Case 5

CT Volume Perfusion Imaging in a Case of Suspected Pancreatic Cancer

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History

A 62-year-old male patient presented to the hospital, complaining of persistent upper abdominal pain which was exacerbated after intake of fatty foods. He claimed to have lost 15 kg and to have completely quit consuming alcohol in the past two months. Fatty defecation had not been observed, however, a tendency toward obstipation had developed which could be occasionally relieved by inducing vomiting.

The patient had a history of acute pancreatitis, gastrointestinal ulcer bleeding within the duodenum, chronic type B gastritis, and pandiverticulosis.

Endosonography results indicated a suspected chronic pancreatitis. Esophagogastroduodenoscopy revealed erosive gastritis, a gastric voiding disorder as well as an axial hiatus herniation.

A biphasic CT examination of the chest and abdomen, as well as perfusion imaging of the pancreas, were requested for further evaluation.

Diagnosis

CT images revealed a hypodense lesion, measuring 6.4 × 3.2 cm, in the corpus of the pancreas. The lesion was compressing the portal vein, had infiltrated the splenic vein and reached the coeliac trunk, the common hepatic artery and the gastroduodenal artery. It also surrounded the left gastric artery, and the splenic artery which was constricted by the lesion. Extensive paragastric collaterals were formed.

No suspicious lymph nodes or metastases were seen within the chest and abdomen. Compared with the supposedly healthy and normally perfused tissue of the pancreatic head, the lesion was hypoperfused.

MRI confirmed the CT findings, showing a contrast-enhanced lesion with moderate diffusion restriction.

The patient underwent surgical exploration and resection. The histopathology revealed local advanced pancreatic adenocarcinoma.

Comments

Organ perfusion CT studies provide anatomical as well as functional information, which is useful for tissue characterization and evaluation of response to therapy.[1] Pancreatic perfusion studies were first performed in the 1990s.[2] However the lack of full organ coverage was the most obvious limitation of this technique, as were the radiation dose concerns that made multiphasic scanning the standard procedure for decades.

With the evolution of larger detectors and dose saving strategies, whole-organ CT perfusion studies are increasingly performed in patients to gain additional functional information.[3]

In this case, it was possible to stay within the diagnostic reference dose values for the complete chest, abdominal and volume perfusion CT scans.

The CT Body Perfusion application of the *syngo*.via VA30 allows automatic motion correction and noise reduction, as well as the creation of perfusion maps such as blood flow, blood volume, and flow extraction product (permeability). Before finding its way into clinical routine, large studies are needed in order to investigate the robustness of the perfusion parameters and to define possible cut-offs that help to properly interpret the quantitative measurements. ■

References

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[3] Xie Q, Wu J, Tang Y, Dou Y, Hao S, Xu F, Feng X, Liang Z. Whole-organ CT perfusion of the pancreas: impact of iterative reconstruction on image quality, perfusion parameters and radiation dose in 256-slice CT-preliminary findings. PLoS One. 2013 Nov 26;8(11):e80468. doi: 10.1371/journal.pone.0080468.

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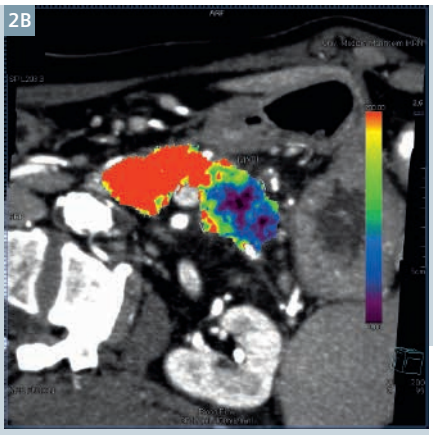
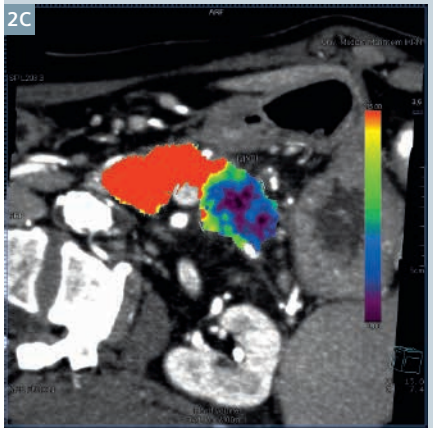
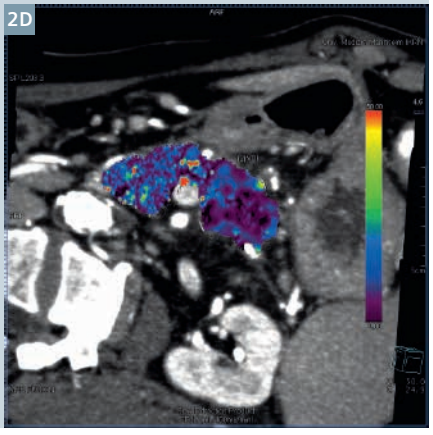
Curved MPR (Fig. 1A) and VRT (Fig. 1B) images show that the lesion was compressing the portal vein, had infiltrated the splenic vein and reached the coeliac trunk, the common hepatic artery, and the gastroduodenal artery. It also surrounded the left gastric artery and the splenic artery which was constricted through the lesion. The extensive paragastric collaterals that were formed can also be seen.







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In comparison with the normal pancreatic tissue, the adenocarcinoma revealed hypodensity in the temporal MIP (Fig. 2A), less blood flow (Fig. 2B), less blood volume (Fig. 2C) and a decreased flow extraction product (Fig. 2D).

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Relative time-density curves (ROI#3 in yellow = normal pancreatic tissue; ROI#4 in green = adenocarcinoma).

Examination Protocol

Scanner	SOMATOM Force
Scan area	Upper Abdomen
Scan mode	VPCT
Scan length	174 mm
Scan direction	Adaptive 4D spiral
Scan time	43 s
Tube voltage	70 kV
Tube current	200 mAs
Dose modulation	–
$CTDI_{vol}$	46.66 mGy
DLP	914.9 mGy cm
Rotation time	0.33 s
Slice collimation	48 ×1,2 mm
Slice width	1.5 mm
Reconstruction increment	1.0 mm
Reconstruction kernel	Br36
Contrast	400 mg / mL
Volume	50 mL + 50 mL Saline
Flow rate	5 mL / s
Start delay	5 s