

## Postoperative bleeding after pancreaticoduodenectomy: CT findings and role

Published on 20.11.2015

**DOI:** 10.1594/EURORAD/CASE.13174

**ISSN:** 1563-4086

**Section:** Abdominal imaging

**Area of Interest:** Pancreas Biliary Tract / Gallbladder

**Procedure:** Surgery

**Procedure:** Diagnostic procedure

**Imaging Technique:** CT

**Special Focus:** Haemorrhage Neoplasia Case Type:

Clinical Cases

**Authors:** Tonolini Massimo, MD.

**Patient:** 76 years, male

### Clinical History:

An elderly male with an unremarkable past medical history underwent pylorus-preserving pancreaticoduodenectomy (Traverso technique) to remove a pT3N1G2 common bile duct adenocarcinoma.

After an uneventful early postoperative course, 7 days after surgery he experienced sudden hypotension, abdominal pain and distension, blood from the drainage tube and laboratory signs of blood loss.

### Imaging Findings:

Preoperative CT (Fig.1) confirmed physical and laboratory findings of obstructive jaundice, by depicting moderately dilated intrahepatic bile ducts, gallbladder and common bile duct above a "tapering" choledochal stricture.

Before hospital discharge, when the patient's clinical conditions suddenly worsened emergency multidetector CT was performed to investigate surgeon's suspicion of acute haemorrhage. Unenhanced acquisition (Fig.2) revealed haemoperitoneum, abundant recent blood near to the pancreatico-jejunostomy, in the mesentery and right lateroconal and anterior pararenal spaces. CT-angiographic acquisition (Fig.3) did not detect active arterial bleeding or pseudoaneurysms amenable to transarterial embolisation, particularly at the characteristic bleeding site represented by the gastroduodenal artery "stump". The pancreatic body-tail remnant showed normal size, morphology and enhancement. Serpiginous contrast extravasation consistent with venous bleeding (Fig.4) was seen within the mesenteric blood.

Immediate laparotomy confirmed haemoperitoneum and stopped oozing venous bleeding at the transverse mesocolon. The patient ultimately recovered after repeated abdominal toilet.

### Discussion:

Pancreatico-duodenectomy (PD) is the standard surgical treatment for neoplasms of the pancreatic head, common bile duct, periampullary region and duodenum. An aggressive, high-risk surgery including multiple anastomoses, PD currently carries acceptable (1-3%) mortality but remains associated with substantial (40-50%) postoperative morbidity. Following PD, iatrogenic complications often result in prolonged hospitalization or readmission after discharge (20-25%), and frequently require demanding postoperative investigations, interventional procedures or repeated surgery. Post-PD complications include delayed gastric emptying, pancreatic fistula (PF), leaking gastrojejunostomy, biloma, bleeding, abscesses, portal-mesenteric venous thrombosis, and acute pancreatitis of the remnant gland in descending order of frequency [1-3].

Post-PD haemorrhage (PPDH) occurs in a minority (<10%) of patients but is responsible for 28-38% of in-hospital

mortality. Early bleeding develops within 24 hours from surgery, is generally severe, and commonly (nearly 50% of cases) result from inadequate ligation of the gastro duodenal artery at its origin from the hepatic artery. Conversely, the more frequent late PPDH occurs after a variable time (up to ten weeks), and is preceded by PF, anastomotic leak or intra-abdominal sepsis in approximately one-half of cases. Whereas extraluminal PPDH is heralded by blood from drainage tube or abdominal wound, the less common (33% of cases) intraluminal (within jejunum) haemorrhage manifests with hematemesis or melaena. In both cases, variable degrees of abdominal pain, signs of haemodynamic impairment and dropping haematocrit are present. Unfortunately, clinical and laboratory findings may not accurately reflect the true entity of bleeding [4, 5].

Rapid diagnosis and treatment of PPDH are imperative. After PD, haemodynamically stable patients who do not require immediate laparotomy, multidetector CT reliably allows detection of post-surgical complications, and is crucial to investigate suspected early or late haemorrhage. CT may depict hyperattenuating effusion consistent with haemoperitoneum, peripancreatic or retroperitoneal blood collections, and more hyperdense (45-70 Hounsfield Units) "sentinel" clots nearby the bleeding site. Furthermore, contrast-enhanced acquisition including CT-angiography study shows the postoperative vascular anatomy, and may precisely identify the underlying such as vascular erosions or pseudoaneurysms, active arterial or venous bleeding [5-9].

Currently, angiography and transcatheter arterial embolization is increasingly preferred as first-line treatment for PPDH, and is successful in stopping bleeding without repeated surgery in 75-85% of patients although rebleeding is not uncommon. Laparotomy is necessary in nearly 50% of cases. As this case of severe venous bleeding exemplifies, multidetector CT is vitally important to diagnose PPDH, to guide embolisation or alternatively to direct therapy towards surgery [4, 5, 10, 11].

**Differential Diagnosis List:** Late postsurgical venous bleeding after pancreaticoduodenectomy for bile duct carcinoma., Normal post-surgical appearances, Postoperative pancreatic fistula, Haematoma without active bleeding, Arterial bleeding requiring embolisation, Biloma / abscess collection, Portal-mesenteric venous thrombosis

**Final Diagnosis:** Late postsurgical venous bleeding after pancreaticoduodenectomy for bile duct carcinoma.

## References:

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**Figure 1**

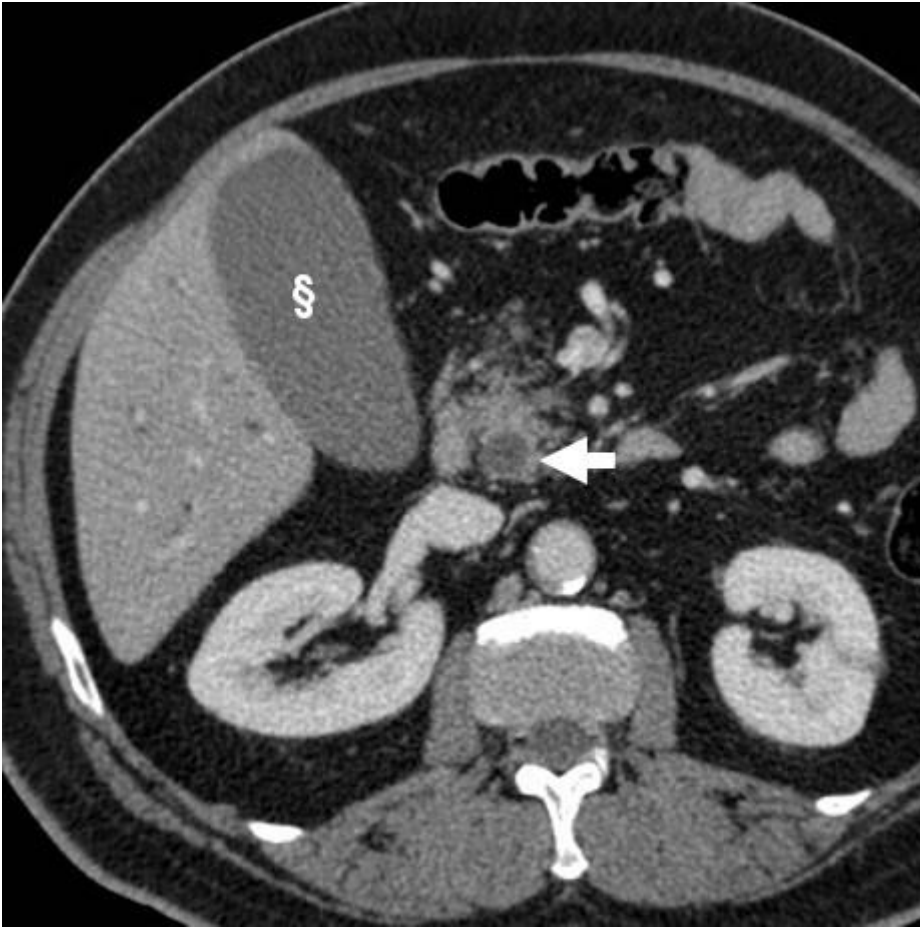
a



**Description:** Multiplanar images from preoperative CT showed moderately dilated intrahepatic bile ducts (+), overdistended gallbladder (§), common bile duct dilatation (short arrows) with distal "tapering" stricture (arrowheads).

Signs of vascular invasion and distant metastases were not seen. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

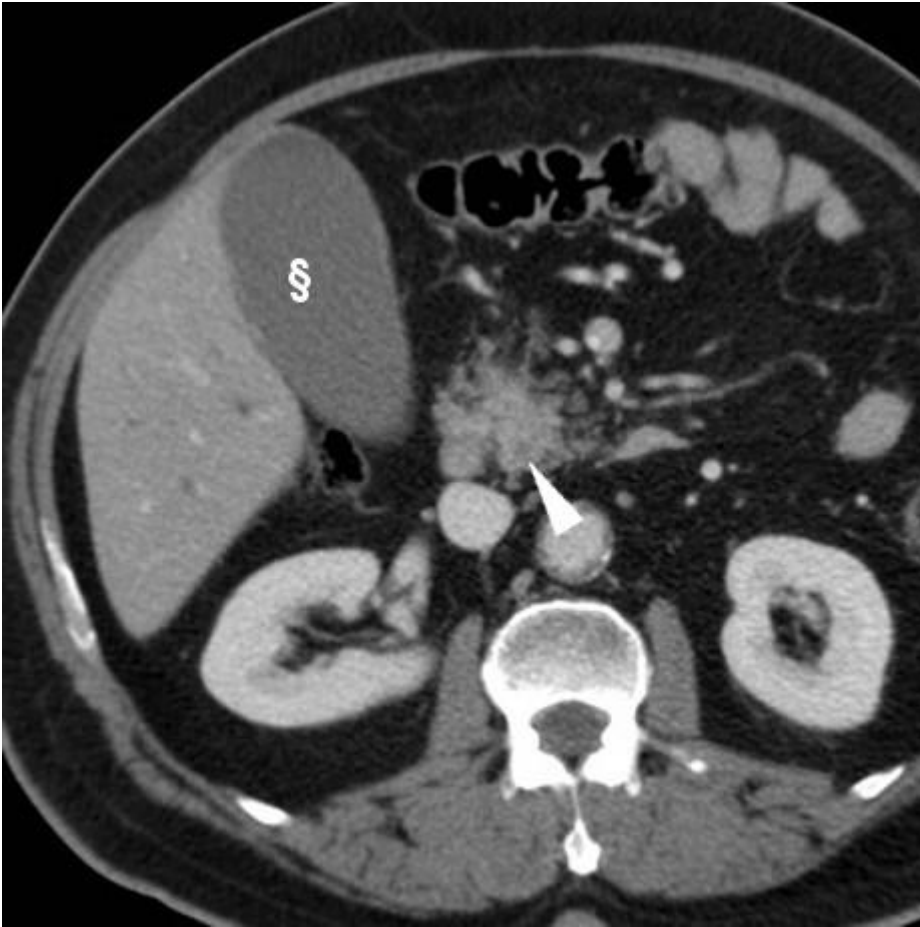
**b**



**Description:** Multiplanar images from preoperative CT showed moderately dilated intrahepatic bile ducts (+), overdistended gallbladder (§), common bile duct dilatation (short arrows) with distal "tapering" stricture (arrowheads).

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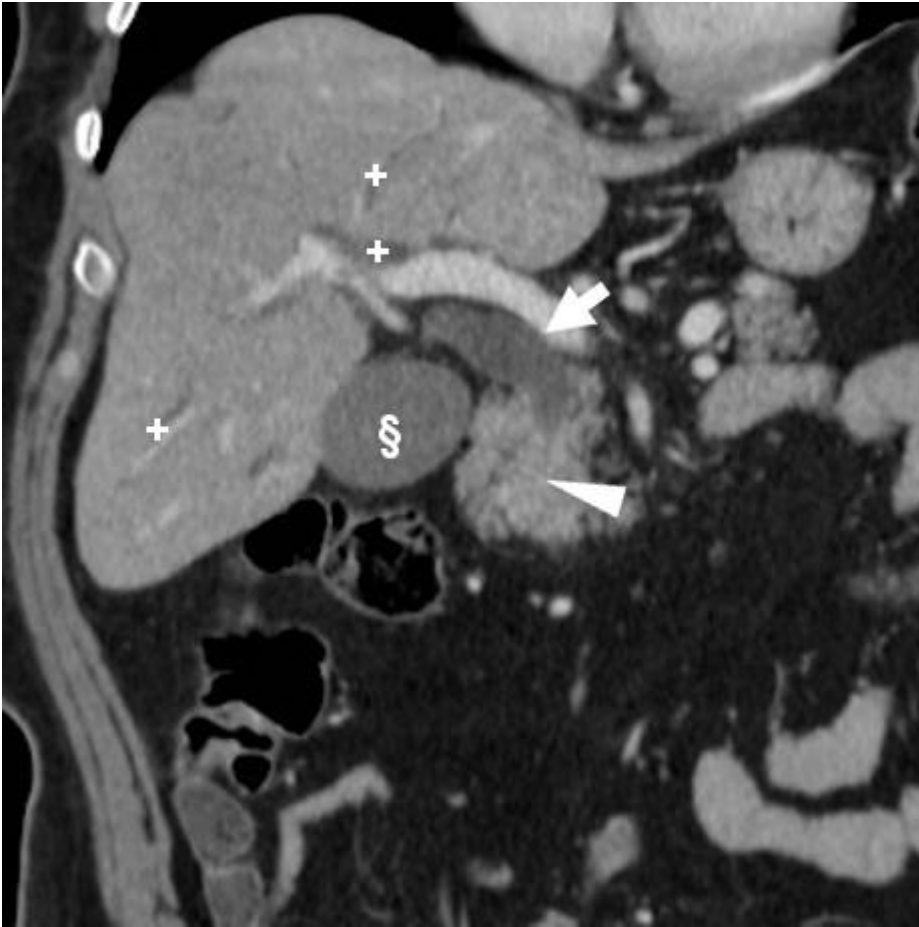
c



**Description:** Multiplanar images from preoperative CT showed moderately dilated intrahepatic bile ducts (+), overdistended gallbladder (§), common bile duct dilatation (short arrows) with distal "tapering" stricture (arrowheads).

Signs of vascular invasion and distant metastases were not seen. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

d



**Description:** Multiplanar images from preoperative CT showed moderately dilated intrahepatic bile ducts (+), overdistended gallbladder (§), common bile duct dilatation (short arrows) with distal "tapering" stricture (arrowheads).

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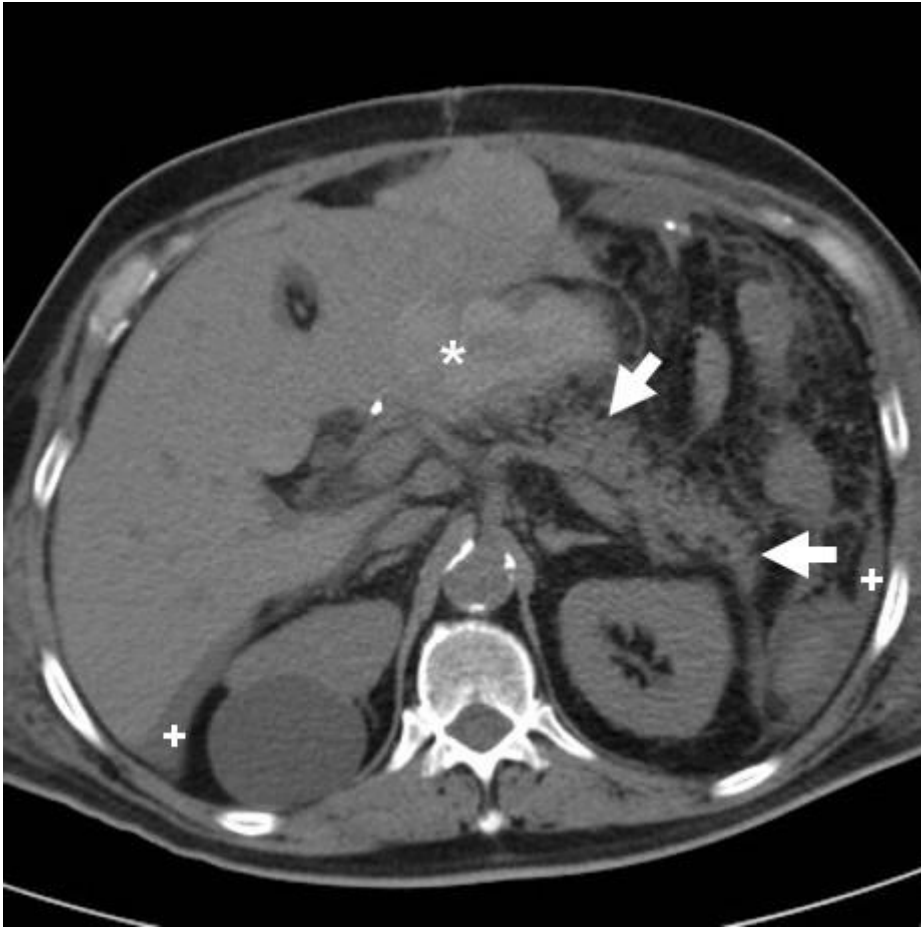
**Figure 2**

a



**Description:** Preliminary unenhanced images showed multi compartmental peritoneal effusion (+) with higher-than water attenuation consistent with haemoperitoneum. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**b**



**Description:** The pancreatic body-tail remnant (short arrows) showed normal size and structure. Abundant mixed hyperattenuating blood (\*) collected near to the site of pancreatico-jejunostomy, and extended ventrally and laterally in the right abdomen. Note haemoperitoneum (+). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

c



**Description:** Abundant mixed hyperattenuating blood (\*) collected near to the site of pancreatico-jejunostomy, and extended ventrally in the mesentery and laterally in the right lateroconal and anterior pararenal spaces. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

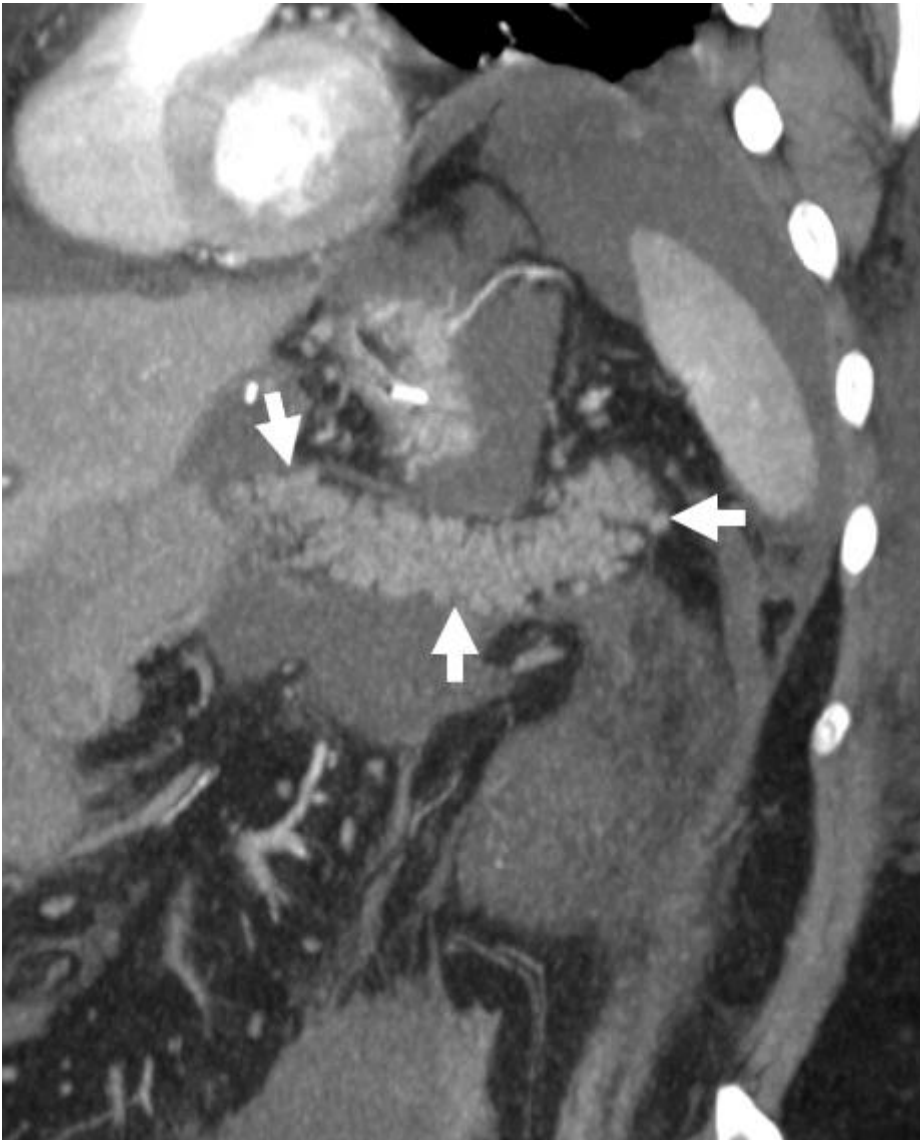
d



**Description:** Sagittal maximum-intensity projection (MIP) reconstruction showed haemoperitoneum in the cul-de-sac (+) and hyperattenuating blood (\*) collecting nearby the surgical site and extending ventrally in the mesentery. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**Figure 3**

**a**



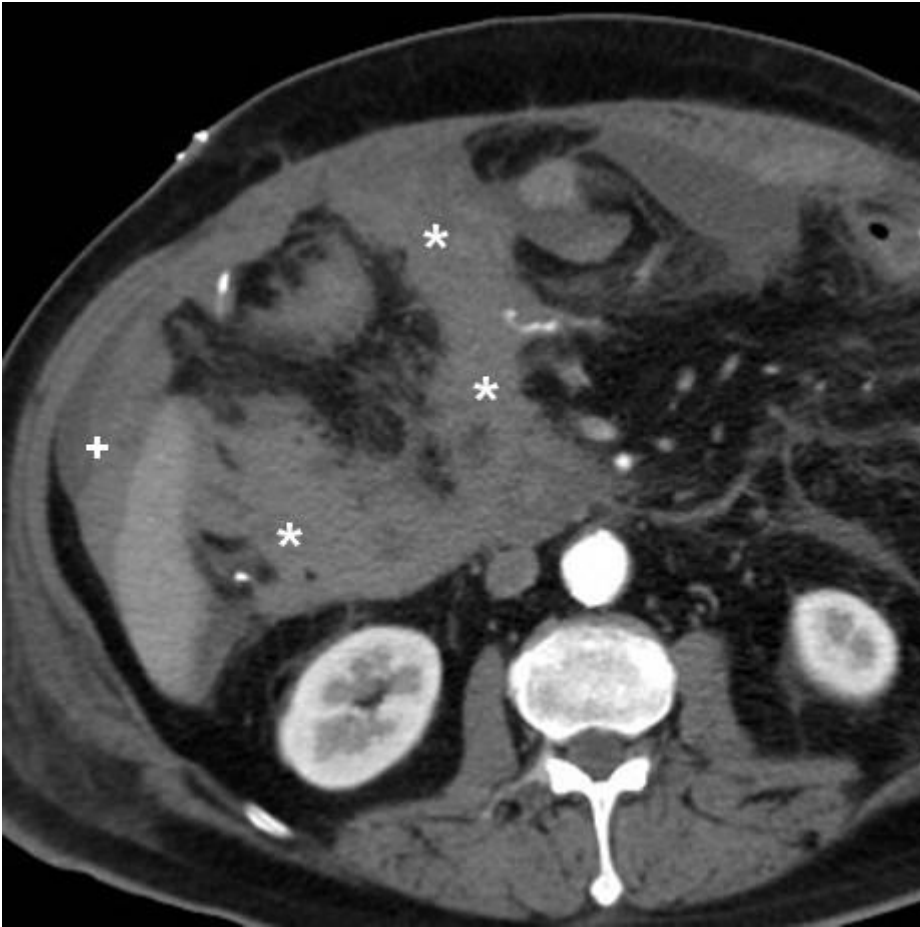
**Description:** The pancreatic body-tail remnant (short arrows) showed normal size, morphology and enhancement. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**b**



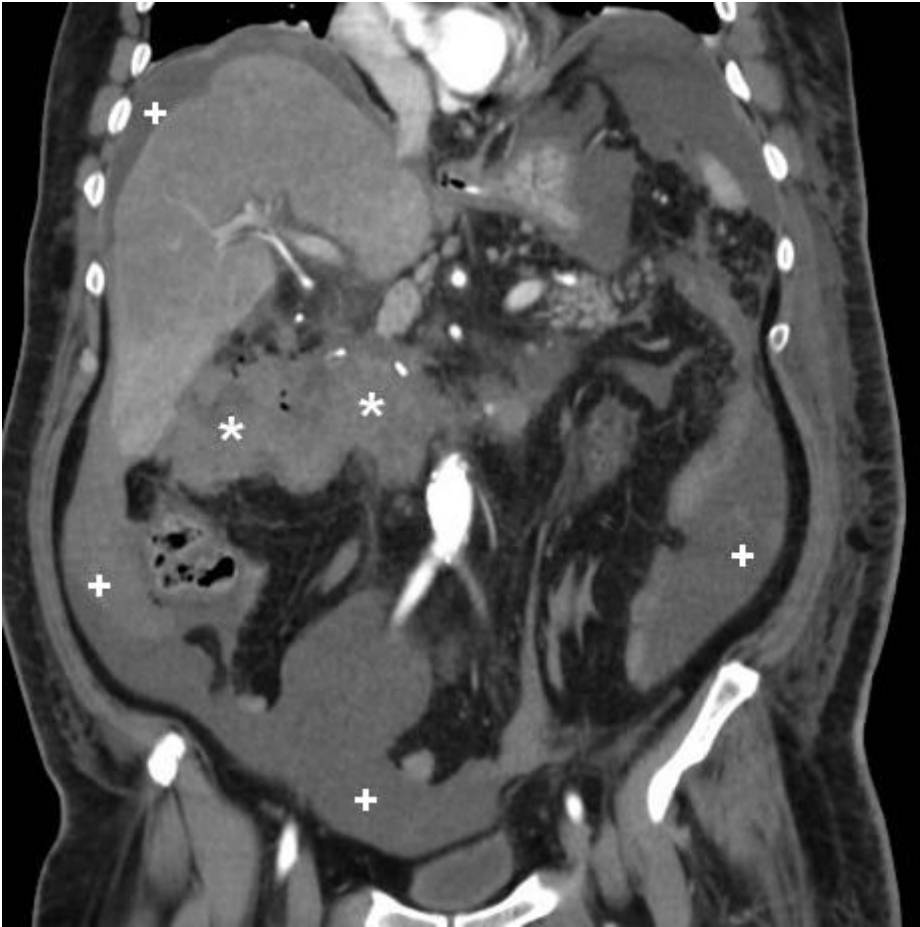
**Description:** Abundant mixed attenuation blood (\*) was seen collecting near the pancreatico-jejunosomy site and flowed ventrally in the mesentery and in the right lateroconal and anterior pararenal spaces. Contrast extravasation indicating active arterial bleeding was not seen. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**c**



**Description:** Abundant mixed attenuation blood (\*) was seen collecting near the pancreatico-jejunosomy site and flowed ventrally in the mesentery and in the lateroconal and anterior pararenal spaces. Contrast extravasation indicating active arterial bleeding was absent. Note haemoperitoneum (+). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

d



**Description:** Abundant mixed attenuation blood (\*) was seen collecting near the pancreatico-jejunojejunostomy site and flowed ventrally in the mesentery and in the lateroconal and anterior pararenal spaces. Contrast extravasation indicating active arterial bleeding was absent. Note haemoperitoneum (+). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

e



**Description:** CT-angiographic maximum-intensity projection (MIP) reconstructions confirmed absence of contrast extravasation indicating active arterial bleeding, particularly at the typical site represented by the gastroduodenal artery stump (arrow in f). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

f



**Description:** CT-angiographic maximum-intensity projection (MIP) reconstructions confirmed absence of contrast extravasation indicating active arterial bleeding, particularly at the typical site represented by the gastroduodenal artery stump (arrow in f). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**Figure 4**

a



**Description:** Venous-phase acquisition confirmed normal aspect of pancreatic remnant (short arrows), haemoperitoneum (+), abundant mixed hyperattenuating blood (\*) collecting near the pancreatico-jejunostomy and extending in the mesentery and in the right lateroconal and anterior pararenal spaces.

**Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**b**



**Description:** Venous-phase acquisition confirmed haemoperitoneum (+) and abundant mixed hyperattenuating blood (\*) collecting near the pancreatico-jejunojejunostomy and extending in the mesentery and in the right lateroconal and anterior pararenal spaces. **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

**c**



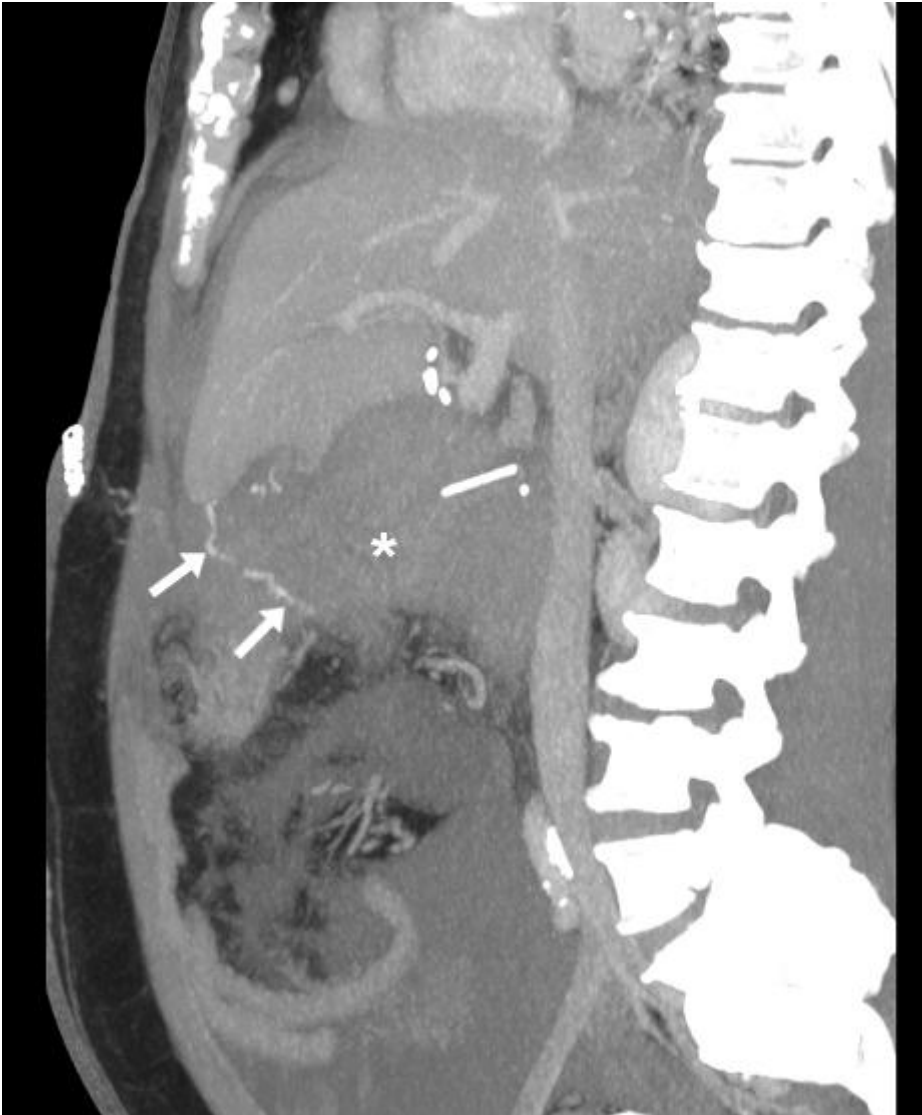
**Description:** Additionally, serpiginous active contrast extravasation (arrows) consistent with venous bleeding was seen within the mesenteric blood (\*). Note haemoperitoneum (+). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

d



**Description:** MIP reconstructions (d,e) depicted serpiginous contrast extravasation (arrows) consistent with active venous bleeding within the mesenterial blood (\*). Note drainage tube (thin arrows). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)

e



**Description:** MIP reconstructions (d,e) depicted serpiginous contrast extravasation (arrows) consistent with active venous bleeding within the mesenterial blood (\*). Note drainage tube (thin arrows). **Origin:** Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)