Coil embolization using microballoon assistance combined with the double-catheter technique for a large superior mesenteric arterial pseudoaneurysm and fistula secondary to acute pancreatitis

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ABSTRACT

Pseudoaneurysm of the superior mesenteric artery (SMA) is rare and associated with the risk of massive fatal hemorrhage and acute mesenteric ischemia. We describe a 43-year-old man with acute pancreatitis who presented with an SMA pseudoaneurysm measuring 13 × 12 cm in diameter. The pseudoaneurysm originated between the first and second jejunal arteries and drained into the mesenteric vein. The SMA trunk between the first and second jejunal arteries was embolized with detachable coils using microballoon assistance. After coil placement, arteriography showed the collateral circulation and no perfusion delay of the distal SMA. This technique was useful for isolation of the SMA pseudoaneurysm. (J Vasc Surg Cases and Innovative Techniques 2018;4:152-5.)

Pancreatitis is associated with high morbidity and mortality rates. A common fatal complication of pancreatitis is the visceral artery pseudoaneurysm.[1] Severe bleeding accompanying pancreatitis has been reported in 14.5% of cases.[2] The rupture rate of pseudoaneurysm secondary to pancreatitis is as high as 50%,[1,3] and mortality rates are high in cases of rupture (25%-70%).[4] Pseudoaneurysm of the superior mesenteric artery (SMA) is rare, with an incidence of only 0.01% to 2.6%; however, it presents the risk of massive fatal hemorrhage and acute mesenteric ischemia.[5] Conventional treatment of SMA pseudoaneurysms has consisted of surgical ligation, assessment of bowel viability, and revascularization.[6] McGraw et al[7] reported the first case of endovascular treatment by using a covered stent in the autogenous vein. Recently, covered stent placement for the pseudoaneurysm has become common. We report a rare, large SMA pseudoaneurysm in which covered stent placement was difficult and the SMA trunk was successfully isolated by placing the coils on the expanded microballoon. We obtained consent to publish from the patient.

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CASE REPORT

A 43-year-old man with a history of alcoholic liver disease presented with severe abdominal pain due to acute pancreatitis. Acute pancreatitis was diagnosed on the basis of abdominal contrast-enhanced computed tomography (CE-CT) and laboratory data. Physical examination indicated skin jaundice and abdominal distention and tenderness. Vital signs were as follows: systolic blood pressure, 114 mm Hg; respiratory rate, 22 breaths/min; heart rate, 104 beats/min; and oxygen saturation by pulse oximetry, 100% with 2 L O_2/min. Laboratory data showed the following: serum lactate dehydrogenase, 280 U/L; serum alkaline phosphatase, 604 U/L; serum γ-glutamyl transpeptidase, 208 U/L; serum total bilirubin, 10.2 mg/dL; serum amylase, 571 U/L; hemoglobin, 8.9 g/dL; and hematocrit level, 24.8%. Hemodynamic status was continuously stable. Abdominal CE-CT revealed the SMA pseudoaneurysm, measuring 13 × 12 cm in diameter, that extended from the pancreatic head to the porta hepatis (Fig 1). The pseudoaneurysm neck was on the SMA trunk. This large pseudoaneurysm drained into the mesenteric vein.

Emergency endovascular treatment was performed through the bilateral femoral arteries with 4F systems under local anesthesia. Superior mesenteric arteriography through a 4F catheter (shepherd hook; Medikit Co Ltd, Miyazaki, Japan) demonstrated a pseudoaneurysm originating from the SMA that arose between the first and second jejunal arteries (Fig 2, *a*). The pseudoaneurysm neck length was 3 mm; the pseudoaneurysm drained directly into the mesenteric vein, and the diameter of the normal SMA measured 1.7 mm. Therefore, a temporary 1.8F microballoon (0-5 mm in diameter, 12 mm in length) catheter (LOGOS; PIOLAX, Inc, Yokohama, Japan) occlusion of the SMA at the point of the pseudoaneurysm neck revealed the collateral formation through the first and second jejunal arteries (Fig 2, *b*). We judged that coil embolization was suitable at the point of the pseudoaneurysm neck. However, blood flow was fast, and it was impossible to stabilize the coil. Accordingly, an approach

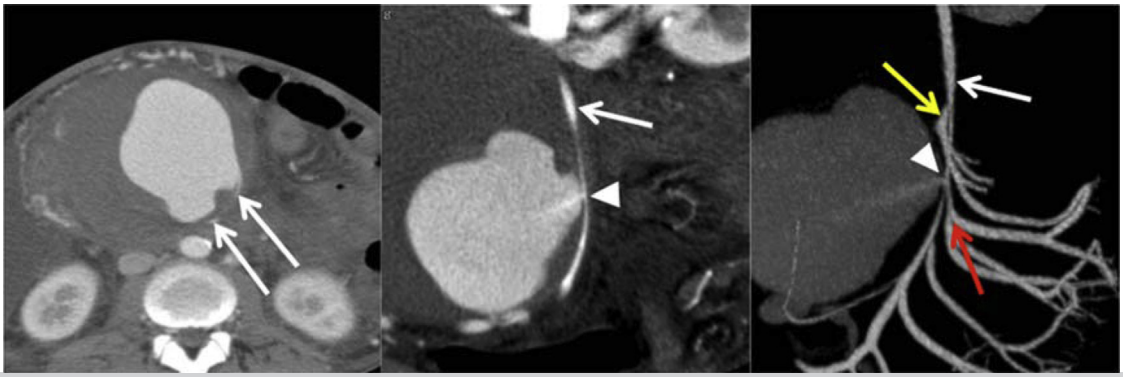

Fig 1. Abdominal contrast-enhanced computed tomography (CE-CT) scans and maximum intensity projection showed a pancreatic pseudoaneurysm measuring 13 × 12 cm in diameter that originated from the superior mesenteric artery (SMA; *white arrow*) trunk. The SMA was excluded and extended from the pancreatic head to the porta hepatis. *Arrowhead*, Pseudoaneurysmal neck; *yellow arrow*, first jejunal artery; *red arrow*, second jejunal artery.

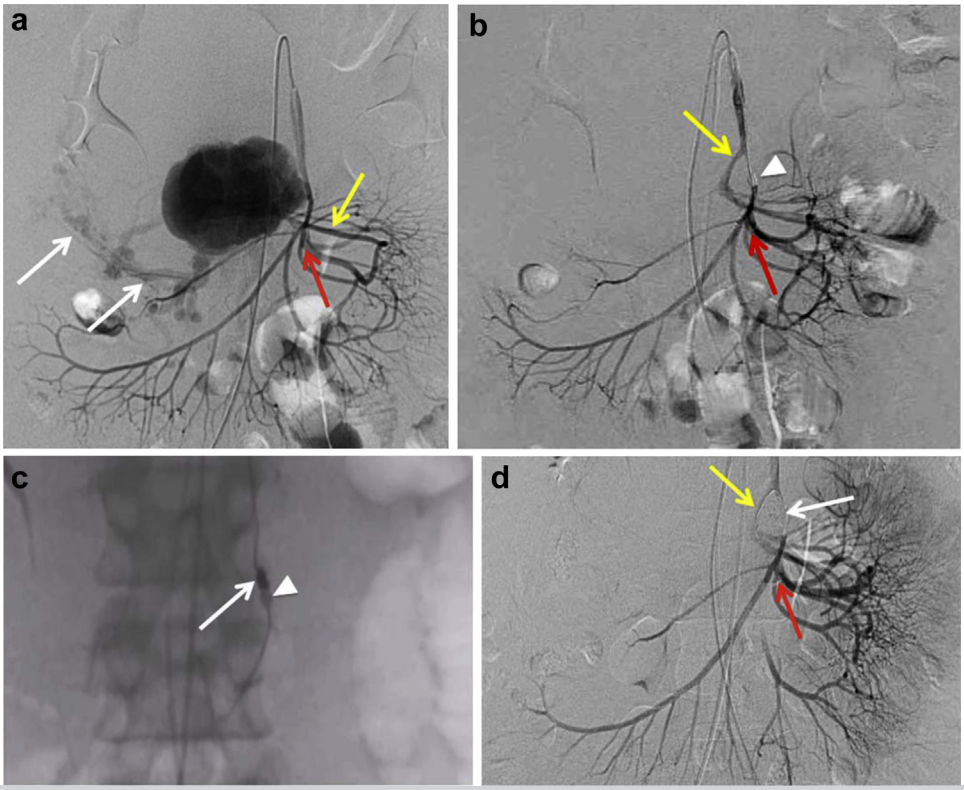

Fig 2. Digital subtraction angiography. **a,** Superior mesenteric arteriography demonstrated a superior mesenteric artery (SMA) pseudoaneurysm. The pseudoaneurysm drained directly into the mesenteric vein (*white arrow*); *yellow arrow*, first jejunal artery; *red arrow*, second jejunal artery. **b,** Under the SMA occlusion at the point of the pseudoaneurysmal neck, arteriography revealed collateral formation through the first and second jejunal arteries. A pseudoaneurysm is not shown. *Arrowhead*, Microballoon. **c,** Four detachable coils (*arrow*) were placed on the expanded microballoon (*arrowhead*) and in the SMA trunk. **d,** After coil placement (*white arrow*), arteriography showed disappearance of the pseudoaneurysm and blood flow in the SMA through the collateral circulation without perfusion delay of the distal SMA.

was taken to isolate the pseudoaneurysm with the assistance of a 1.8F microballoon and the double-catheter technique. First, the distal side of the pseudoaneurysm neck was occluded with the microballoon to prevent coil migration. Second, using a 2.2F two-marker catheter (coiling support; HI-LEX MEDICAL, Hyogo, Japan), a total of four detachable coils (one piece, 4 mm × 15 cm; three pieces, 3 mm × 12 cm; Ruby; Penumbra, Inc, Alameda, Calif) were placed on the expanded microballoon, maintaining stability, and in the SMA trunk between the first and second jejunal arteries (Fig 2, *c*). Finally, the microballoon

Fig 3. Eighteen months after discharge, contrast-enhanced computed tomography (CE-CT) showed complete disappearance of the pseudoaneurysm.

was contracted and slowly pulled out so that the coils did not deviate. Arteriography showed disappearance of the pseudoaneurysm and blood flow in the SMA through the collateral circulation without perfusion delay of the distal SMA (Fig 2, *d*).

On day 9 after admission, fever and elevated white blood cell count and C-reactive protein level were observed. Unenhanced CT findings were suggestive of infection of the pseudoaneurysm. On day 12 after admission, endoscopic ultrasound-guided drainage was performed between the stomach and the pseudoaneurysm. Thereafter, the pseudoaneurysm shrank, and the inflammatory reactions improved. The post-treatment course was favorable; all laboratory data gradually normalized because of reduction of pseudoaneurysm compression, and the patient was discharged on day 36 after admission. Eighteen months after discharge, CE-CT revealed complete disappearance of the pseudoaneurysm (Fig 3) and a clearly enhanced periphery of the SMA.

DISCUSSION

A pseudoaneurysm is a pulsatile, blood-filled extraluminal sac that communicates with the arterial lumen. The mechanism of pseudoaneurysm formation is elastolytic erosion of the vessel wall resulting from the necrotizing inflammatory process around the pancreas, extravasated proteolytic and lipolytic enzymes, secondary abscesses, and long-term pseudocysts.[2,3,5] Approximately 10% of abdominal isolated visceral pseudoaneurysms are thought to be related to pancreatitis.[8] Pseudoaneurysm rupture rates and mortality rates in cases of rupture are very high.[1,3] Therefore, the pseudoaneurysm must be treated regardless of size.

Bleeding from the SMA accompanying pancreatitis occurred in only 2.2%.[5] To achieve successful coil embolization in the SMA trunk, the following had been considered. The pseudoaneurysm originating between the first and second jejunal arteries and the collateral formation revealed through the first and second jejunal arteries had been assessed. The pseudoaneurysm had a neck length of 3 mm and a narrow diameter. Therefore, it was possible to embolize the SMA trunk without collapsing the branch vessels. In performing coil embolization of the SMA trunk, maintaining coil stability was difficult because of rapid blood flow. In the case of coil migration to the periphery, there was a possibility of organ ischemia or necrosis. Accordingly, flow control and coil stability were important to complete coil embolization. Even when the proximal side of the SMA trunk was occluded with a balloon, it was difficult to control the collateral circulation. Therefore, we performed a unique coil embolization of the SMA trunk using microballoon assistance combined with the double-catheter technique that occluded the distal side, placed the coils on the expanded microballoon, and kept the coil stable. Filling in a pseudoaneurysm with coils or glue is not a general treatment. In addition, the pseudoaneurysm was large and extended to the porta hepatis, which compressed the biliary tract. Therefore, we expected that filling embolus in pseudoaneurysm would be difficult to cancel the compression of the biliary tract.

Covered stent placement for the pseudoaneurysm has become common, and the important role of the SMA trunk in global abdominal organ perfusion is to preserve the main trunk even if the branch vessels are sacrificed. However, there were problems, such as being unable to guarantee long-term patency and the need to take antiplatelet medicine for a lifetime because of the patient's young age. Of course, occlusion of the unnecessary branch vessels due to covered stent placement would be less morbid. However, when the covered stent becomes obstructed, blood flow from the branch blood vessels cannot be expected, so there was concern for organ ischemia. In addition, it was difficult to select a suitable size to exclude because the normal SMA trunk diameter was as small as 1.7 mm due to compression and spasm caused by the pseudoaneurysm. Endoscopic ultrasound-guided thrombin injection is a new treatment.[3,8] Thrombin injection is recommended in cases of hemodynamic stability, slow flow, and small pseudoaneurysms.[3] However, this case did not conform to these indications. Surgical repair is not the first treatment choice because reports have indicated that endovascular treatment achieves better results than surgical repair, and mortality rates of surgical repair are approximately 56%.[9,10] The Amplatzer vascular plug (St. Jude Medical, St. Paul, Minn) is considered to be most suitable for safe embolization while maintaining peripheral blood flow in case of hesitation in placement of a covered stent. However, the Amplatzer vascular plug was not introduced in our country at the time.

We think that partial embolization in the SMA trunk generally does not entail clinically significant consequences because the SMA blood flow is supplied through the collateral circulation. However, before performing embolization, we recommend checking for adequate blood flow from the collateral circulation under the SMA occlusion with a balloon. When blood flow from the

collateral circulation cannot be expected, covered stent placement or surgical repair must be considered.

CONCLUSIONS

Coil embolization for isolation of the SMA pseudoaneurysm using microballoon assistance combined with the double-catheter technique was useful and feasible. This technique can be applied to coil embolization of every vessel with rapid blood flow.

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