

## Tips and Tricks

# Mangan-enhanced MR imaging for the detection and localisation of small pancreatic insulinoma

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**Abstract.** Insulinoma is the most common pancreatic endocrine tumor. Localization of small tumors remains a diagnostic challenge. Recently, Mangafodipir-enhanced MR imaging using a whole-body coil has been shown to be effective in the detection and staging of pancreatic cancer [3]. Localization of even small tumors is improved and surgical techniques, such as robotic-assisted surgery, have been made possible.

**Keywords** Insulinoma · Diagnosis · Surgical therapy · Mangafodipir-enhanced MRI

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## Insulinoma

Insulinomas are rare tumors and account for 90% of all endocrine pancreatic tumors [2].

The presence of a solitary tumor is typical in these cases. In 10% of cases insulinomas may occur in multiple sites especially in multiple endocrine neoplasia (MEN) type-I syndrome [2, 8].

Malignant insulinomas appear in 10% of cases. Insulinomas occur at every age, but mainly around age 50 years. Due to its small size, diagnostic localization is often difficult [8].

## Diagnosis

In the past, diagnosis was based on the clinical pattern and, in particular, on Whipple's triad: signs and symptoms of fasting hypoglycemia; blood glucose level <50 mg/dl; and the disappearance of symptoms after glucose administration.

At present, the first step in the evaluation of patients with suspected insulinoma is an accurate biochemical investigation that consists of simultaneous serial measurements of serum glucose and insulin levels during a 72-h fast.

The second step is the preoperative identification and localization of the tumor [4].

## Topographic diagnosis

Abdominal sonography, CT, angiography, and MR imaging are the most commonly used modalities for preoperative localization of insulinomas [4].

Recent studies have shown that contrast-enhanced MRI is comparable or superior to other imaging modalities such as CT and/or angiography and/or endoscopic retrograde cholangiographic pancreatography in patients with pancreatic tumors [1].

Currently, no single diagnostic imaging modality is reliable for localizing insulinomas [5].

The combination of abdominal sonography and MR imaging represents the first radiological approach in clinically suspected insulinomas. Both CT and angiography should be reserved for negative and/or doubtful cases [4].

Gehl et al. [9] reported that IV infusion of 10  $\mu\text{mol/kg}$  Mangafodipir results in a signal intensity of 98% in the parenchyma. There is only very little uptake of the agent in tumors, which results in a reliable increase in contrast enhancement in pancreatic tumor contrast of more than 200%, thus improving the detectability of pancreatic cancer. Since 2001, Mangafodipir trisodium has been licensed for the use in pancreatic MR imaging in many EU countries [7].

Technical advances, such as high field strength MR imaging with a phased-array coil, and ultrafast imaging, have provided excellent results in terms of detection and staging of pancreatic cancer [3], thus increasing the sensitivity of MRI in the detection of liver metastases.[7]

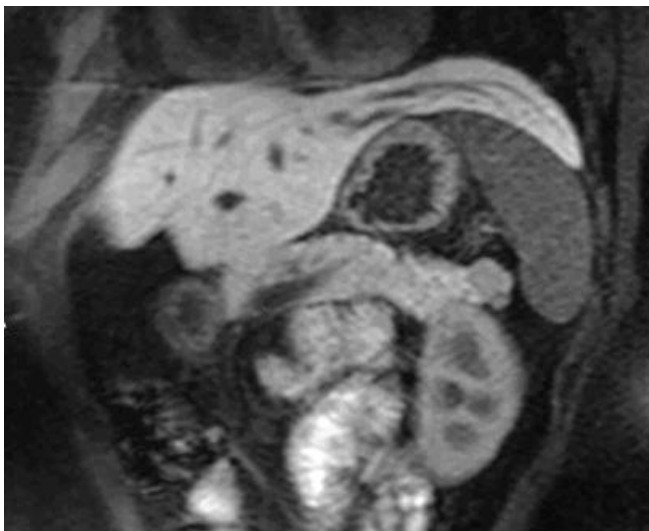
Magnetic resonance imaging with the administration of Mangan as contrast agent has shown a small lesion of approximately 10 mm positioned in the anterior part of the pancreatic tail, without Mangan-specific enhancement. No liver metastases have been documented.

The accurate localization of the tumors was based on the MR imaging, and the operation (Telerobotic-assisted laparoscopic resection of the pancreatic tail) was performed on 30 January 2003. No complications were observed.

Surgery is the only procedure that can cure patients with insulinoma. Traditionally open surgery is frequently employed for these benign small-size lesions, but advancing laparoscopic technology in conjunction with increasing experience in laparoscopic procedures, especially in the field of computer-enhanced telemanipulative surgery, has enabled the surgeon to boost procedural flow and facilitated complex operations such as pancreatic surgery [6].

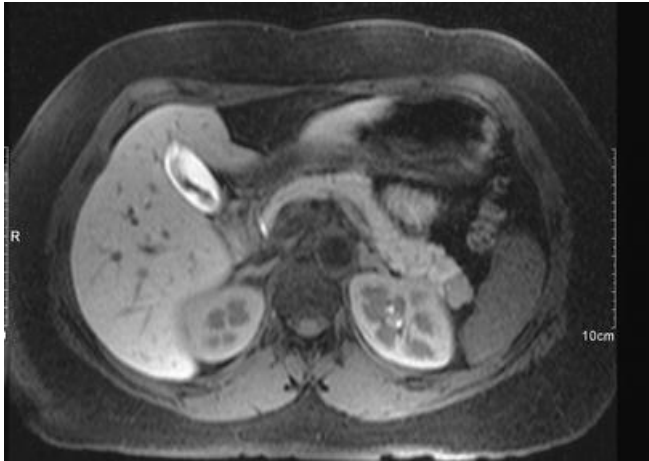
Due to the exact pre-operative localization of the insulinoma, the operation was planned to be performed as a Telerobotic-assisted Laparoscopic resection of the pancreatic tail (DaVinci TM, Intuitive Surgical R Sunnyvale USA).

The insulinoma was found at the top of the pancreatic tail exactly matching preoperative imaging results. After complete mobilization of the pancreatic tail, resection was performed using an endoscopic linear stapling device with normal post-operative course (Figs. 1, 2, 3, 4, 5).



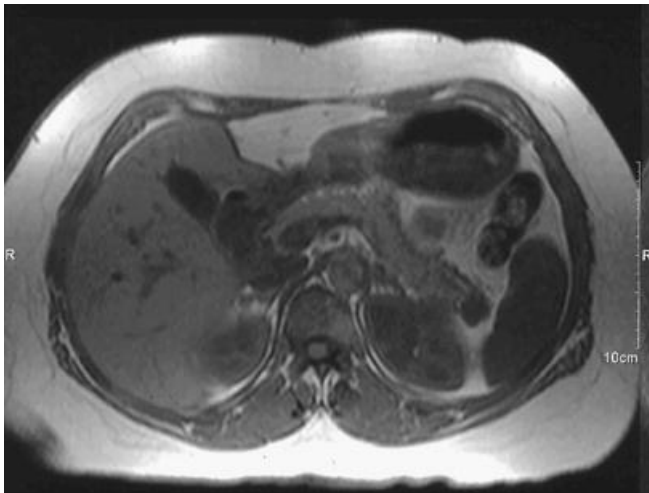
**Fig. 1.** Coronal MR imaging of the abdomen after contrast administration demonstrates a small lesion in the pancreatic tail without Mn-DPDP enhancement (vibe coronal-plane enhanced)

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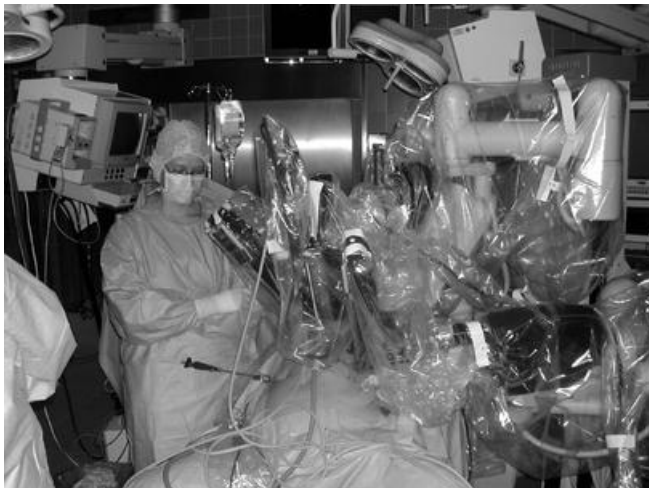
**Fig. 2.** Upper abdominal MR imaging for the same patient as in Fig. 1 demonstrates the same lesion, this time in axial slice orientation (vibe sagittal-plane enhanced MRT, with fat saturation)

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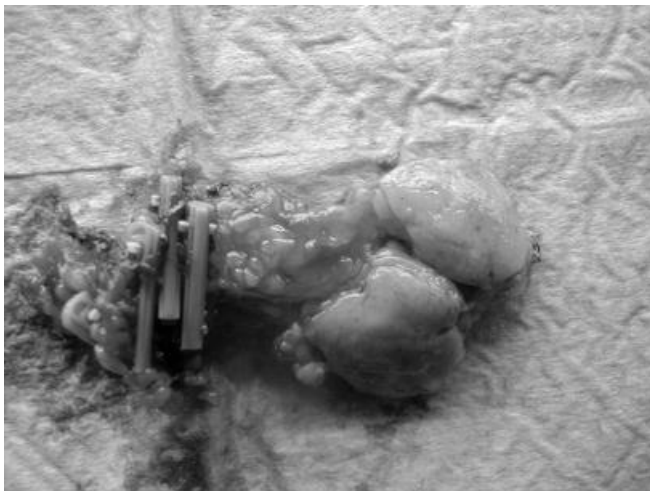
**Fig. 3.** T1-weighted sequence (TR 500 ms/TE 17 ms, conventional MRI) reveals hypodense lesion in the tail of the pancreas in the same patient

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**Fig. 4.** Telerobotic-assisted resection of the pancreatic tail for insulinoma, operative setting

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**Fig. 5.** Insulinoma after resection

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Insulinomas are the smallest tumor of the pancreas which are most difficult to locate. The recently developed diagnostic techniques and tissue-targeted contrast agents, such as MR imaging with the administration of Mangafodipir, permits the accurate localization of these tumors and enables the surgeon to plan even complex minimally invasive telemanipulative procedures.

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