Treatment of Pancreatitis Associated Visceral Arterial Pseudoaneurysms

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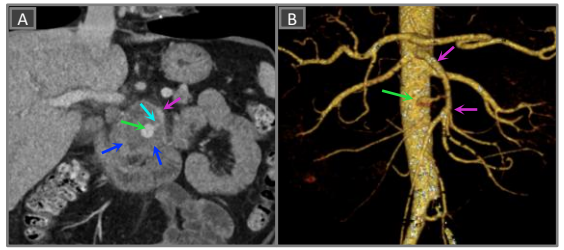
Introduction:

Visceral artery pseudoaneurysms (VAPAs) are life-threatening sequelae of pancreatitis. Proteolytic and lipolytic enzymes released into the perivascular space weaken the surrounding vessels and can lead to pseudoaneurysm formation. Rupture of these unstable lesions carries a high mortality rate. Treatment of VAPAs is individualized on a case-by-case basis and attempts to exclude the pseudoaneurysm while maintaining patency of parent vessels. In this exhibit, we present a patient who developed recurrent VAPAs of the superior mesenteric artery (SMA). The course of these recurrences will serve as a scaffold to review the endovascular management of these lesions.

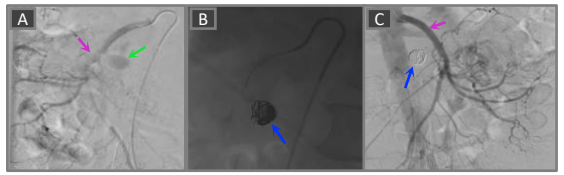
First Intervention: Imaging

The patient is a 51-year-old male with a history of recurrent exacerbations of acute-on-chronic pancreatitis on coumadin s/p aortic and mitral valve replacement who presented to the emergency department complaining of abdominal pain. CT angiography in the arterial phase (A) demonstrated contrast extravasation into a 9.0 x 8.0 mm saccular pseudoaneurysm contained within a previously identified 59.8 x 50.0 x 43.0 mm complex pancreatic pseudocyst with a contrast-filling linear connection to the SMA. 3D reconstruction (B) shows the small pseudoaneurysm sac originating from the proximal left SMA.



First Intervention: Transarterial Embolization

A contrast-enhanced arteriogram (A) confirmed a pseudoaneurysm arising from the first proximal branch of the SMA. The feeding artery was super-selected with a 2.4 Fr microcatheter, which was placed at the VAPA neck. The sac was excluded with 18mm x 40cm 3D detachable microcoils, 16mm x 40cm, and 6mm x 20cm Helix detachable microcoils (B). A repeat SMA angiogram showed pseudoaneurysm sac exclusion, while the SMA and its branches remained widely patent (C).



First Intervention: Discussion

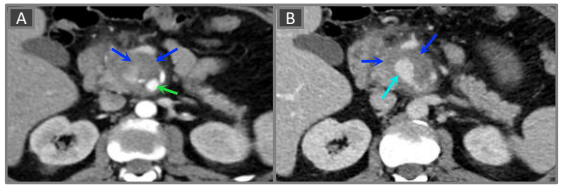
Transarterial embolization (TAE) is commonly used in the treatment of VAPAs. Metal coils/micro-coils are the most common embolic agents. Others include N-butyl-2-cyanoacrylate glue (N-BCA), ethylene vinyl alcohol copolymer (EVOH), gelfoam (used in emergent situations only), thrombin, and Amplatzer vascular plugs. Coils can be utilized in the treatment of VAPAs using a variety of techniques:

Embolization Technique	Description of Technique
Sac Packing	Filling the VAPA sac with coils without embolizing the parent vessel. Works best when VAPA has a narrow neck
Sandwich Technique	Involves placing coils in the parent artery lumen distally, at the lesion, and proximal to the lesion. This is important in visceral vessels and other organs with a rich collateral vasculature that allows retrograde filling of the VAPA via the efferent vessel.
Proximal Occlusion	Embolization proximal to the lesion is used in end organ arteries where there's no risk of retrograde filling.
Stent Caging	Deployment of an uncovered stent over the VAPA and metal coils into the VAPA sac through the interstices of the stent.

In this case, a microcatheter was directed into the sac, allowing coils to be deployed within the sac, while the narrow neck ensured a low risk of coil migration and parent vessel occlusion. Follow-up imaging showed no coil migration or VAPA reperfusion.

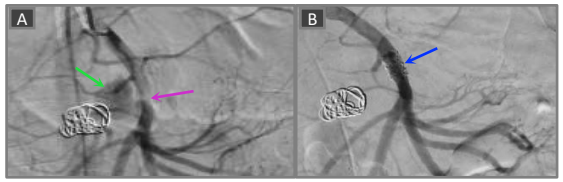
Second Intervention: Imaging

The patient returned to the ED 10 days later with severe epigastric pain. CT angiography demonstrated the same complex pancreatic pseudocyst, with a new 11.0 x 9.0 mm saccular pseudoaneurysm seen in the arterial phase (A) and a new 24.0 x 16.0 mm pseudoaneurysm seen in the venous phase (B).



Second Intervention: Stent Graft

Selective contrast angiogram of the SMA (A) revealed a new delayed ovoid contrast collection arising from either a mesenteric collateral vessel or an unclear area of irregularity of the SMA proximal to its branches without identifiable arterial inflow. A short, 6mm x 15cm balloon-mounted covered-stent graft 28mm distal to the SMA origin to exclude the area of irregularity thought to supply the new pseudoaneurysm. A post-stent SMA angiogram (B) confirmed exclusion of the pseudoaneurysm.



Second Intervention: Discussion

Stent grafting is also frequently used in the treatment of VAPAs. The use of a stent graft is advantageous in that it allows for preservation of the parent artery while effectively excluding the VAPA. This is particularly useful in VAPAs with wide necks that would otherwise carry high risk of non-target embolization in TAE.

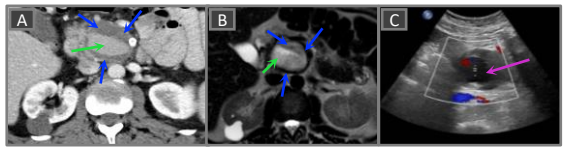
Stent grafting, however, is not suitable in all circumstances.

- The main limitation of stent grafting in VAPAs is the small size and tortuosity of visceral vessels, which generally restricts its use to proximal lesions such as the main hepatic artery, main splenic artery, and SMA.
  - Balloon angioplasty is frequently used to ensure good apposition to the vessel wall and thus reduce the risk of endoleak.
  - Alternatively, there is some evidence that flexible, self-expanding stents may be preferable to more rigid, balloon-expanded stents that better contour the tortuous visceral vessels, thus decreasing the risk of thrombosis.
- In VAPAs, because no embolic material is used in the lesion sac, there is some risk of rupture even after it has been successfully excluded from the circulation.
- Furthermore, because treatment success is largely dependent of appropriate graft sizing, the need for extra planning limits the utility of stent grafts in emergency situations.

In this case, endograft deployment was a viable treatment option because we ensured that there was rich collateral mesenteric flow so endograft deployment doesn't lead to mesenteric ischemia. Additionally, there was no identifiable path to the pseudoaneurysm to perform trans-arterial embolization, so endograft deployment was the only indicated intervention in this situation to treat an otherwise life-threatening condition.

Third Intervention: Imaging

Two months later, the patient returned to the ED with recurrent abdominal pain, similar to previous episodes. Axial CT abdomen with IV contrast (A) and axial T2-weighted axial MRCP with contrast (B) both showing the same chronic complex pseudocyst now increased in size to 63.0 x 52.0 x 55.0 mm. The 45.0 x 22.0 mm opacified central area was initially ruled as non-enhancing, but ultrasound demonstrated the presence of a high resistance arterial waveform in the central anechoic portion of this lesion (C). Thus, the central area was reevaluated to be a pseudoaneurysm demonstrating delayed filling.

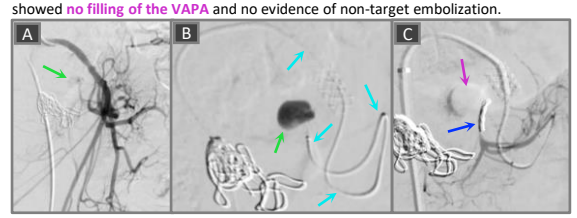


Third Intervention: Percutaneous Thrombin Injection

Selective angiography of the SMA (A) shows a 1.1 cm ovoid lesion filling with contrast. The pseudoaneurysm was super-selected with a 2.4 Fr microcatheter revealing prominent vessel tortuosity of the SMA branch supplying the pseudoaneurysm (B). No arterial out-flow could be seen, and it was difficult to advance the microcatheter into the pseudoaneurysm sac. As a result, embolization of the pseudoaneurysm sac alone was not possible.

Third Intervention: Proximal Embolization and Percutaneous Thrombin Injection

First, the proximal arterial in-flow was embolized with two 3mm x 4mm detachable microcoils. Then using ultrasound guidance, a 22-gauge Chiba needle was advanced percutaneously into the pseudoaneurysm using an anterior approach. Needle tip positioning in the pseudoaneurysm was further confirmed on fluoroscopic and cone-beam CT. 800 units of recombinant thrombin was instilled through the needle and prompt thrombosis was noted on real-time ultrasonography. Repeat angiography (C) showed no filling of the VAPA and no evidence of non-target embolization.



Third Intervention: Discussion

The decision was to perform either liquid embolization or thrombin injection of the VAPA. While liquid embolization with EVOH was considered, which does not depend on coagulation, there is a great financial expense when using this product. There is also a learning curve with liquid embolics to use the appropriate quantity and avoid catheter retention. Percutaneous thrombin injection is described as a safe, successful second-line therapy after failed endovascular treatment or if no feeding vessels are identified. The immediate thrombosis of the sac can be seen in real-time on ultrasound. In this case, thrombosis was more likely after proximal coiling reduced arterial in-flow. Non-target embolization is minimized with image guidance and by positioning the needle tip away from the VAPA neck. Because this technique requires penetrating the unstable VAPA wall, the risk of rupture is increased.

Conclusion:

VAPAs are highly fatal when left untreated but can be managed effectively with various endovascular treatment options. Depending on the size and location of the lesion, endovascular therapies can offer advantages over surgical management, including better safety and efficacy outcomes in general.

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