac artery or the superior mesenteric artery is less accurate than more selective catheterization of pancreatic arterial branches.

Carcinoid tumors of the bowel are often diagnosed first when the patient presents with carcinoid syndrome. In such a case, liver angiography may reveal the metastases and injection of contrast material into the superior or inferior mesenteric artery, can demonstrate arterial changes characteristic for a carcinoid tumor with a desmoid reaction in the mesentery. Very few patients present with blood in the stools, and in such patients a barium examination can reveal a polypoid lesion in the bowel. Other patients may present with signs of bowel obstruction produced by a carcinoid tumor in which case surgery reveals the correct diagnosis.

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