Hybrid approach to intrapancreatic inferior pancreaticoduodenal aneurysm repair

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ABSTRACT

Pancreaticoduodenal artery aneurysms (PDAAs) are an extremely rare visceral artery aneurysm subtype, usually managed by endovascular techniques. We report the case of a 57-year-old man with an intrapancreatic, inferior PDAA abutting the superior mesenteric artery (SMA). This location, in relation to the SMA, risks SMA thrombosis using an endovascular-only approach. Our approach consisted of open exploration and ligation of the inferior PDAA junction at the SMA, followed by endovascular coil embolization of the aneurysm. This case serves as a reminder that although many vascular diseases can be treated with less invasive endovascular strategies, open surgery can sometimes be the safer alternative. (J Vasc Surg Cases Innov Tech 2024;10:101505.)

Keywords: Hybrid approach; Inferior pancreaticoduodenal aneurysm; Open surgery; Pancreaticoduodenal artery aneurysms; Superior mesenteric artery; Visceral artery aneurysms

Visceral artery aneurysms (VAAs) have a prevalence of <0.2% of the population.[1,2] Pancreaticoduodenal artery (PDA) aneurysms (PDAAs) are a rare subtype that constitutes <2% of all VAAs.[3] Historically, the first PDAA was reported in 1895,[4] and, as of 2015, approximately 100 total cases were reported in the literature.[3] Recently, most PDAA case reports describe endovascular therapy as the treatment modality of choice. PDAAs pose risks of ischemic intestinal damage and possible fatality if rupture occurs.[2] The Society for Vascular Surgery guidelines state that all visceral aneurysms should be repaired.[5] Since the development and advancements of endovascular surgery, the open approach has been used less frequently.[5,6] The current favored modality for treating PDAAs is endovascular, based on the guidelines and successful cases in the recent literature.[5,7] The minimally invasive endovascular approach is usually the safer alternative with a shorter hospital stay; however, there could be a greater risk of aneurysm reperfusion[7] or the need for reintervention.[8] Endovascular strategies typically involve coil embolization or covered stents. We present a rare case of an inferior PDAA in continuity with the superior mesenteric artery (SMA). The location of the aneurysm eliminated an endovascular-only approach due to potential thrombus extension into SMA and an open-only approach due to the intrapancreatic nature of the aneurysm. We present a hybrid solution to this complex case. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 57-year-old man, dependent on tobacco, presented at our hospital with abdominal pain. Computed tomography of the abdomen revealed an incidental 2.2-cm inferior PDAA located just distal to the SMA branch point (Figs 1 and 2). He was found to have a significant proximal stenosis of the celiac artery, which was likely the pathogenic basis for this aneurysmal degeneration. The initial plan was to address the aneurysm endovascularly via the gastroduodenal artery (GDA) or SMA, followed by coil embolization. However, the angiogram confirmed an indistinct origin between the aneurysm and SMA, eliminating coil embolization as the sole treatment option (Fig 3). Due to the patient's relatively young age, stenting was deemed an impractical choice. Consequently, open exploration and repair were planned.

Right and left medial visceral rotation was performed. Elevating the duodenum and pancreas from the right enabled access to the posterior pancreatic head. The left medial visceral rotation allowed for elevation of the spleen and pancreatic tail, which allowed access to the posterior pancreas. Lesser sac exploration mobilized the stomach cephalad and allowed access to the aneurysm behind the superior mesenteric vein. Once the superior mesenteric vein was dissected and mobile, it was swept laterally and dissected posteriorly, just overlying the aorta outside the pancreatic tissue. This allowed access to the SMA. The SMA was dissected from the aortic origin to the PDA branch, which was complex due to chronic fibrosis and because the aneurysm was deeply embedded in the mid-pancreas.

The duodenum and pancreatic head were mobilized to investigate the posterior pancreatic head in an attempt to visualize the PDAs feeding into the aneurysm (Fig 4). Intraoperative ultrasound guidance successfully allowed for localization of both arteries and showed preferential flow from the PDA into the SMA.

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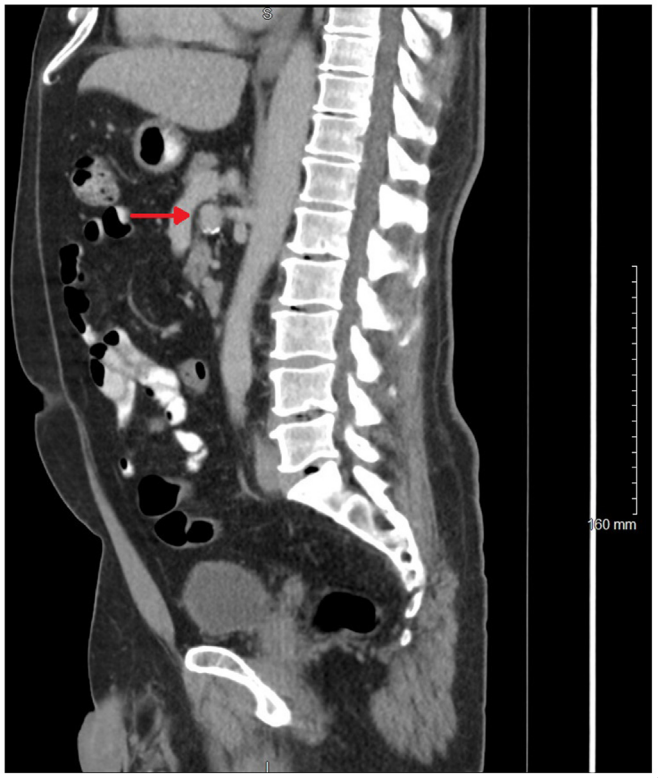

Fig 1. Computed tomography scan showing a 2.2-cm inferior pancreaticoduodenal aneurysm (*arrow*) adjacent to the superior mesenteric artery (SMA).

Fig 2. Magnetic resonance image of the aneurysm (*arrow*) within the pancreaticoduodenal artery (PDA).

This clearly revealed the risk that would have existed had we chosen to embolize. Because dissection at such depth in the pancreatic tissue posed a significant risk of pancreatic fistula, it was decided that the optimal plan would be to first isolate the aneurysm proximally by ligation, effectively excluding the aneurysm from the SMA. The secondary procedure would be to coil embolize the aneurysm.

Fig 3. Angiogram via the left radial artery approach showing an indistinct branch point between the inferior pancreaticoduodenal artery aneurysm (PDAA) (*arrow*) and superior mesenteric artery (SMA).

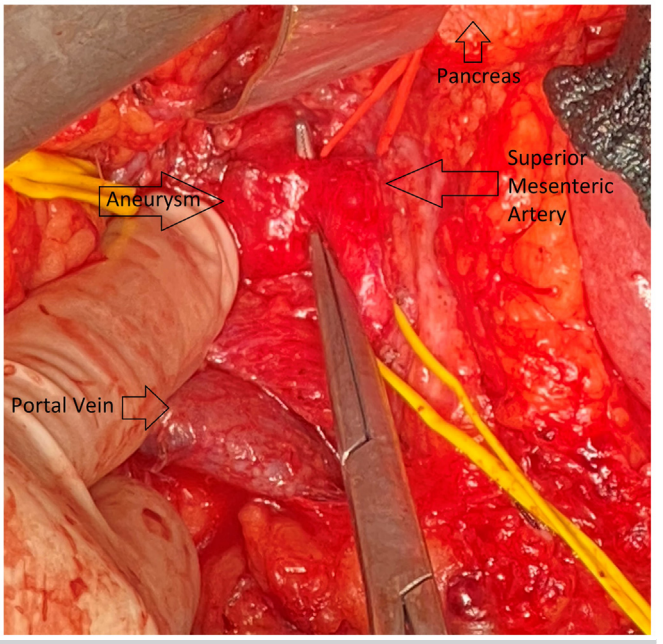

Fig 4. Open exposure of superior mesenteric artery (SMA) and aneurysm.

Postoperatively, the patient had an uneventful recovery. He subsequently followed up for elective coil embolization of the two feeding PDAs via the GDA for complete aneurysm exclusion. This was completed using a 5F radial access sheath and selectively catheterizing the aneurysm through the celiac artery, GDA, and PDAs. Using a PROGREAT microcatheter system with Ruby standard (Terumo Interventional Systems) and packing coils, we successfully embolized the aneurysm.

DISCUSSION

PDAAs are exceedingly rare. Men aged >50 years are four times more likely to be affected by peripancreatic aneurysms.[9] Once discovered, it is estimated that the lifetime risk of rupture is ~65%, with a mortality rate of 50%.[10] Most of these aneurysms are diagnosed late, once they are either symptomatic or have ruptured.[11] The PDAA of the present patient was found incidentally, which allowed for a complete workup, diagnosis, and treatment plan. In comparison to other aneurysms, there is limited literature and consensus guidance for repair. In the most recent guidelines, endovascular approaches for PDAAs and other aneurysms have been designated as the first-line treatment.[5,7,11] In recent years, there has been a paucity of reporting on open or hybrid surgical approaches. Although endovascular intervention has been shown to be successful, the long-term results of open approaches to VAA repair still have relatively low mortality and complication rates but are highly dependent on the surrounding anatomy.[8]

Our patient's aneurysm was in close proximity to the SMA and, due to concern of protruding embolization into the SMA, a hybrid open and endovascular approach was chosen. The diagnosis of the exact location required multiple preoperative diagnostic studies, including computed tomography angiography and diagnostic selective angiography. Intraoperatively, multiple maneuvers were necessary to obtain access to the aneurysm, which was deeply encased within the pancreatic body and surrounding fibrosis. On successful visualization, it was determined that distal control of the aneurysm was not possible because it was deep within the pancreatic tissue. We were, however, successful in isolating and ligating the aneurysm from the SMA. Once ligated, the risk of thrombosis progression was eliminated, and we could safely coil embolize the PDAA.

This case report illuminates the potential complexity of PDAAs, serves as an example of the limitations of solely endovascular management, and illustrates an example in which a hybrid approach can be used successfully.

CONCLUSIONS

This is a case of a patient with a PDAA abutting the SMA, limiting the possibility of an endovascular-only approach. This patient was treated with open ligation of the proximal PDAA at the takeoff of the SMA, followed by coil embolization. We demonstrate an example of when an endovascular only approach is not possible, open surgery can still be performed safely, requiring careful planning and execution.

DISCLOSURES

None.

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