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INTERVENTIONAL RADIOLOGY

TECHNICAL NOTE

Treatment of mycotic superior mesenteric vein pseudoaneurysm via placement of covered endovascular stent

Jules Eustache
Zhixia Rong
Louis Bouchard
Pierre Perrault
Edouard Girard
Réal Lapointe

ABSTRACT

Vascular pseudoaneurysms are a rare yet life-threatening complication of untreated pancreatic pseudocysts related to their high risk of rupture and bleeding. Several studies and reports have established endovascular approaches as a successful first-line therapy in the management of arterial pancreatic pseudoaneurysms. However, no reports have been published describing endovascular repair of a venous pseudoaneurysm that developed after infection of a chronically stable pancreatic pseudocyst, most likely due to its rare occurrence. We report in this technical note the treatment of a superior mesenteric vein pseudoaneurysm that developed as a result of an infected small pancreatic pseudocyst, by radiologic placement of a covered endovascular stent.

Vascular pseudoaneurysms are a rare yet life-threatening complication of untreated pancreatic pseudocysts related to their high risk of rupture and bleeding. Several studies and reports have established endovascular approaches as successful first-line therapy in management of arterial pancreatic pseudoaneurysms (1). However, no reports have been published describing endovascular repair of a venous pseudoaneurysm that developed after infection of a chronically pancreatic pseudocyst, most likely due to its rare occurrence. The patient provided informed consent and has agreed to publish his case details and images.

Technique

A 68-year-old man known for coronary artery disease, type 2 diabetes, dyslipidemia, and hypertension presented with progressive confusion in the context of a one-week history of fever. Fifteen years prior he was treated for acute infected necrotizing pancreatitis with surgical necrosectomy. The event was complicated by subsequent finding of a 16 mm pancreatic pseudocyst which was managed conservatively over a 15-year period. Pseudocyst remained stable in size for the first 7 years and then progressed over the next 3 years reaching a size of 30 mm. Despite changes in morphology, pseudocyst remained clinically asymptomatic during the 15-year period. For his current presentation, patient underwent complete sepsis workup. Initial blood cultures tested positive for *Streptococcus gordonii*. A CT scan revealed air pockets within the pseudocyst and superior mesenteric vein (SMV) pseudoaneurysm (9×10 mm) protruding into the infected pancreatic pseudocyst (Fig. 1). Sampling of the collection via endoscopic ultrasound was performed and was positive for *Staphylococcus epidermidis*, *Streptococcus gordonii*, and *Candida lusitaniae* species. The patient was immediately treated with intravenous piperacillin-tazobactam and fluconazole, which resulted in rapid clinical improvement of his moderate sepsis. After a week of effective intravenous antibiotic therapy, the patient was stable without bacteremia signs and underwent the placement of endovascular stent to obliterate SMV parietal defect.

The procedure was performed in angio-interventional suite under general anesthesia. Access to the portal system was achieved by ultrasound-guided percutaneous puncture of a right peripheral portal branch using a Neff percutaneous access set (Cook Medical). A 9 French Flexor introducer was positioned at level of the main portal vein. Subsequently, a Pigtail catheter with markers was advanced until the tip of the catheter reached the splenic and mesenteric veins in order to perform sequential spleno-portography and mesenteri-

From the Departments of Hepatopancreatobiliary Surgery and Liver Transplantation (J.E., Z.R., E.G. ✉ *edouard.girard@umontreal.ca*, R.L.), and Department of Radiology (L.B., P.P.), University of Montreal Hospital Center (CHUM), Montreal, QC, Canada; Grenoble Alpes University (E.G.), CNRS, CHU Grenoble Alpes, Grenoble INP, Grenoble, France.

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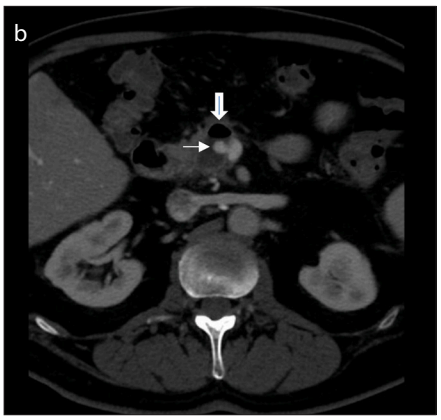

Figure 1. a, b. Coronal CT image **(a)** of the abdomen shows an SMV pseudoaneurysm *(small white arrow)*. Axial CT image **(b)** of the abdomen shows air pockets *(large arrow)* within the infected pancreatic pseudocyst and protrusion of SMV pseudoaneurysm (9×10 mm) *(small arrow)*.

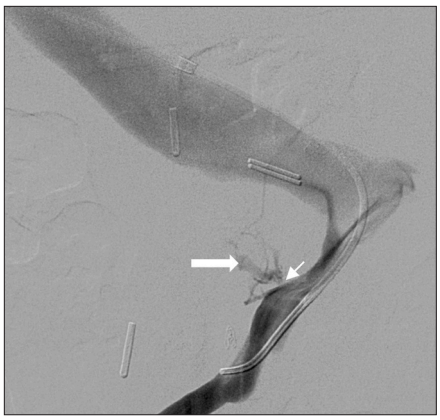

Figure 2. Angiogram of SMV shows the small breach in the venous wall *(small arrow)* which resulted in the mycotic pseudoaneurysm; filling of dye into the pancreatic pseudoaneurysm *(large arrow)* is seen.

Figure 3. A small proximal jejunal branch in close proximity to the wall breach was embolized with a 12 mm type I Amplatzer vascular plug *(large arrow)*, in order to avoid a possible periprosthetic endoleak. Fluency covered stent (10 mm diameter × 40 mm length) was deployed into the superior portion of SMV and centered over the breach in the venous wall *(small arrows)*.

Main points

- Vascular pseudoaneurysms are a rare yet life-threatening complication of untreated pancreatic pseudocysts related to their high risk of rupture and bleeding.
- Endovascular stenting could be an alternative for the treatment of venous visceral pseudoaneurysms.
- In the context of infected aneurysms, placement of stent grafts is an acceptable therapeutic option with no evidence of increased complications.

co-portography (Fig. 2). The SMV and its proximal branches were catheterized, and a small breach in the venous wall which resulted in the mycotic pseudoaneurysm was identified. A small proximal jejunal branch in close proximity to the wall breach was identified and embolized in order to avoid a possible periprosthetic endoleak. Specifically, a 12 mm type I Amplatzer vascular plug (St-Jude Medical) was deployed near the distal portion of the jejunal venous trunk. Subsequently, a Fluency (Bard Medical) covered stent (10 mm diameter × 40mm length) was deployed in the superior portion of the SMV, centered over the breach in the venous wall. This stent graft was post-dilated to 8 mm at its lower end, and 10 mm at its upper end. Subsequent contrast phlebography did not demonstrate any visible residual pseudoaneurysmal opacification or endoleaks (Fig. 3). Finally, the transhepatic tract was embolized using a 6 mm type II Amplatzer plug (St-Jude Medical). There were no immediate complications. After the procedure, anticoagulation at therapeutic dosing (enoxaparin 120 mg subcutaneous once daily) was prescribed for 3 months in addition to prophylactic aspirin 80 mg daily. The patient was discharged two weeks later with oral antibiotics (cefadroxil and metronidazole). Post-stent insertion, the pseudocyst was punctured and evacuated twice. Since the first aspiration revealed presence of *Streptococcus viridans* in cultured cyst fluid, the patient remained on oral antibiotics; the second drainage performed three months later for a persistent 25 mm cyst yielded sterile inflammatory fluid. The collection has then completely collapsed, and antibiotics were discontinued. Last follow-up CT scan (3 years post-procedure) showed patency of SMV without evidence of pseudocyst recurrence (Fig. 4).

Discussion

Pseudoaneurysms are a rare complication of pancreatic pseudocysts and are the result of local inflammation and release of pancreatic enzymes leading to erosion of the peripancreatic vessels wall (2). The major complication of pseudoaneurysms is rupture which can result in acute life-threatening hemorrhage (2). In the literature, the most frequent sites of pseudoaneurysms are the splenic and hepatic arteries followed by the gastroduodenal and other visceral vessels that share close anatomical proximity with the pancreatic bed (2). Interestingly, few cases have been published on the development of venous pseudoaneurysms secondary to pancreatic pseudocysts (3). As such, our case represents a rare finding of a SMV pseudoaneurysm caused by acute infection of a long-standing pancreatic pseudocyst.

Several treatment options exist for pseudoaneurysms and the conduct is dictated by the hemodynamic status of the patient. In patients presenting with hemodynamic instability or an acute abdomen, immediate surgery remains the best option. In hemodynamically stable patients, treatment approaches include endovascular embolization using a variety of embolic agents, image-guided direct puncture and thrombin injection, covered stent placement, or a combination of these techniques with perioperative intravenous antibiotics (4). Endovascular techniques have the bene-

Figure 4. a, b. Follow-up CT scan performed 3 years following the intervention. Coronal reconstructed image **(a)** shows patency of the SMV with persistent occlusion of the pseudoaneurysm. Axial CT image **(b)** of the abdomen shows no evidence of pancreatic pseudocyst recurrence.

fit of being significantly less invasive than open surgery; however, the optimal angiointerventional approach is still to be determined.

The most often studied endovascular technique is coil embolization, which has established itself as an effective treatment option for pseudoaneurysms secondary to pancreatitis. A retrospective review of 33 patients with pseudoaneurysms due to chronic pancreatitis by Udd et al. (5) concluded that coil embolization was successful in 67% of cases, and was not associated with significant differences compared to open surgical approaches in terms of morbidity and mortality. However, it was associated with lower transfusion requirements and reduced overall length of hospital stay. Zyromski et al. (6) showed an impressive success rate in 35 patients with pseudoaneurysms of the visceral arterial tree. They reported a 100% success rate in controlling pseudoaneurysm hemorrhage via angiographic intervention, with a 6% need for reintervention and an overall mortality of 14% (6). Current literature suggests that angioembolization, in addition to being less invasive than open surgery, is a reasonable first choice therapy in the treatment of pseudoaneurysms in hemodynamically stable patients.

The placement of endovascular stent grafts has been suggested as an alternative endovascular repair technique for pseudoaneurysms, with promising results being increasingly published. This technique allows the affected vessel to remain patent, which is sometimes mandatory to prevent target organ ischemia. A retrospective study by Kim et al. (7) of 6 patients treated with covered stents for superior mesenteric artery (SMA) pseudoaneurysms demonstrated successful exclusion without extravasation in all patients. The only two complications were residual narrowing for one which required balloon angioplasty, and the need for a secondary stent placement in another patient to treat a recurrent bleed secondary to SMA dissection (7). Several other groups have reported success in using covered stents in the context of hepatic artery pseudoaneurysms following pancreatic surgery (1). In current practice, infected aneurysms are considered as contraindication for stent-graft placement. However, several reports have since been published suggesting that even in the context of infected aneurysms, placement of stent grafts is an acceptable therapeutic option with no evidence of increased complications (8). In our case, patient did not have any infectious sequelae due to endovascular stent graft placement. To decrease the risk of future thrombotic events, therapeutic anticoagulation was prescribed for three months and prophylactic aspirin continued indefinitely. CT scan performed 3 years following the event showed patency of the endovascular stent without evidence of pseudocyst recurrence.

In conclusion, deployment of an endovascular covered stent to treat mycotic SMV pseudoaneurysm is a safe technique. This technique could be another tool for the treatment of venous visceral pseudoaneurysms. However, the effectiveness of venous visceral endovascular covered stent has to be proven in a large cohort.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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