CT Imaging of Insulinomas – Biphasic or Dynamic?

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History

A 64-year-old female patient, suffering from frequent hypoglycemic attacks, went to a local hospital for a checkup. Clinical and laboratory tests revealed endogenous hyperinsulinemic hypoglycemia. An insulinoma was suspected. A routine abdominal contrast CT was performed, however no tumor was seen. Subsequently, the patient was referred to our institution and a Dynamic CT, covering the liver and the entire pancreas, was performed. The CT data were then used to create different temporal phases and functional parameter maps.

Diagnosis

Perfusion CT images showed an isolated, hyper-perfused lesion in the pancreatic head. The lesion was significantly enhanced in the arterial phase, supplied by the superior pancreaticoduodenal artery, and measured 1.8 × 1.5 cm in size. The non-contrast phase of the liver showed homogeneous hypo-attenuation relative to the intrahepatic vessels with a negative liver-to-spleen attenuation ratio. This suggested a diffuse hepatic fat deposition. A hyperdense stone with a hypodense core, measuring 1.9 × 1.5 cm in size, was shown in the gallbladder. No signs of metastases were seen in the liver or in the adjacent lymph nodes.

The patient underwent surgical removal of the tumor, using a laparoscopic approach, and recovered uneventfully.

Comments

Insulinomas are the most common hyperfunctioning pancreatic endocrine tumors.[1] Primarily, the diagnosis is made based on clinical and laboratory findings. Surgical removal of the tumor is the most effective treatment. Preoperative tumor localization using imaging examinations is important,[1–2] especially when a laparoscopic approach for tumor enucleation is considered. According to published data, substantial subsets of insulinomas are not captured in standard biphasic CT scans. This is due to the fact that the enhancement patterns of isolinomas vary and tumor–parenchyma contrast is time-dependent. For example, insulinomas which are transient hyper-enhancing (30.2%)[3] or iso-attenuating (24.9%),[4] can be missed in biphasic CT scans.

In our institution, a low dose dynamic CT scan protocol is employed for imaging suspected insulinomas. The acquired image data is used to evaluate tumor perfusion, as well as to create multiple phases based on the Time-Attenuation Curve (TAC). Image quality is significantly improved using temporal average and temporal MIP reconstructions provided by *syngo*.CT Dynamic Angio. The applied radiation dose is in a range comparable to a biphasic scan plus a native scan.[5] The amount of contrast agent needed is greatly reduced, compared to that of a biphasic protocol, which applies contrast agent according to patients' body weight –[3] in this case (158 cm, 63.5 kg, BMI 25.4), 45 mL was applied instead of 90 mL.

Our experience with this approach has been promising – the required diagnostic information of tumor perfusion, morphology and vascularity can be acquired in a single dynamic scan dynamic scan with comparable radiation dose and a reduced amount of contrast agent. ●

Reference
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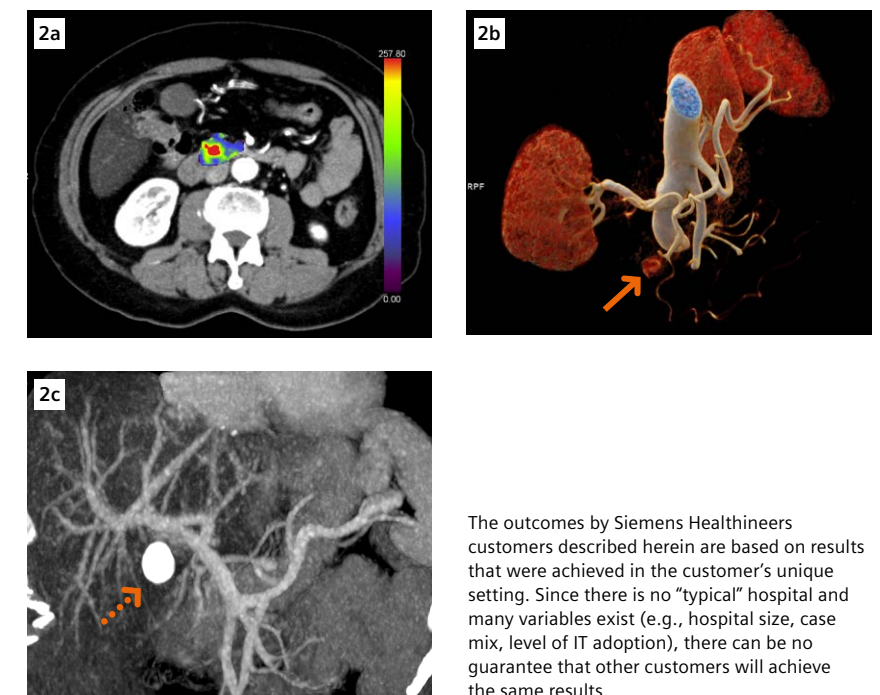
Examination Protocol

Scanner	SOMATOM Force
Scan area	Liver and pancreas
Scan mode	Adaptive 4D spiral
Scan length	176 mm
Scan direction	Bidirectional shuttle
Scan time	45 s
Tube voltage	80 kV
Effective mAs	80 mAs
CTDI$_{vol}$	44.14 mGy
DLP	840.3 mGy cm
Rotation time	0.25 s
Slice collimation	48 × 1.2 mm
Slice width	1.5 / 3 mm
Reconstruction increment	1 / 2 mm
Reconstruction kernel	Br36
Contrast	370 mg/mL
Volume	45 mL + 40 mL saline
Flow rate	5 mL/s
Start delay	6 s

1 Axial CT images (3 mm) of the native (Figs. 1a and 1b), arterial (Fig. 1c) and portal venous (Fig. 1d) phases, created using temporal average reconstruction with *syngo*.CT Dynamic Angio, demonstrate excellent image quality. The liver shows homogeneous hypo-attenuation in the native phase (Fig. 1a) relative to the intrahepatic vessels with a negative liver-to-spleen attenuation ratio. This suggests a diffuse hepatic fat deposition. A hyperdense stone (dotted arrow) with a hypodense core is shown in the gallbladder. A hyperenhanced lesion (arrow) in the pancreatic head is clearly visualized in the arterial phase.
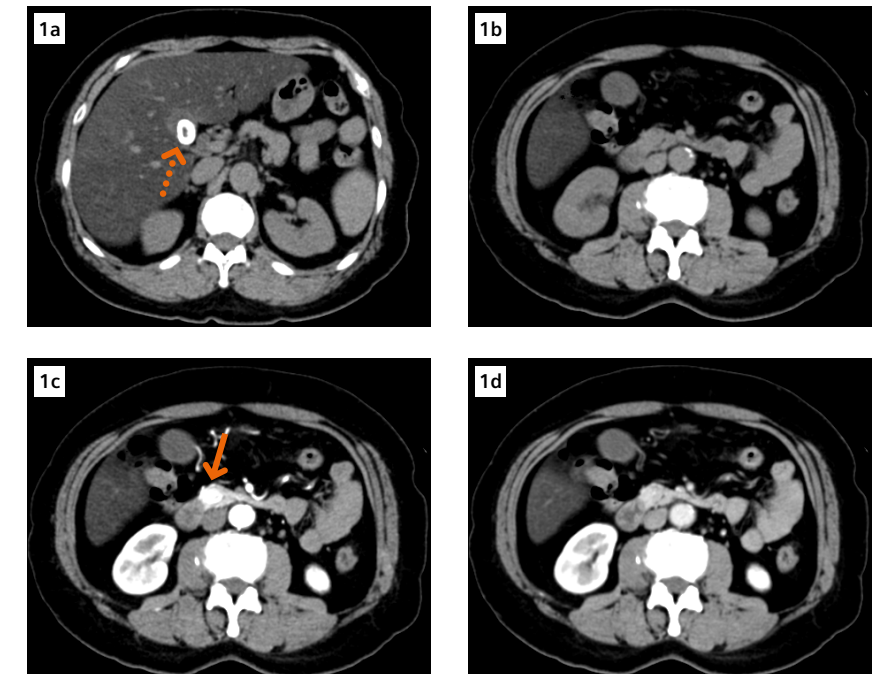
2 CT Perfusion image (Fig. 2a) shows a hyper-perfused lesion with higher Blood Flow, compared to the normal pancreatic tissues, in the pancreatic head. A cinematic VRT image (Fig. 2b) demonstrates tumor blood supply (arrow) from the superior pancreaticoduodenal artery. A MIP image (Fig. 2c) shows a normal portal venous system and a hyperdense gallbladder stone (dotted arrow). The arterial and the portal venous phases were created using temporal MIP reconstruction with *syngo*.CT Dynamic Angio.