Case 14

Pre-operative Detection of an Isoattenuating Pancreatic Insulinoma in Volume Perfusion CT

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History

A 23-year-old female patient, suffering from frequent hypoglycemic attacks, was referred to our institution for suspected hyper-functioning pancreatic endocrine tumor. Clinical and laboratory tests suggested endogenous hyper-insulinemic hypoglycemia. Because previous imaging was unable to localize the tumor, Volume Perfusion CT (VPCT) of the pancreas was ordered by the clinician for insulinoma localization.

Diagnosis

Images acquired by Adaptive 4D Spiral scans were reconstructed in multiple series. Dynamic scans captured the transient hyper-enhancement of the tumor – a hyperenhancing nodule with clear margin in the early arterial phase, washing out quickly and becoming isoenhancing compared to the pancreatic parenchyma in the standard pancreatic arterial phase. The hypervascular nature of the tumor was also reflected by its significantly increased perfusion. On the pseudo-colored perfusion maps, the tumor was shown as a "hot spot", standing out from the background parenchyma.

Comments

Insulinoma is the most common hyper-functioning pancreatic endocrine tumor. Its characteristic manifestation leads to clinical diagnosis. The role of imaging is to detect and to indicate the precise location of the tumor. Since most insulinomas are small, and the changes of pancreatic contour are subtle or absent, tumor localization greatly relies on the enhancement pattern.[1,2] Although insulinomas typically manifest as a hyperenhancing nodule, isoattenuating tumors can be encountered in up to 25% of the cases,[3] which limits the sensitivity of standard biphasic enhanced CT.[4]

VPCT of the pancreas allows for fast, dynamic scans of the pancreas, which are useful in capturing the transient hypervascular flush of the tumors. Since isoattenuating tumors show significant increased blood flow compared to the normal pancreatic parenchyma, VPCT may increase the sensitivity for insulinoma detections. ■

References

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[2] Daneshvar K, Grenacher L,Mehrabi A, Kauczor HU, Hallscheidt P (2011) Pre-operative tumor studies using MRI or CTin patients with clinically suspected insulinoma. Pancreatology 11:487–494.
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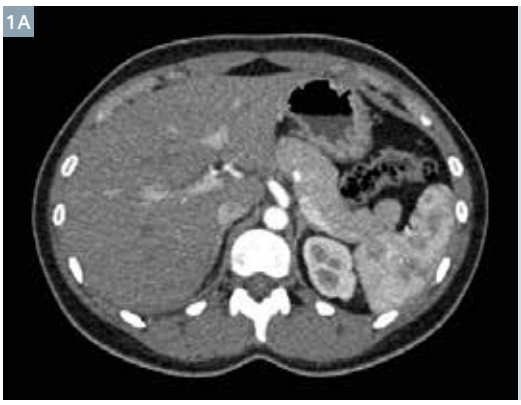

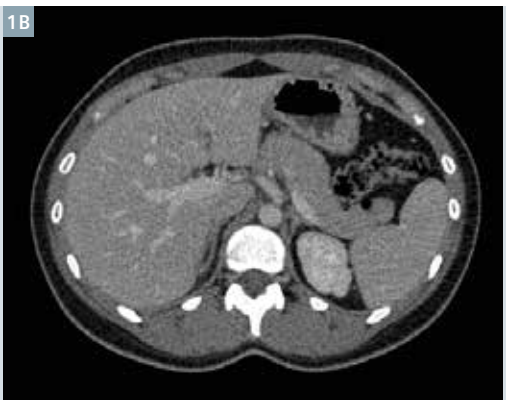

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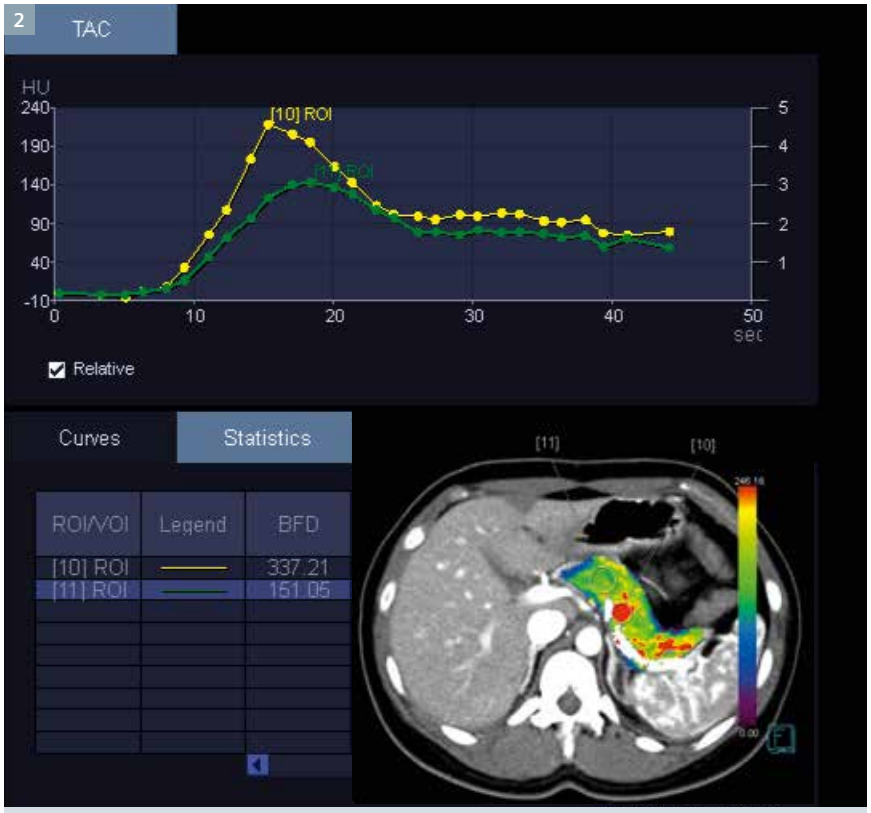
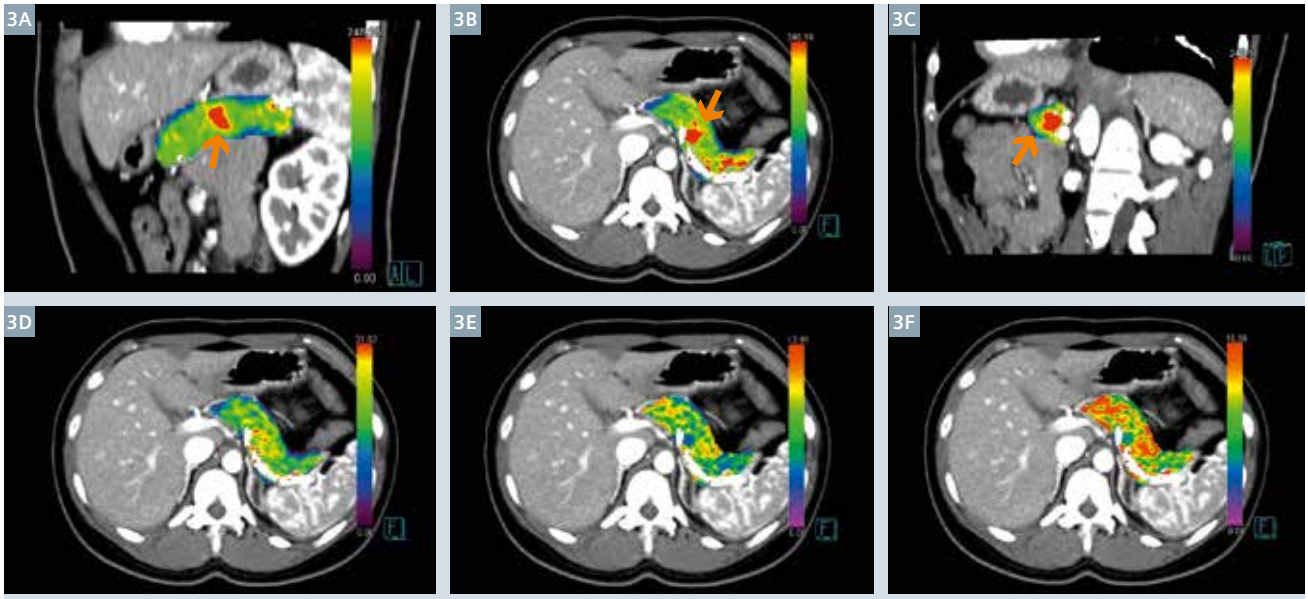
Arterial (Fig. 1A) and portal venous (Fig. 1B) phases of previous CT revealed negative result.

Examination Protocol



2 The tumor-harbouring area (ROI#10) shows more than doubled blood flow than that of the tumor-free area (ROI#11).

Scanner	SOMATOM Force
Scan area	Upper abdomen
Scan mode	Adaptive 4D Spiral
Scan length	176 mm
Scan direction	Bi-directional
Scan time	43.5 s
Tube voltage	80 kV
Effective mAs	55 mAs
$CTDI_{vol}$	30.3 mGy
DLP	577 mGy cm
Effective dose	8.7 mSv
Rotation time	0.325 s
Slice collimation	48 × 1.2 mm
Slice width	3 mm
Reconstruction increment	2 mm
Reconstruction kernel	Br36
Contrast	370 mg/mL
Volume	48 mL + 20 mL saline
Flow rate	5 mL/s
Start delay	6 s



3 Perfusion maps show a higher blood flow (BF, arrows, Fig. 3A – long axis, Fig. 3B – axial, Fig. 3C – short axis), an inconspicuous blood volume (BV, Fig. 3D), a shorter mean transit time (MTT, Fig. 3E) and a shorter Tmax* (Fig. 3F).

*Time needed by a theoretical unit of contrast media to reach the maximum concentration in one specific voxel. Mathematically defined as Tmax = TTS + MTT/2. It reflects the transit time to the center of the IRF (ideal impulsive bolus response function) at the voxel location. Tmax is the sum of the arteries' bolus delay and the tissue transit time to the center of the voxel.