Acute-phase endovascular management of an uncommon bleeding peripancreatic pseudoaneurysm

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ABSTRACT

Pancreatic pseudoaneurysms represent relatively rare but potentially lethal complications of acute or chronic pancreatitis, involving several visceral arteries. Due to their intrinsic instability and subsequent high risk of massive bleeding, these lesions require prompt treatment, regardless of the size of the pseudoaneurysm. First option of treatment is today represented by transcatheter embolization; this treatment, in fact, shows higher rates of clinical and technical success and lower recurrence rates than conventional surgery. We present a clinical case of endovascular management of a large pseudoaneurysm, measuring 54 x 53 mm (AP x LL), involving right gastric artery in a 35-year-old woman with history of chronic alcoholic abuse presenting with severe anemia.

CASE REPORT

CASE REPORT

A 35-year-old female with a history of chronic alcohol intake, presented to the Emergency Department of our hospital complaining with severe asthenia, mild dyspnea and dependant oedemas lasting since one week; moreover since 4-5 days she noticed intermittent melena.

Hematochemical values showed a severe anemia with RBCs 1.4 10^6/mm³ (4.70-6.10 10^6/ mm³), Hb 2.4 g/dL (14.0-18.0 g/dL), Ht 11.1% (42.0-52.0 %), WBCs 16.09 10^3/mm³ (4.80-10.80 10^3/ mm³), altered indices of hepato-biliary and pancreatic function with pancreatic Amylase 190 UI/L (8-53 UI/L), Lipase 117 UI/L (8-78 UI/L), GOT and GPT counting respectively 104 UI/L (0-40 UI/L) and 37 UI/L (0-35 UI/L), TB 2.28 mg/dl (0.00-1.20 mg/dl) and DB 0.80 mg/dl (0.00-0.25 mg/dl); RFT 0.90 mg/dl (0.60-1.20 mg/dl).

An abdominal ultrasound examination, performed in the emergency department, demonstrated multiple cystic formations likely arising from pancreatic parenchyma (images not available); moreover mild hepato-splenomegaly with pelvic and abdominal fluid was observed. Abdominal computed tomography (CT) examination was immediately performed. CT examination confirmed a widespread subversion of pancreatic parenchyma, with evidence of multiple inhomogeneous hypodense and partially confluent cystic formations, the largest in the pancreatic tail measuring about 6 cm. In the head-body pancreatic junction a round lesion measuring 54 x 53 mm (AP x LL) was detected (Fig. 1 a-b-c). This lesion showed avid and homogeneous enhancement of the inner component in the arterial phase with slow tendency to increase in density in the venous phase.

According to these findings, a bleeding arterial pancreatic pseudoaneurysm was suspected and angiographic examination was promptly performed to confirm the diagnosis and to carry out possible embolization. After obtaining a right common femoral arterial access with a 4F sheath, a selective catheterization of celiac trunk and superior mesenteric artery was performed using a 4F Cobra C1 diagnostic catheter (Cordis Corporation, Miami Lakes, FL, USA). Anomalous origin of the common hepatic artery from superior mesenteric artery, incidentally detected in the CT examination, was

confirmed. The selective angiogram of superior mesenteric artery showed a contrast blush arising from right gastric artery with formation of a pseudoaneurysm. After excluding any other vascular supply to the pseudoaneurysm, the vessel was selectively engaged with a coaxial 2.7F microcatheter (Progreat® Terumo Europe, Leuven, Belgium) (Fig. 2 a-b-c).

Subsequently, coil embolization of donor artery was performed deploying two 3x60mm fibered detachable coils (Interlock™-18 2D Boston Scientific, Cork, Ireland) starting distally to the pseudoaneurysmal neck, according to Sandwich technique, finally obtaining complete coverage of the neck (Fig. 3 a-b).

Fibered coils provide higher thrombogenicity and flexibility and offer adequate control in distal, peripheral vasculature; these coils are compatible with 0.021" lumen microcatheters and can be advanced and retracted before final placement thanks to interlocking arms.

Check-up angiography confirmed total exclusion of the pseudoaneurysm. Fluoroscopy time was about 16 minutes. CT scans performed after the procedure showed staining of contrast medium inside the pseudoaneurysm without evidence of any extravasation (Fig.4 a). The patient was then admitted in the General Surgical Department and finally discharged after 7 days with RBCs 3.34 10^6/mm³ (4.70-6.10 10^6/ mm³), Hb10.1 g/dL (14.0-18.0 g/dL), Ht 32.2% (42.0-52.0 %), WBCs 7.37 10^3/mm³ (4.80-10.80 10^3/ mm³), RFT 0.85 mg/dl (0.60-1.20 mg/dl) and normality of hepato-biliary and pancreatic function indices. Her clinical course did not show any complication.

A follow-up CT examination, performed 6 months after embolization, confirmed exclusion of the vascular lesion; interestingly, the larger pancreatic pseudocyst, previously involving pancreatic tail, showed resolution with evidence of diffuse dilatation of Wirsung duct (Fig.4 b).

DISCUSSION

Etiology & Demographics:

Pancreatic pseudoaneurysms represent rare but potentially lethal complications of pancreatitis.

The incidence of these conditions in chronic pancreatitis ranges between 7% and 10%, while in acute pancreatitis is lower (1-6%). Splenic artery is the most common site affected by this process (30-50% of cases) followed by the gastroduodenal artery (10-15%); isolated involvement of right gastric artery is a very rare condition [1].

Three mechanisms are recognized to cause formation of pseudoaneurysms: enzymatic auto-digestion of pancreas and peripancreatic tissues with arterial wall damage, erosion and conversion of a pseudocyst into a pseudoaneurysm and lastly, pseudocyst eroding the bowel wall and bleeding from the mucosal surface. Concerning literature data, risk factors for future development of a peripancreatic pseudoaneurysm (PPA) are, apart from chronic and acute pancreatitis, previous bilio-pancreatic surgery and, rarely, pancreatic transplantation [2].

Clinical & Imaging findings:

The development of a PPA is usually detected by multi-detector computed-tomography angiography (CTA) and occasionally by Doppler ultrasound (DU). DU is a fast modality that can demonstrate a hypoechoic cystic structure adjacent to supplying artery, the size of the sac and the connection of the sac to the artery. DU characteristically shows the "yin-yang sign" which refers to the to and fro blood movement from the neck into the pseudoaneurysmal sac in the systolic and diastolic phases respectively.

Disadvantages of DU include the limitation in the evaluation of visceral arteries. CTA shows high accuracy in diagnosing arterial injuries; it can demonstrate the full extent of a pseudoaneurysm, in case of partial thrombosis, and its effect on the adjacent viscera [3]. Consecutive post-processing analysis with maximum intensity projections and 3D reconstructions with vessel analysis can be very useful in pre-procedural planning. PPA usually present as an inhomogeneously hyperdense structure in plain scans showing avid enhancement in the arterial phase with increase in density in the venous phase in case of active bleeding.

CTA has the disadvantage of radiation exposure, which is particularly critical in young patients. MRI angiography, despite the advantage of lacking radiation exposure, plays a limited role in urgent conditions [4]. Significant advantages of angiography (DSA) are real-time evaluation of an arterial bed, which includes the accurate identification of the supplying vessel and the assessment of collateral circulation to determine the expendability of parent artery, and the possibility to establish whether dealing with a high or low-flow lesion [3, 5].

Treatment & Prognosis:

These lesions require immediate treatment when diagnosed because of their intrinsic instability, with high bleeding risk independently from the size of the pseudoaneurysm and a mortality rate up to 40% of the cases, depending on severity and duration of pancreatitis [1].

Endovascular embolization is nowadays the treatment of choice for managing pseudoaneurysms in haemodynamically stable patients since it is associated with a lower post-operative morbidity and mortality (4-19%) compared to surgery and a high rate of technical success (67-97%) [6].

Historically, pancreatitis-related pseudoaneurysms were treated surgically; the various surgical procedures included resection and bypass procedure, arterial ligation, and partial or total organ removal. Surgical treatment of a pseudoaneurysm is indicated in case of haemodynamically instable patients, lack or failure of angiographic treatment; besides, it often presents a higher technical complexity, a higher risk of perioperative bleeding and mortality rates of approximately 16% for pseudoaneurysm of the head and 50% for lesions involving pancreatic tail [5]. Endovascular treatment has several advantages compared to open surgical repair, allowing accurate localization of pseudoaneurysm and assessment of

collateral vessels; it is less invasive and associated with a lower recurrent bleeding rate than surgery (ranging from 18-37% of cases) [7]; moreover, if rebleeding occurs, the procedure can be promptly repeated.

Many endovascular treatment options are today available mainly depending on expendability of parent artery and size of pseudoaneurysmal neck.

Parent artery is expendable when adequate extensive collateral circulation is present; in this case aggressive coil embolization can be performed.

Coil embolization of expendable arteries is preferable distally and proximally to the site of extravasation (the so-called "sandwich" technique), thereby preventing backflow from the collateral circulation [3, 8]. In some cases, after performing coil embolization, recanalization of the embolized sac can occur, especially if coils are not packed tightly. In most cases, however, expendability of parent artery and adequate sizing of coils allow to perform complete and rapid exclusion of PPA. If the donor artery is not expendable, it is mandatory to accurately evaluate the neck of the pseudoaneurysm; if the neck is narrow, the lesion may be embolized delivering coils into the sac itself or excluded by releasing a covered stent-graft. If the neck is wide, a covered stent-graft may provide sufficient exclusion of the pseudoaneurysm and it should be preferable than coiling [8, 9]. Stent-graft placement requires a higher profile and a stiffer delivery system; hence pseudoaneurysms arising from tortuous arteries pose a significant technical challenge. Supplementary endovascular options include use of liquid embolic agents or temporary embolic materials (Gelfoam slurry) [10]. Placement of an Amplatzer Vascular Plug can also provide fast and complete occlusion of a large artery feeding a pseudoaneurysm, faster than placing multiple coils [10]. However, these devices are challenging for smaller-sized and tortuous vessels due to their requirement for larger delivery systems and limited manoeuvrability. Another option is the ultrasound (US)-guided percutaneous thrombin injection into visceral pseudoaneurysms; if visualized by US, thrombin can be directly injected into the site of blood extravasation with real-time evaluation for occlusion [11, 12]. Complications associated with endovascular treatment are rare and include failure of treatment, re-bleeding, distal ischemia, non-target coiling or stenting and infections. Lastly, post-procedural haemoglobin and haematocrit values decreases require prompt re-evaluation of patients, performing non-invasive diagnostic imaging modalities, or repeating DSA [8]. It is noteworthy that in some cases endovascular treatment of PPA can be performed in combination with endoscopic management of pancreatic pseudocyst. In fact, even if in some cases pseudocysts tend to resolve spontaneously over time, in several cases they represent an acknowledged risk factor for future development of PPA; hence, especially if symptomatic or complicated, they require treatment. First-line treatment of these lesions is represented by therapeutic drainage, mainly performed with an endoscopic US-guided approach and subsequent trans-gastric or trans-duodenal puncture with final placement of one or more pigtail stents [13]. In conclusion, endovascular treatment represents today a safe and effective technique for management of bleeding PPA, presenting a high success and a low complication rate procedure; in selected cases it can be combined with endoscopic treatment of pancreatic pseudocysts. Endovascular treatment should be always considered the first-line option in the management of PPA in the haemodynamically stable and, in some conditions, unstable patients.

Differential Diagnosis:

Pancreatic pseudocyst

Main differential diagnosis of pancreatic pseudoaneurysm is pancreatic pseudocyst.

Pancreatic pseudocysts are frequent complications in patients with subacute or chronic pancreatitis. These formations are usually not evident in conventional radiography and do not present Doppler signal in US.

CT scans can well depict a hypodense regular formation with thin walls and without contrast enhancement, differently from pancreatic pseudoaneurysms which present avid and homogeneous enhancement in arterial phase with pooling in venous phase if bleeding is present.

Pancreatic pseudocysts are not seen in DSA.

TEACHING POINT

CT-angiography is a fundamental diagnostic tool in suspicion of bleeding peripancreatic pseudoaneurysm to identify the bleeding site and to adequately plan endovascular treatment. When performing DSA it is mandatory to assess expendability of the parent artery in order to select the most suitable embolization technique. Endovascular treatment should always be considered the first-line treatment for bleeding peripancreatic pseudoaneurysms in haemodynamically stable and, in some circumstances, relatively unstable patients.

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FIGURES

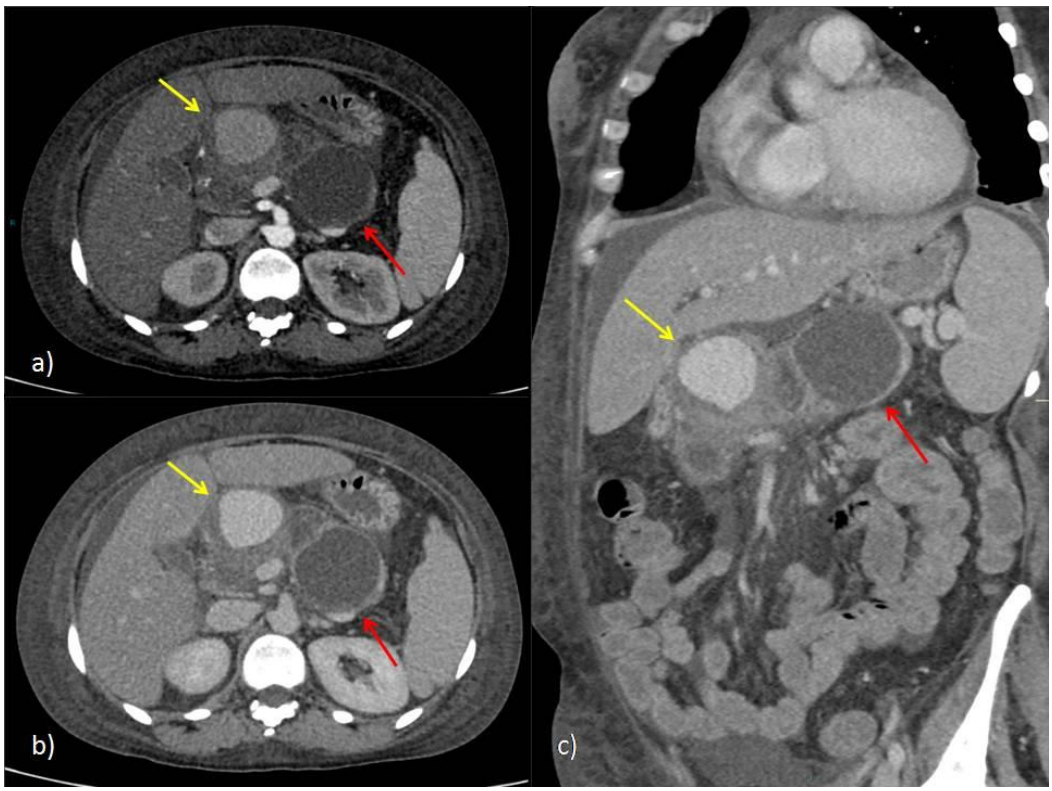

Figure 1: 35-year-old female with bleeding peripancreatic pseudoaneurysm
Technique: Toshiba Aquilion One 320-row scanner computed tomography in axial arterial (a), axial venous (b) and oblique coronal venous (c) phase. 40 mAs, 120 kV, 1mm slice thickness; after intravenous administration of 100 mL of contrast medium (Iomeron 400).
Findings: Axial CT in arterial phase (a) shows a complete subversion of pancreatic parenchyma due to chronic pancreatitis. Moreover a well-circumscribed round lesion, measuring 54 x 53 mm (AP x LL), in the pancreatic head-body junction is evident. The lesion shows avid and homogeneous enhancement in the arterial phase with tendency to increase in density in the venous phase (yellow arrow) (b); the findings are consistent with a peripancreatic pseudoaneurysm. CT images also showing a large hypodense round formation in pancreatic tail, measuring about 6 cm, with slight parietal enhancement as for pancreatic pseudocyst (red arrow). Oblique coronal CT in venous phase (c) better highlights complete subversion of pancreatic parenchyma.

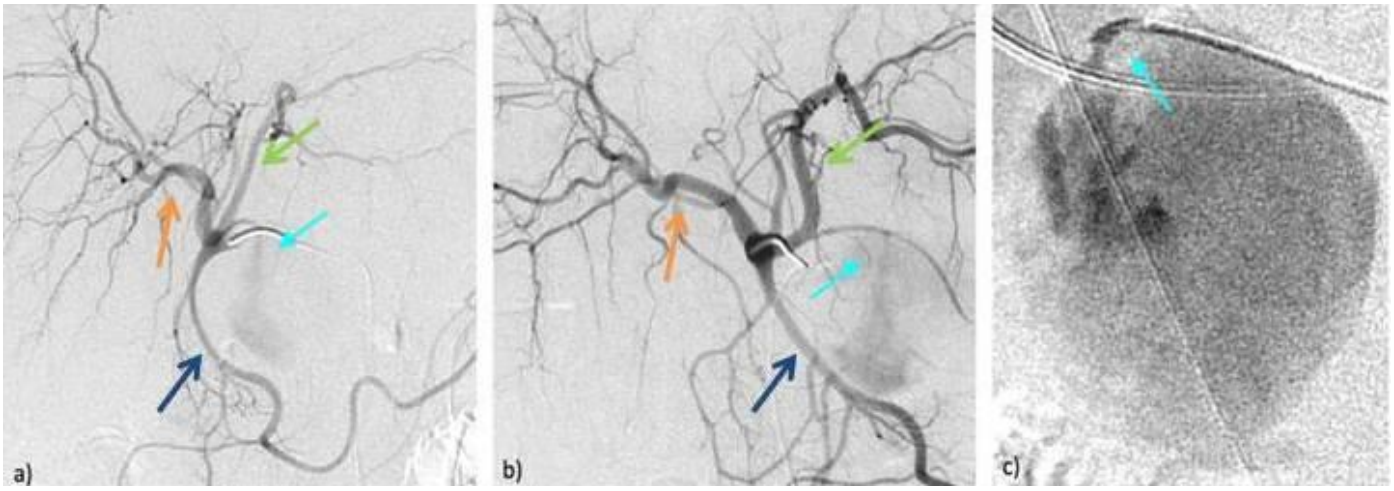

Figure 2: 35-year-old female with bleeding peripancreatic pseudoaneurysm
Technique: Siemens Artis Zee biplane. Antero-posterior projection (a), 40°right oblique projection (b) and latero-lateral projection (c).
Findings: Selective angiogram with injection from proper hepatic artery in antero-posterior (a) and 40° right oblique (b) projection showing active contrast extravasation arising from right gastric artery (light-blue arrow). Selective angiograms (a, b) also showing: right (orange arrow) and left (green arrow) hepatic artery, gastroduodenal artery (blue arrow).
Superselective angiography with injection from gastric hepatic artery (c) confirms extravasation with pooling of contrast medium (light-blue arrow).

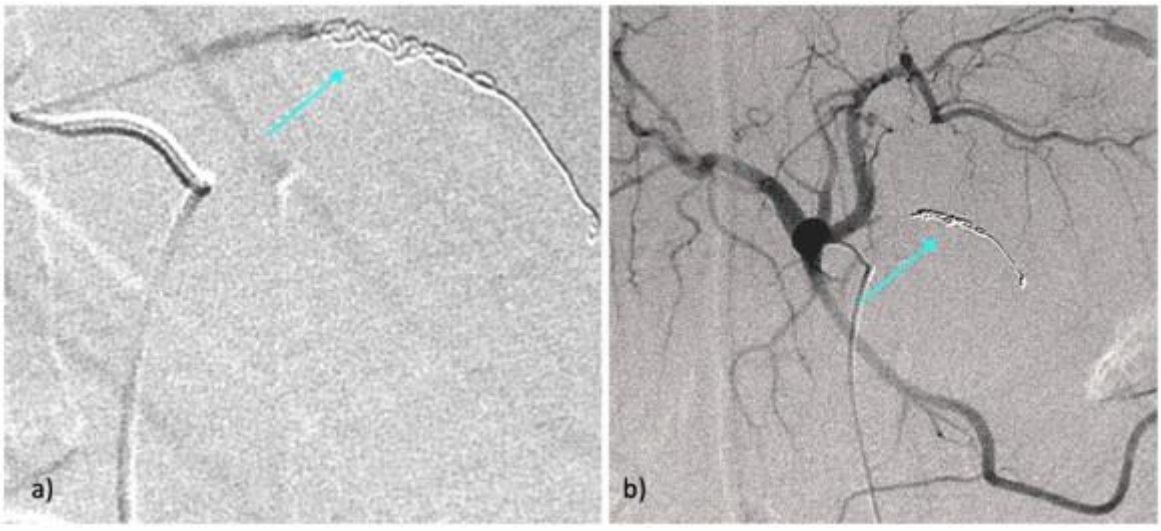

Figure 3: 35-year-old female with bleeding peripancreatic pseudoaneurysm
Technique: Siemens Artis Zee biplane.40° right oblique projection (a, b)
Findings: Superselective angiography with injection from right gastric artery (a) and proper hepatic artery (b) showing release of coils with complete exclusion of the vascular lesion (light-blue arrow).

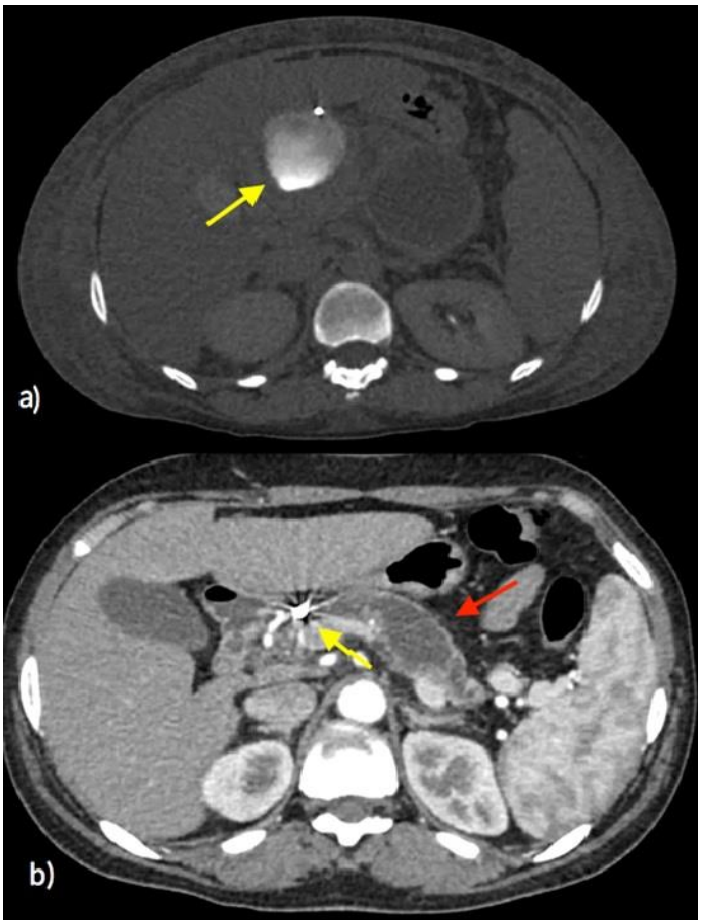

Figure 4 (left): 35-year-old female with bleeding peripancreatic pseudoaneurysm
Technique: Toshiba Aquilion One 320-row scanner computed tomography. Plain CT scan (a) and arterial phase scan (b), bone and soft tissues window respectively;40 mAs, 120 kV, 1mm slice thickness.
Findings: Unenhanced CT scan performed after embolization (a) shows remaining staining of contrast medium inside the pseudoaneurysm (yellow arrow). Arterial-phase CT scan performed 6 months after procedure (b) confirms complete exclusion of the vascular lesion (yellow arrow). Moreover, complete regression of the pseudocyst previously involving pancreatic tail can be seen, together with ectasia of Wirsung duct (red allow) and widespread atrophy of pancreatic parenchyma.

ETIOLOGY:	• Chronic or acute pancreatitis • Blunt or penetrating abdominal trauma • Bilio-pancreatic surgery • Pancreatic transplantation
INCIDENCE:	• 7-10% chronic pancreatitis • 1-6% acute pancreatitis
GENDER RATIO:	Depending on etiology
AGE PREDILECTION:	Depending on etiology
RISK FACTORS:	• Alcoholic or lithiasic pancreatitis • Bilio-pancreatic surgery for cancer • Abdominal sepsis • Pancreas transplantation
TREATMENT:	• Endovascular treatment • Surgical resection or ligation
PROGNOSIS:	• Mortality after surgery: 28-56 % depending on the site • Overall mortality after endovascular treatment: 4-19%
IMAGING FINDINGS:	• Doppler Ultrasound (DU): Fast technique able to show a hypoechoic cystic structure with connection to parent artery and Doppler signal • Computed tomography angiography (CTA): well-circumscribed lesion with avid and homogeneous enhancement in arterial phase and tendency to pooling in venous phase if active bleeding is present.

Table 1: Summary table for peripancreatic pseudoaneurysm.

	Pancreatic pseudoaneurysm	**Pancreatic pseudocyst**
X-ray	Limited role; may depict parietal calcifications	Usually not evident
US	Doppler signal	No Doppler signal
CT	Avid and homogeneous enhancement in arterial phase; pooling in venous phase if bleeding	Hypodense cystic structure with thin walls and no enhancement
DSA	Contrast-enhancing formation with tendency to stagnate	Not evident

Table 2: Imaging differentiation between pancreatic pseudoaneurysm and pseudocyst.

ABBREVIATIONS

AP: Antero-posterior
CT: Computed tomography
CTA: Computed-tomography angiography
DB: Direct bilirubin
DSA: Digital subtraction angiography
DU: Doppler ultrasound
GOT: Glutamic oxalacetic transaminase
GPT: Glutamic pyruvic transaminase
Hb: Haemoglobin
Ht: Hematocrit
LL: Latero-lateral
MRI: Magnetic resonance imaging
PPA: Peripancreatic pseudoaneurysm
RFT: Renal function test (creatinine)
RBCs: Red blood cells
TB: Total bilirubin
US: Ultrasound
WBCs: White blood cells

KEYWORDS

CTA; DSA; Pancreatic pseudocyst; Visceral pseudoaneurysm; Embolization