

## Case Report

# Endovascular embolization of inferior pancreaticoduodenal artery pseudoaneurysm post-laparoscopic cholecystectomy in a patient with celiac artery stenosis – A case report

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Received: 20 November 2022  
Accepted: 25 November 2022  
Epub Ahead of Print: 13 March 2023  
Published: 26 July 2023

### DOI

10.25259/CRCR\_39\_2022

### Quick Response Code:



## ABSTRACT

Inferior pancreaticoduodenal artery (iPDA) pseudoaneurysms are mostly secondary to pancreatitis, abdominal trauma, or iatrogenic procedures. We present a rare case of iPDA pseudoaneurysm secondary to laparoscopic cholecystectomy in a patient with celiac artery stenosis. A 50-year-old man who underwent laparoscopic cholecystectomy 7 days back presented with abdominal pain, blood in drain output, and tachycardia. Abdominal computed tomography (CT) showed a large retroperitoneal hematoma adjacent to head of pancreas with a pseudoaneurysm likely arising from gastroduodenal artery. Proximal stenosis of celiac artery was also present. Digital subtraction angiography (DSA) showed pseudoaneurysm arising from posterior branch of iPDA. Coil embolization was performed with complete obliteration of the aneurysm. However, the patient presented again with increasing abdominal pain and hemoglobin drop after 8 days. CT showed migration of coil loop into the hematoma and residual filling of pseudoaneurysm. Repeat embolization was planned and the pseudoaneurysm with iPDA branch was embolized with 33% glue-lipoidal mixture. On follow-up 3 months later, the patient was found to be stable with no further complications. iPDA pseudoaneurysm is less commonly encountered visceral artery pseudoaneurysm. Trapping of pseudoaneurysm with both proximal and distal vessel occlusion is ideal method for embolization to prevent recurrence.

**Keywords:** Pancreaticoduodenal artery pseudoaneurysm, Celiac artery stenosis, Pseudoaneurysm embolization, Glue embolization, Splanchnic artery

## INTRODUCTION

Pancreaticoduodenal artery (PDA) aneurysms are rare, accounting for 2% of visceral artery aneurysms. Most of the PDA aneurysms are secondary to pancreatitis, duodenal ulcers, abdominal trauma, or iatrogenic procedures. These pseudoaneurysms can result in massive retroperitoneal hematoma or upper gastrointestinal bleed.<sup>[1]</sup> Treatment of these aneurysms can be challenging, due to their anatomic location and tortuous course of these vessels. Here, we present a rare case of inferior pancreaticoduodenal artery (iPDA) pseudoaneurysm secondary to laparoscopic cholecystectomy.

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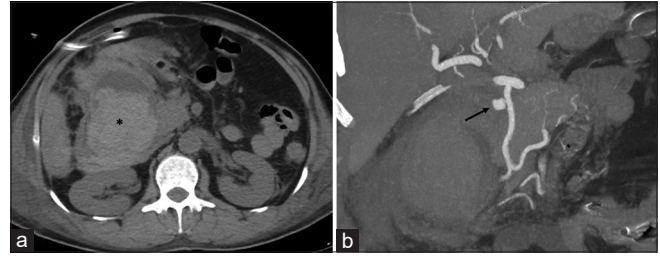
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## CASE REPORT

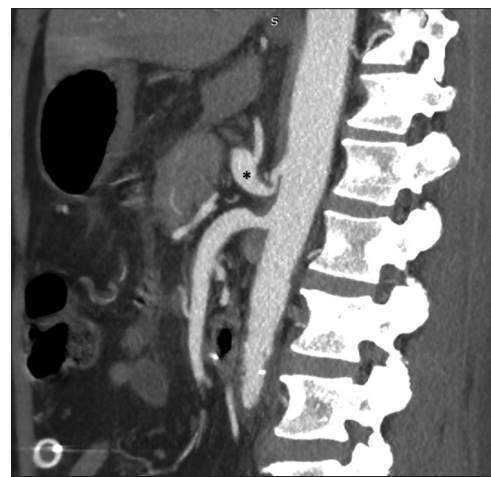
A 50-year-old man underwent laparoscopic cholecystectomy 7 days back for ruptured acute calculus cholecystitis with Mirizzi's syndrome. The surgery went uneventful and the patient was discharged in stable condition. Patient presented 3 days later to the emergency department with complaints of abdominal pain and blood in drain output. Around 250 mL of blood per day was seen in drain on post-operative days 4 and 5. On admission, patient had tachycardia (100/min) and blood pressure was stable (110/80 mm Hg). Other vitals were within normal limits. His abdomen was diffusely tender. Routine blood investigations revealed decreased hemoglobin (6.4 g/dL). 5 units of packed red blood cells were transfused to the patient. With suspicion of intraperitoneal bleed, computed tomography (CT) of the abdomen with CT angiography (CTA) was performed. CT showed a large retroperitoneal hematoma measuring around 8 × 6 cm, adjacent to the head and uncinate process of pancreas, and compressing on the right kidney [Figure 1a]. CT angio showed a 10 mm pseudoaneurysm within the hematoma, likely arising from a branch of gastroduodenal artery (GDA) [Figure 1b]. Celiac artery stenosis was seen in this patient, likely due to extrinsic compression by median arcuate ligament [Figure 2]. The patient was planned for endovascular embolization.

Under local anesthesia, through right transfemoral approach, celiac and superior mesenteric arteriograms (SMA) were taken [Figure 3]. It showed a tight stenosis (70–80%) of the proximal celiac artery with post-stenotic dilatation. GDA was not seen filling in celiac arteriogram. The pseudoaneurysm was seen filling from the posterior branch of iPDA, from SMA. Anterior branch of iPDA was seen retrogradely filling the GDA and hepatic artery. A small branch was seen arising from pseudoaneurysm and joining right hepatic artery. Selective cannulation of iPDA could not be done by transfemoral route. The left transbrachial approach was taken and cannulation of iPDA branch by microcatheter was done. Two coils (8 × 14 mm; Nester, Cook Medical, IN, USA) were deployed into the pseudoaneurysm, protruding slightly into the parent vessel. Post-coiling and check angiogram showed complete obliteration of the aneurysmal sac with stasis of flow in the parent vessel. The anterior branch of iPDA was seen filling normally. No periprocedural complications were seen.

At the time of discharge, patient was clinically stable, with no further drop in hemoglobin values. However, 4 days after discharge (8 days after the endovascular procedure), the patient again presented with increasing abdominal pain and drop in hemoglobin. Repeat CT showed increase in hematoma size with migration of a coil loop into the hematoma and residual filling of pseudoaneurysm [Figure 4]. The patient was taken up for emergency endovascular embolization. The selective branch of iPDA was cannulated,



**Figure 1:** A 50-year-old male with inferior pancreaticoduodenal artery pseudoaneurysm post-laparoscopic cholecystectomy. (a) Axial non-contrast computed tomography image showing a large retroperitoneal hematoma(\*). (b) Coronal reformatted maximum intensity projection image showing pseudoaneurysm (arrow) likely arising from gastroduodenal artery.



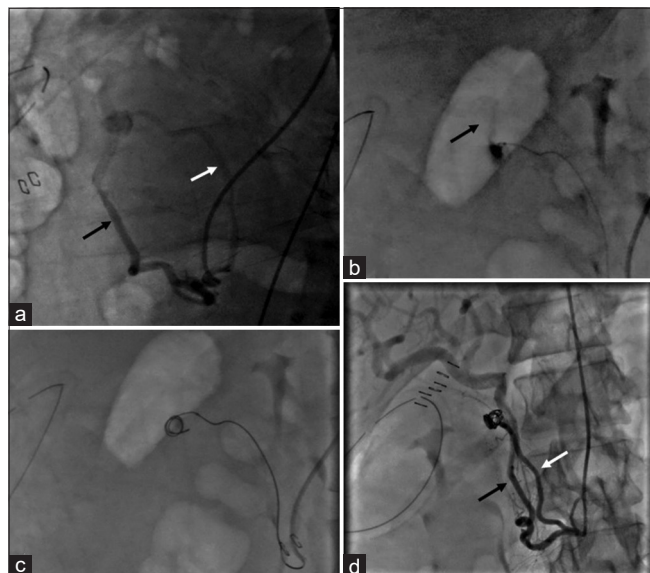
**Figure 2:** A 50-year-old male with inferior pancreaticoduodenal artery pseudoaneurysm post-laparoscopic cholecystectomy. Sagittal reformatted maximum intensity projection image showing severe proximal celiac artery stenosis with post-stenotic dilatation(\*).

which was seen to be decreased in caliber. Angiogram showed filling of pseudoaneurysm with a loop of coil migrated outside the initial site of deployment. The parent vessel and the pseudoaneurysm were embolized with 33% glue-lipoidal mixture. Post-embolization, no residual filling of aneurysm noted. Other branch of iPDA was seen filling normally [Figure 5].

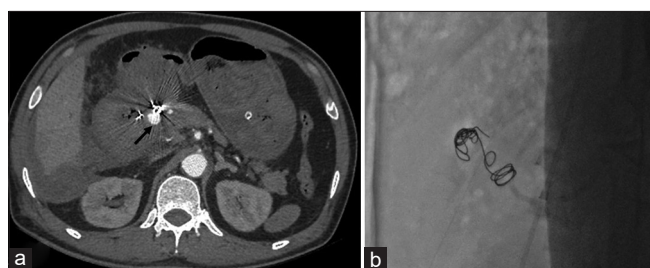
On follow-up 3 months later, the patient was found to be stable with no further complications.

## DISCUSSION

Visceral artery pseudoaneurysms can occur due to trauma, iatrogenic injuries including surgical, endoscopic, and endovascular procedures, inflammatory conditions such as pancreatitis, cholecystitis, infective, or malignant conditions.<sup>[2]</sup> The incidence of pseudoaneurysms following

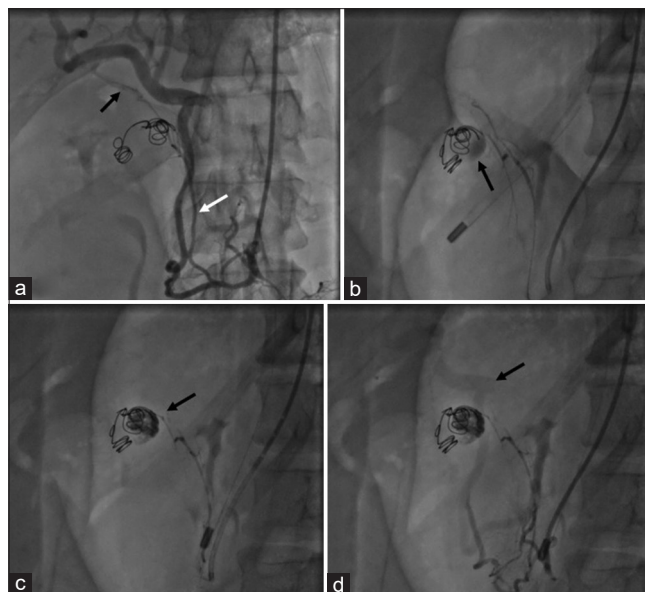


**Figure 3:** A 50-year-old male with inferior pancreaticoduodenal artery pseudoaneurysm post-laparoscopic cholecystectomy. Digital subtraction angiography images showing angiographic runs taken from superior mesenteric artery through the left transbrachial route. (a) Two branches of inferior pancreaticoduodenal arteries (iPDA) are seen, with pseudoaneurysm filling from posterior branch (white arrow). Anterior branch (black arrow) is seen retrogradely filling gastroduodenal artery (GDA). (b) On selective cannulation of posterior branch of iPDA, the pseudoaneurysm is seen filling and a small branch is seen continuing cranially and joining GDA/right hepatic artery (arrow). (c) Coiling of pseudoaneurysm performed. (d) Post-coiling, both branches of iPDA are seen filling normally (arrows); however, no filling within pseudoaneurysm noted.



**Figure 4:** A 50-year-old male with hematoma recurrence post-inferior pancreaticoduodenal artery pseudoaneurysm embolization. Images of the same patient 8 days after coiling. (a) Axial contrast-enhanced computed tomography image showing coil loop within hematoma and residual filling of pseudoaneurysm (arrow). (b) Fluoroscopic image showing migration of coil loop.

laparoscopic cholecystectomy is around 0.6–1%, most commonly affecting right hepatic, cystic, and gastroduodenal arteries.<sup>[3]</sup> iPDA pseudoaneurysm post-laparoscopic cholecystectomy has not been reported to the best of our knowledge. The relative anatomy of these vessels, being away from the site of dissection, might explain the rarity of their injury. Pancreaticoduodenal artery aneurysms constitute



**Figure 5:** 50-year-old male with hematoma recurrence post-inferior pancreaticoduodenal artery pseudoaneurysm embolization. Digital subtraction angiography images showing angiographic runs taken from superior mesenteric arteriograms through the left transbrachial route. (a) Posterior branch of inferior pancreaticoduodenal arteries appears decreased in caliber (white arrow); continuation of this branch into right hepatic artery is well visualized (black arrow). The anterior branch appears normal. (b) Selective cannulation showing residual filling of pseudoaneurysm (arrow). (c) About 33% of glue-lipoidal mixture injected, with glue cast seen in the vessel and aneurysmal sac (arrow). (d) Check angiogram showing normal filling of anterior branch (arrow) with no residual filling of either the pseudoaneurysm or the parent vessel.

only around 2% of splanchnic aneurysms. The majority of PDA pseudoaneurysms described in the literature are secondary to either pancreatitis or pancreatic surgeries.<sup>[4]</sup>

iPDA arises from SMA either directly or from the first jejunal branch and usually divides into anterior and posterior branches. These anastomose with corresponding branches of superior pancreaticoduodenal artery, which arises from GDA, and form the pancreaticoduodenal arcades. These usually small caliber vessels become a major collateral pathway in cases of celiac artery or SMA stenosis.<sup>[5]</sup> Increased retrograde flow through iPDA branches in celiac artery stenosis causes dilatation of these vessels with increased stress on the endothelial layer and weakening of its walls. The occurrence of aneurysms of iPDA in association with celiac artery stenosis has well been described in various studies, with incidence ranging from 50% to 80%.<sup>[6–8]</sup> Both the branches of iPDA in our patient were well dilated, and retrogradely filling the hepatic artery through GDA.

PDA pseudoaneurysms usually present with vague abdominal pain with bleeding into the retroperitoneal



space around the pancreas. They can even rupture into the duodenum, resulting in the upper gastrointestinal bleed, which can sometimes be massive resulting in hypotension and shock. Mass effect due to hematoma can also occur. Rarely, these pseudoaneurysms can be incidentally detected.<sup>[2,6]</sup> Diagnosis can be made usually by contrast CTA. The vessel of origin might be difficult to trace in the presence of significant hematoma and multiple pancreaticoduodenal arcade collaterals. Catheter angiography or DSA remains the gold standard for diagnosis. Selective catheter injections into celiac, hepatic, gastroduodenal, and superior mesenteric arteries are needed for accurately diagnosing and deciding the possible management options.

The treatment options can be either surgical, endovascular, or percutaneous. The surgical options include resection, ligation, or aneurysmorrhaphy.<sup>[7,9]</sup> With novel techniques and better devices, the endovascular treatment is gaining more importance and considered as first line of management in patients with hemodynamic compromise. Good long-term outcomes with endovascular embolization have been reported in various studies, with no recurrence of aneurysms post-procedure.<sup>[4,6,7,9]</sup> The commonly used embolic materials are coils and *N*-butyl cyanoacrylate. The pseudoaneurysm, being false aneurysm, lacks a true wall and hence only packing the aneurysmal sac might lead to its recurrence. Ideally, the best technique would be trapping the aneurysm, by occluding the aneurysm and also coiling both the proximal and distal channel, so as to prevent reflux filling by collaterals.<sup>[2]</sup> However, it may not always be possible to occlude the distal vessel, due to tortuosity of the vessel and difficulty of deployment of coils. In cases where the pseudoaneurysm could not be reached, occlusion of the parent vessel can be attempted by *N*-butyl cyanoacrylate. Alternatively, the percutaneous approach can be tried by directly injecting thrombin into the pseudoaneurysm either under ultrasound or CT guidance.<sup>[7]</sup>

There is no consensus regarding the treatment of coexisting celiac artery stenosis in these patients. Depending on the cause, either surgical ligation of median arcuate ligament or angioplasty for atherosclerotic stenosis can be attempted.<sup>[6]</sup> Revascularization of celiac artery should definitely decrease the collateral blood flow, causing stagnation of blood flow within aneurysm and reduce risk of aneurysmal recurrence.<sup>[10]</sup> However, majority of studies have shown no recurrence of aneurysms after successful embolization, even without treating celiac artery stenosis. Unless there was significant ischemic compromise to the liver or duodenum due to celiac stenosis, it needs not be treated.<sup>[8,9]</sup> In our patient, we did not attempt treating celiac artery stenosis, as patient was hemodynamically unstable and the main goal was to stop the bleeding.

## CONCLUSION

We presented less commonly encountered splanchnic artery pseudoaneurysm secondary to laparoscopic cholecystectomy. The possibility of iPDA pseudoaneurysm is to be considered whenever there are retropancreatic hematoma post-trauma or post-iatrogenic procedures. Trapping of pseudoaneurysm with both proximal and distal parent vessel occlusion is ideal method for embolization to prevent recurrence. Screening of PDA should be done in all cases of celiac artery stenosis due to their strong association.

## Teaching points

- Pancreaticoduodenal artery aneurysms are commonly associated with celiac artery stenosis
- Detailed study of CT angiogram is needed to look for the presence of collaterals between celiac artery and SMA in cases of celiac artery stenosis
- Pseudoaneurysms being false aneurysms, lack true wall and hence only packing the sac with coils would not be sufficient. Trapping the aneurysm with occlusion of both afferent and efferent parent vessel should be the ideal treatment.

## MCQs

1. iPDA artery arises from ?
  - a. Gastroduodenal artery
  - b. Splenic artery
  - c. Superior mesenteric artery
  - d. Inferior mesenteric artery

Answer Key: c

2. What is the chemical composition of Glue, the commonly used embolic agent?
  - a. Ethyl vinyl alcohol
  - b. Sodium tetradecyl sulphate
  - c. Monoethanolamine oleate
  - d. *N*-butyl cyanacrylate

Answer Key: d

3. Which is the ideal method to treat abdominal pseudoaneurysms?
  - a. Coil only the aneurysmal sac
  - b. Occlude only the proximal portion of the parent vessel
  - c. Occlude the distal portion of parent vessel
  - d. Occlude both the proximal and distal portions of parent vessel, trapping the aneurysm

Answer Key: d

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Pasha SF, Gloviczki P, Stanson AW, Kamath PS. Splanchnic artery aneurysms. *Mayo Clin Proc* 2007;82:472-9.
2. Madhusudhan KS, Venkatesh HA, Gamanagatti S, Garg P, Srivastava DN. Interventional radiology in the management of visceral artery pseudoaneurysms: A review of techniques and embolic materials. *Korean J Radiol* 2016;17:351-63.
3. Lampropoulos C, Markopoulos G, Tsochatzis S, Bellou A, Amanatidis T, Kehagias D, *et al.* Symptomatic pseudoaneurysms following laparoscopic cholecystectomy: Focus on an unusual and dangerous complication. *J Min Access Surg* 2021;17:450-7.
4. Murata S, Tajima H, Fukunaga T, Abe Y, Niggemann P, Onozawa S, *et al.* Management of pancreaticoduodenal artery aneurysms: Results of superselective transcatheter embolization. *AJR Am J Roentgenol* 2006;187:W290-8.
5. Song SY, Chung JW, Kwon JW, Joh JH, Shin SJ, Kim HB, *et al.* Collateral pathways in patients with celiac axis stenosis: Angiographic-spiral CT correlation. *Radiographics* 2002;22:881-93.
6. Kalva SP, Athanasoulis CA, Greenfield AJ, Fan CM, Curvelo M, Waltman AC, *et al.* Inferior pancreaticoduodenal artery aneurysms in association with celiac axis stenosis or occlusion. *Eur J Vasc Endovasc Surg* 2007;33:670-5.
7. Degheili JA, El Chediak A, Dergham MY, Al-Kutoubi A, Hallal AH. Pancreaticoduodenal artery aneurysm associated with celiac trunk stenosis: Case illustration and literature review. *Case Rep Radiol* 2017;2017:6989673.
8. Savastano S, Feltrin GP, Miotto D, Chiesura-Corona M, Sandri P. Embolization of ruptured aneurysm of the pancreaticoduodenal artery secondary to long-standing stenosis of the celiac axis: Case reports. *Vascu Surg* 1995;29:309-14.
9. Suzuki K, Tachi Y, Ito S, Maruyama K, Mori Y, Komada T, *et al.* Endovascular management of ruptured pancreaticoduodenal artery aneurysms associated with celiac axis stenosis. *Cardiovasc Intervent Radiol* 2008;31:1082-7.
10. Tien YW, Kao HL, Wang HP. Celiac artery stenting: A new strategy for patients with pancreaticoduodenal artery aneurysm associated with stenosis of the celiac artery. *J Gastroenterol* 2004;39:81-5.

**How to cite this article:** Vignesh S, Mukuntharajan T. Endovascular embolization of inferior pancreaticoduodenal artery pseudoaneurysm post-laparoscopic cholecystectomy in a patient with celiac artery stenosis – A case report. *Case Rep Clin Radiol* 2023;1:101-5.