Surgical treatment of a Ruptured Pancreaticoduodenal Artery Aneurysm

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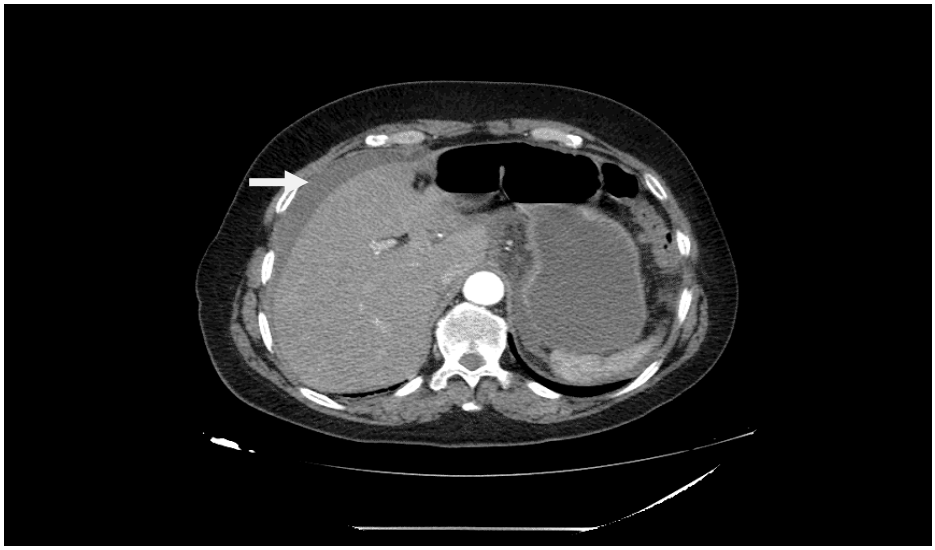
Abstract
Introduction: Pancreaticoduodenal artery (PDA) aneurysm associated with celiac artery (CA) occlusion or stenosis is extremely rare, and occurs in 2% of all visceral aneurysms.
Method: We present the case of a 58 year old female diagnosed with ruptured pancreaticoduodenal aneurysm. The bibliography used was taken from PubMed.
Summary: We report the case of a 58 year old woman who presented at the Surgical Emergency Unit with acute abdominal pain radiating at the back, fatigue, discomfort with a history of a minor trauma. Physical examination is relevant for tenderness of the whole abdomen on palpation. Workup reveals anemia with Hgb at 8.3 g/dL and RBC count at 2.8 x 10^6/mm^3. Imaging studies show retroperitoneal hematoma, contrast accumulation near the pancreaticoduodenal arcade but with no evident relation to the superior mesenteric artery, peripancreatic, perihepatic and free peritoneal fluid.The patient was succesfully treated with surgery and was discharged on the 15th post operative day.
Conclusion: Rupture of visceral artery aneurysms, although rare, may be a relevant differential diagnosis of an acute abdomen. When the patient comes to the emergency department with abdominal pain, a diagnosis of visceral artery aneurysm rupture should be considered.

1.Background

Visceral artery aneurysms are rare, and only 2% involve the pancreaticoduodenal artery (PDA). Although extremely rare, PDA aneurysms are clinically important because most are found after they have ruptured, leading to fatal hemorrhage and high mortality rates. In spite of the importance of accurate diagnosis, ruptured PDA aneurysms are difficult to differentiate from other abdominal pathologies. Here, we report a rare case of a ruptured PDA aneurysm that needed immediate surgical treatment.

2.Case Report

A 58-year old woman , was admitted with acute abdominal pain radiating to the
back and anorexia. There was no history of smoking or excessive alcohol consumption and there had been no episodes of pancreatitis, hypertension, portal hypertension. She refers that shw has suffered aminor trauma days ago. On admission, she was pale and in pain.She was tachicardic. The patient had a markedly distended abdomen with pain in the right hypochondrium with rebound tenderness. The electrolytes, liver function parameters, and serum amylase levels were within the normal ranges. Blood tests revealed a haemoglobin of 8.3 g/dl and a RBC count of 2.8 X 10^6 mm^3 .The contrast-enhanced computed tomography (CT) revealed a large retroperitoneal hematoma and ascites with Hounsfield units consistent with blood. (fig.1) In addition, the CT suggested an aneurysm arising from a branch of the superior mesenteric artery (SMA). (fig.2) For this reason the patient underwent immediate surgical treatment. During laparotomy, massive blood and coagula weighing 1500-2000 g were noted in the peritoneal cavity. (fig.3) A large hematoma was in the retroperitoneum,radix mesenteri, pancreatic tissue and in the walls of the gallbladder.
The source of this bleeding was found in the panceraticoduodenal arcade. The feeding arteries were exposed and were ligated with minimum operative blood loss.The patient stayed in the intensive care for 2 nights were she tooked 10 units of blood, 9 units of plasma then she was hospitalized at the First Surgery Clinic. (fig.4)A CT and an angio CT were performed. The CT scan was normal with no evidence of free fluid in the abdomen, in the angio CT it was revealed a thrombosis of the left iliac artery. She left the hospital after 15 days. Her recovery was uneventful.



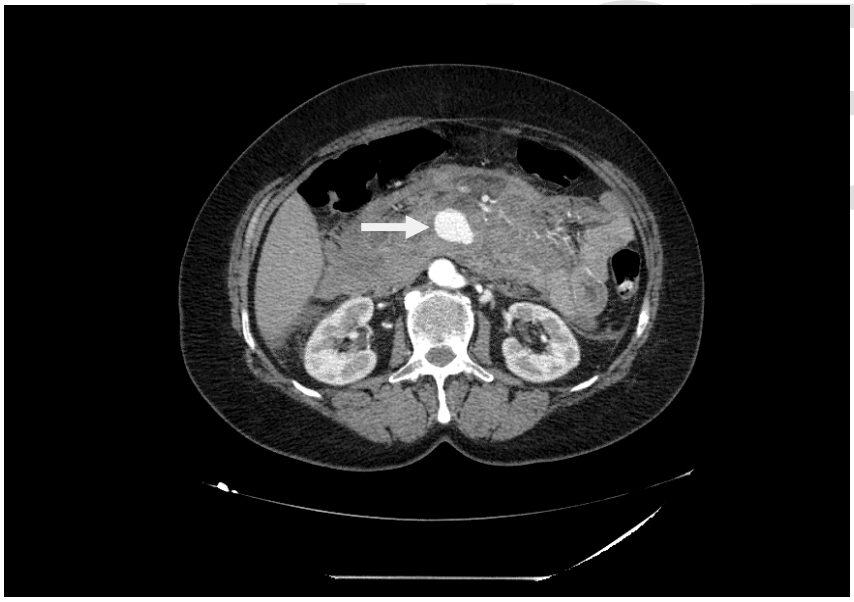
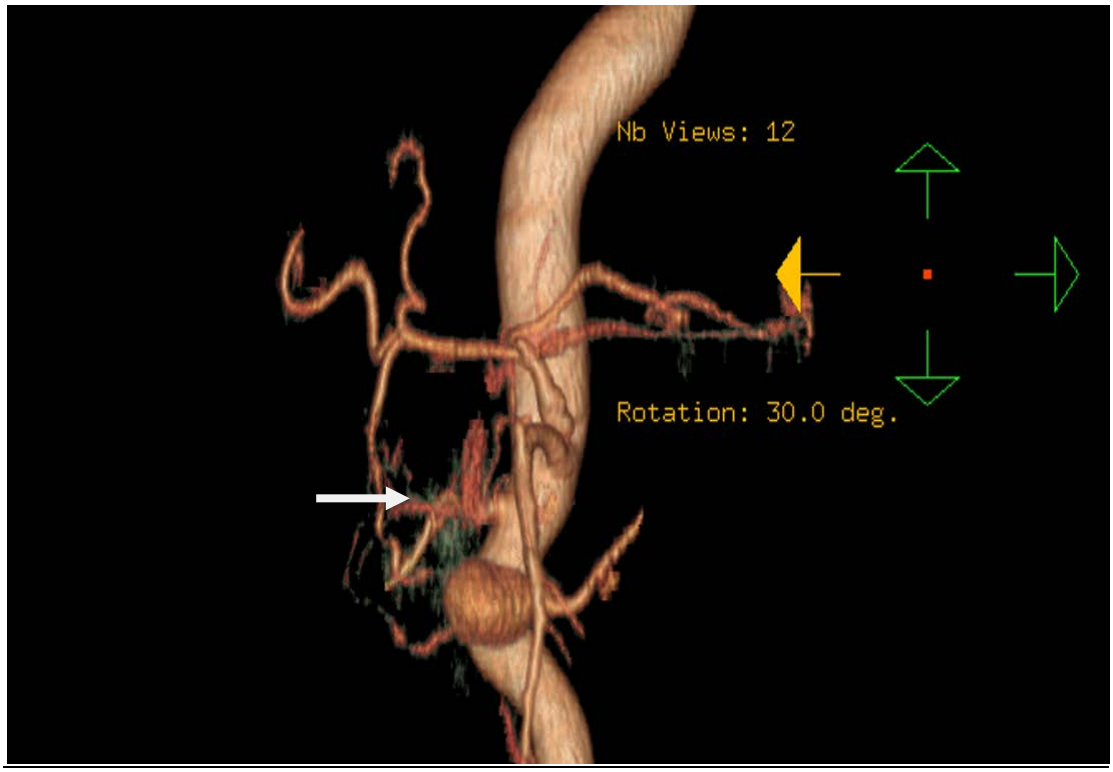


Fig.1 CT scan showing fluid collection in the both the subphrenic and retroperitoneal spaces.



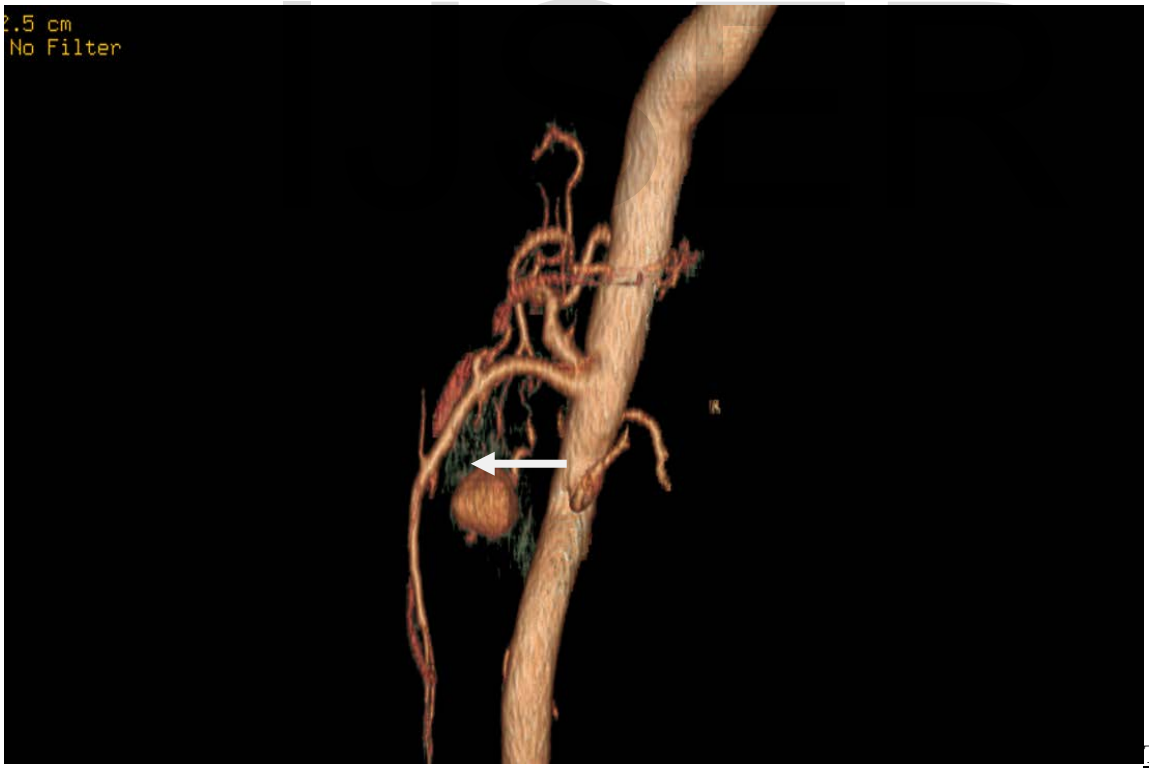


Fig.2 Three dimensional reconstruction of the enhanced CT images revealing the aneurysm *(Arrow)*, originating from a branch of the superior mesenteric artery.

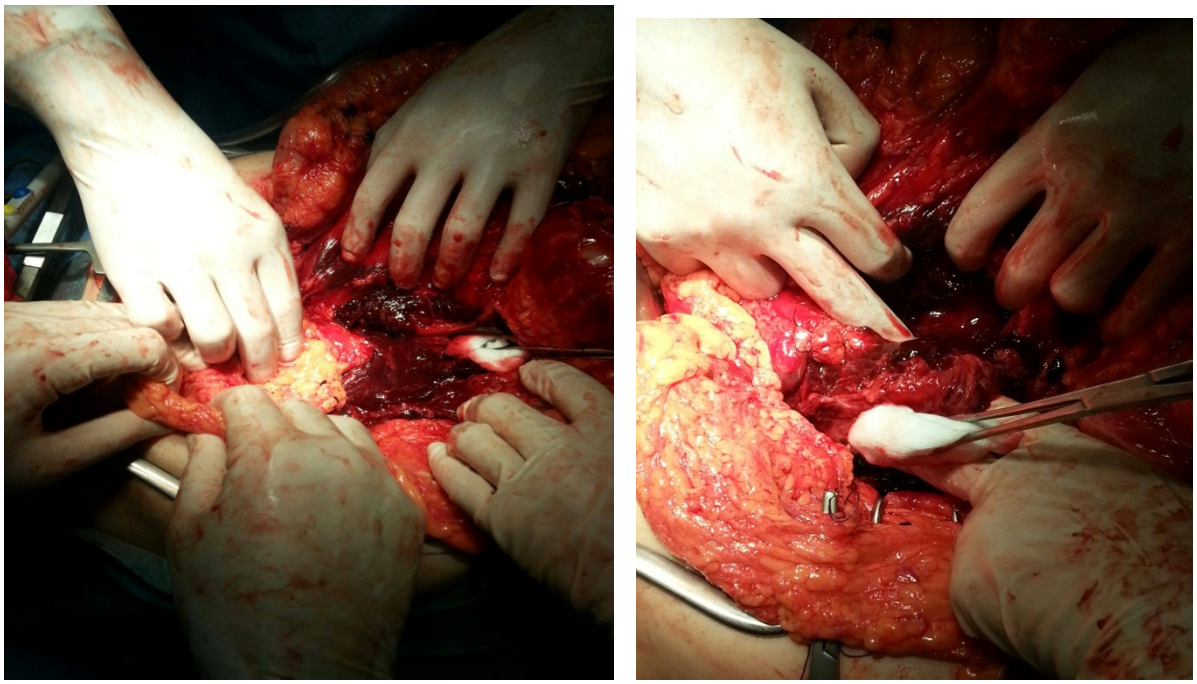
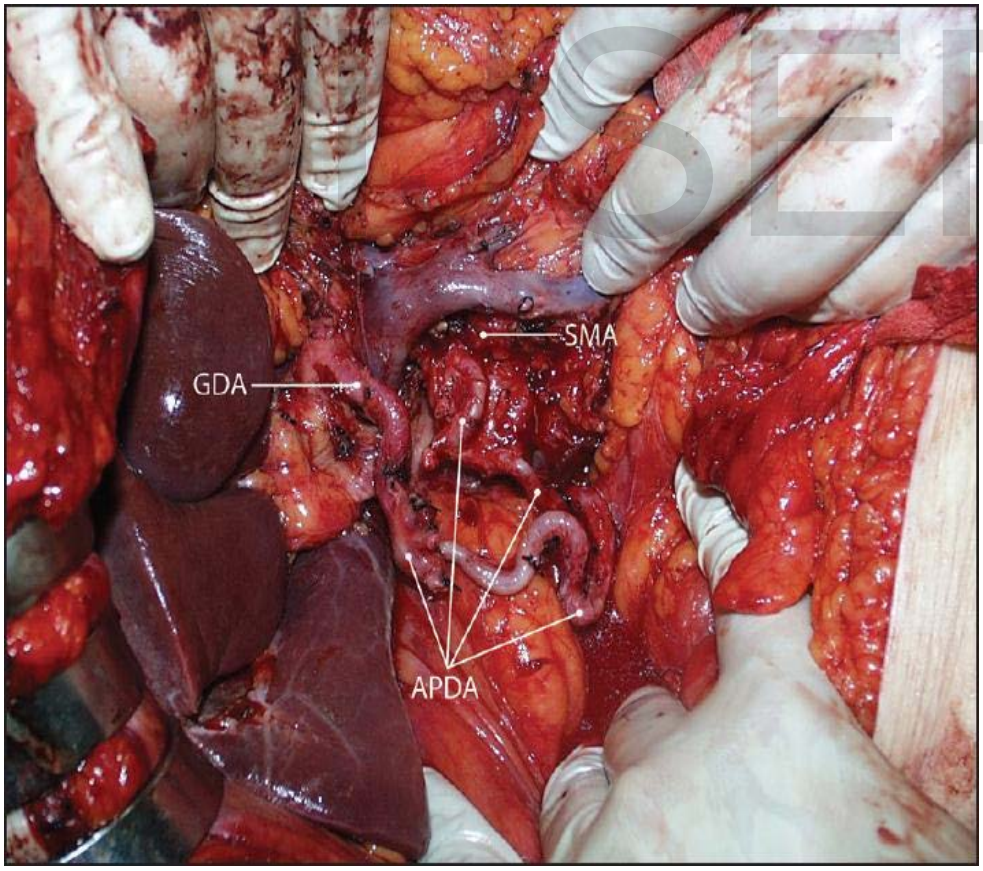


Fig.3 Intraoperative photos.



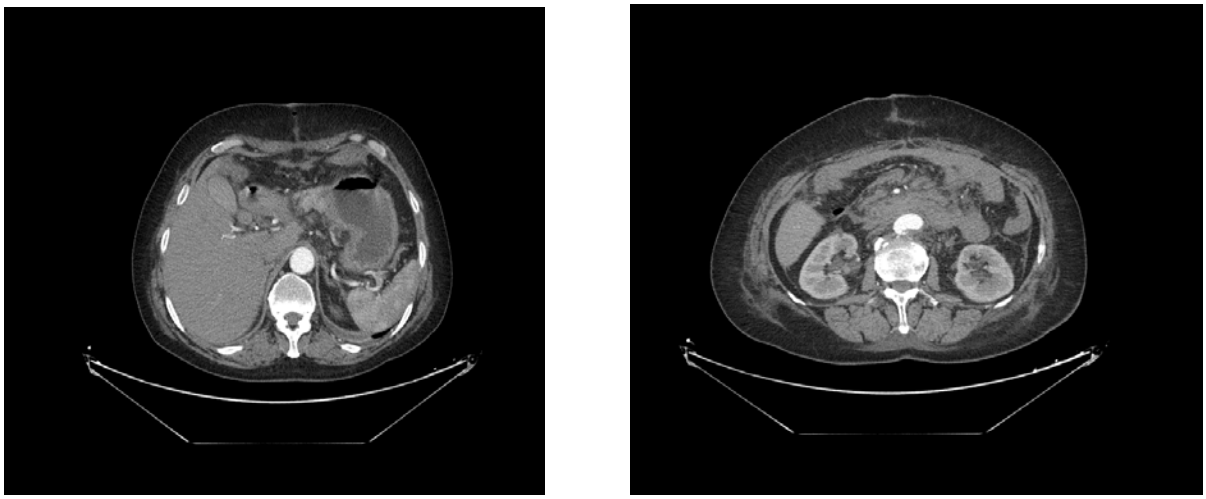


Fig.4 CT scan showing no evidence of free fluid in the abdomen

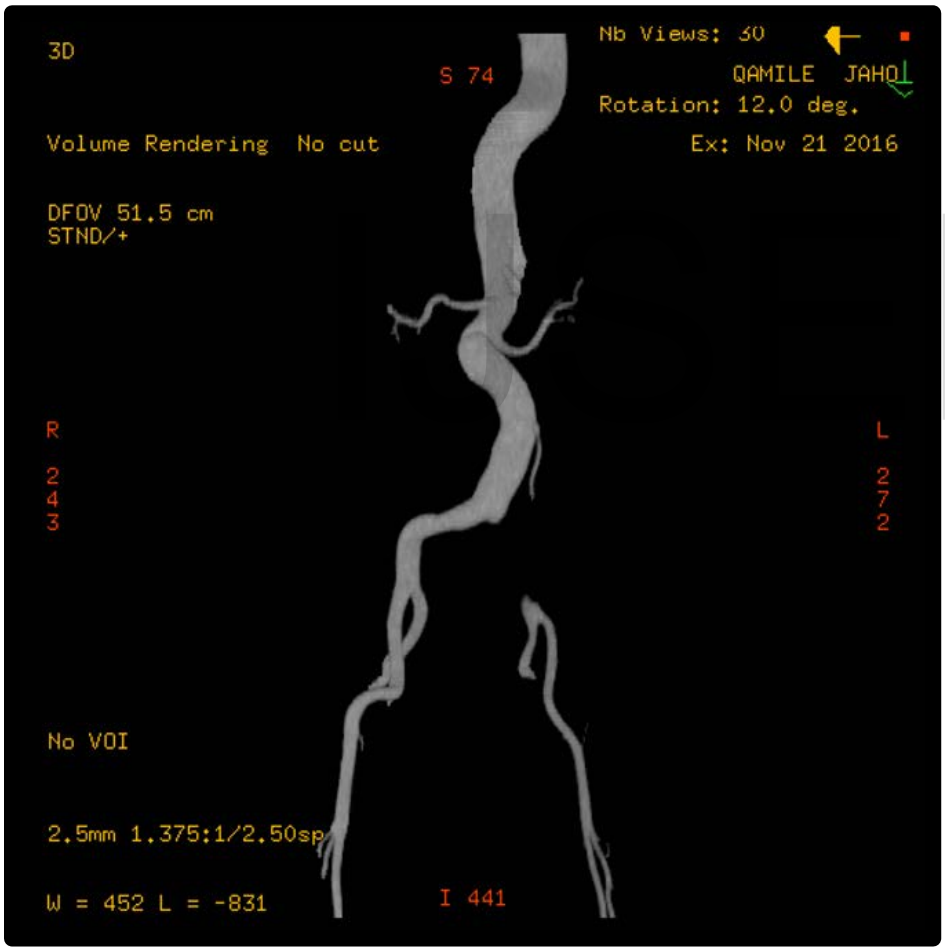


Fig. 4 Angio CT showing thrombosis on the left iliac artery.

3.Discussion

Splanchnic aneurysms can be classified based on their anatomical locations. Visceral aneurysms are the least intima, resulting in alteration of its biochemical profile, the development of erosion, and increased permeability. These changes reflect deeply into the media layer.The media layer, which maintains the integrity and elasticity of vessels, became itself dysfunctional, resulting in aneurysmal formation.
True aneurysms are recognized in 0.09% to 2.00% of the general population .

Celiac Trunk Stenosis and PDA Aneurysms. The pathogenesis behind celiac trunk stenosis may be intrinsic in nature (e.g., caused by atherosclerosis or dysplasia) or extrinsic (e.g., caused by median arcuate ligament compression, which is seen in 10–24% of patients with celiac stenosis). The first reported case of a PDA aneurysm was published by Ferguson. More than 131 cases of PDA aneurysms have been reported to date; 81 of which were linked to celiac trunk stenosis or occlusion. The initial reported case that correlated PDA aneurysms with celiac trunk occlusion was describedby SuttonandLawton. Since then, the reported incidence has ranged from 45% to 67% . Accumulating evidence reveals that 50% to 80% of PDA aneurysms are associated with celiac artery stenosis. De Perrot et al. reported that 63% of true PDA aneurysms were associated with celiac trunk stenosis. In most reported cases, the cause of this stenosis is ambiguous. Of 12 reported cases with a known aetiology, 9 were attributed to median arcuate ligament compression and 3 were due to atherosclerosis, thrombosis, and agenesis of the celiac trunk, respectively.

Detection of PDA Aneurysms. With the advent and increased utility of imaging techniques, the detection of PDA aneurysms is becoming more frequently reported in the literature. Modalities used for detection include contrast-enhancedmultidetector-row CT, three-dimensional contrast-enhancedmagnetic resonance angiography, and CT angiography with 3D reconstruction from thin section (0.6 mm–3 mm) acquisitions. In addition, CT angiography and magnetic resonance angiography are capable of routinely detecting aneurysms less than 1 cm in diameter. More recently, flow-sensitive four-dimensional magnetic resonance imaging has been implemented in studying chronic hyperkinetic flow in the pancreaticoduodenal arcade secondary to blood shifting from the celiac trunk to the SMA branches in the presence of stenosis.This hyperkinetic flow has been shown to form the basis for the formation of PDA aneurysms. Despite these noninvasive modalities, selective digital subtraction angiography remains the gold standard for the diagnosis of PDA aneurysms because the location of the aneurysm and the supplying artery can be determined, and definitive treatment can be simultaneously performed through TAE. With the presence of celiac trunk stenosis and the consequent divergent of retrograde blood from the SMA to the celiac territory, the arcade becomes engorged and easily visualized by SMA angiography and MRI kinetic studies.

Management. No treatment guidelines have been established for the management of PDA aneurysms. Consensus states that such aneurysms must be treated, once detected.With a gastrointestinal haemorrhage incidence of 7% to 15%, mostly into the retroperitoneal cavity , the presence of PDA aneurysms is considered life-threatening. No correlation exists between the size of the PDA aneurysm and the rate of rupture; however, rupture is associated with a significantmortality rate reaching 50% or even higher (up to 75%). Approximately 17.6% of ruptured aneurysms are ≤10mm in diameter. Suzuki et al. reported a similar mean diameter (22.2 versus 21.4 mm) among PDA aneurysms that did and did not rupture, respectively. These facts render PDA aneurysms unique with respect to other visceral aneurysms, thus necessitating rigorous planning and implementation of treatment upon recognition. A major goal in the treatment of aneurysms associated with celiac trunk stenosis revolves around obliteration, resolution of any associated pathologies, and maintenance of adequate blood flow to territories of the celiac trunk. Surgical options oscillate between ligation/resection and aneurysmorrhaphy. Continuous monitoring of the hepatic venous saturation through a right hepatic venous catheter could act as a surrogate approach to ensure an adequate blood supply to the celiac territories after resection or ligation of PDA aneurysms.Asaturation level of >60%indicates adequate hepatic perfusion.
Less invasive techniques, including TAE with or without recanalization or bypass of celiac stenosis, have recently been predominating.Celiac trunk recanalization promotes stagnation of blood within the aneurysm, resulting in regression in the size of the aneurysm by formation of an intramural thrombus. No cases of PDA aneurysm recurrence after successful endovascular embolization alone have been reported, even without the resumption of adequate celiac flow. Considering this evidence, Suzuki et al. stated that if the ischemic risk to the liver and duodenum is not significant, there is no need to reverse the stenosis. In such an approach, monitoring any ischemic insult to the liver would include serial monitoring of liver function tests, after embolization. Transcatheter embolization may take the form of total occlusion of the parent artery in cases of fusiformaneurysms, or coil embolization of the aneurysm itself if it is saccular and its neck is accessible. Occlusion of the parent artery beyond and proximal to the neck of the aneurysm (back door/front door technique) is mandatory to prevent retrograde filling. However it is not always successful because vessels can be tortuous and difficult to bypass for deployment ofembolic agents.However the development of newtrackable microcatheters has improved the ability of the

interventional radiologist to reach the target vessel and optimize the embolization procedure. Recurrence of an aneurysm after embolization may occur because collaterals can be excessive and difficult to access and occlude completely. Alternative techniques such as percutaneous thrombin injection (PTI) under CT or ultrasound guidance have been implemented for the treatment of false aneurysms, thus providing patientswithmore options forminimally invasive procedures before proceeding to surgery. PTI was pioneered byCope and Zeit in 1986 and since then has shown success in obliterating the aneurysmal sac through thrombin injection and thrombus formation without the need to embolize inflow and outflow vessels. With the use of 21-gauge or smaller calibre needles for percutaneous access, the risk of major organ-specific complications ranges from 0.1% to 2.0%. PTI is characterized by a shorter overall procedure time and lower operational cost than transarterial embolization .

4.Conclusion

Rupture of visceral artery aneurysms, although rare, may be a relevant differential diagnosis of an acute abdomen. When the patient comes to the emergency department with abdominal pain, a diagnosis of visceral artery aneurysm rupture should be considered.

Abbreviations

PDA: Pancreaticoduodenal artery
IPDA: Inferior pancreaticoduodenal artery
TAE: Transarterial embolization
SMA: Superior mesenteric artery
PTI: Percutaneous thrombin injection.

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