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CASE REPORT

# Percutaneous treatment of a superior mesenteric artery pseudoaneurysm and arteriovenous fistula with coil embolization: a case report

## Süperiyor mezenterik arter yalancı anevrizması ve arteriyovenöz fistülün mikrosarmal embolizasyon ile başarılı şekilde kapatılması: Olgu sunumu

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***Summary–*** Visceral artery pseudoaneurysm and arteriovenous fistula following penetrating abdominal injuries is a rarely observed complication. Presently described is the case of a 44-year-old male admitted to the hospital after having previously experienced penetrating abdominal trauma. The patient had developed a pseudoaneurysm in the superior mesenteric artery and an arteriovenous fistula between the superior mesenteric artery and vein following surgery. The patient underwent successful coil embolization procedure and he was discharged 1 day after intervention.

***Özet–*** Karın travması sonrası oluşan visseral arter yalancı anevrizması ve arteriyovenöz fistül oldukça nadir görülen klinik bir durumdur. Bu yazıda, hastaneye tekrar başvurmadan önce penetran karın travması geçirmiş 44 yaşındaki erkek hasta sunuldu. Hastada acil cerrahi girişim sonrasında semptomlu hale gelen süperiyor mezenterik arter yalancı anevrizması ve arteriyovenöz fistül gelişti. Tanı için bilgisayarlı tomografi yapıldı. Hastaya mikrosarmal embolizasyon başarılı bir şekilde uygulandı ve girişimden bir gün sonra taburcu edildi.

Abdominal visceral artery aneurysm (AVAA) can involve the superior mesenteric artery, splenic artery, hepatic artery, coeliac trunk, renal artery, and other locations. Rupture, distal embolization, and thrombosis are common complications of AVAA.[1] Rupture is the most dramatic complication, and it is associated with a high mortality rate.[2] The etiology may be atherosclerosis, inflammatory (pancreatitis), collagen vascular disease, portal hypertension, pregnancy, aortic dissection, or trauma.[1] There are various opinions about the treatment of AVAA. The guidelines suggest treatment for visceral artery aneurysm (VAA) with a diameter of >2 cm,[3,4] but there is not consensus on the treatment of abdominal visceral artery pseudoaneurysm (AVAPA). Pseudoaneurysm tends to bleed much more frequently (more than 50%), so a threshold size limit as an indication of treatment is not appropriate for pseudoaneurysm. Nonetheless, pseudoaneurysms should be treated when possible. A classic surgical attempt is associated with significant morbidity rate. Over the past decade, there has been a continuous increase in the use of noninvasive, nonoperative interventions, and endovascular treatment (ET) for AVAA.[5]

## CASE REPORT

A 44-year-old male was admitted to the hospital with the complaint of recurring abdominal pain. Physical examination revealed abdominal distension, diffuse abdominal tenderness, fullness in the upper abdomen and a loud, continuous bruit at admission. He had a

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history of penetrating abdominal injuries to the right upper quadrant of the abdomen received 1 month prior. The patient had been hemodynamically stable but free fluid had been observed in the abdomen. An emergency exploratory laparotomy had been performed, and the patient had been discharged after 1 week. The possibility of an aneurysm or arteriovenous fistula was considered. Computed tomography (CT) scan was performed to evaluate this possibility. The scan of the abdomen revealed a pseudoaneurysm originating in the superior mesenteric artery (SMA) and a large arteriovenous fistula between the SMA and the superior mesenteric vein (SMV) (Figure 1a). Reoperation was not contemplated, as the risk of bleeding complications was thought to be potentially fatal. He was referred for angiography and possible intravascular treatment (covered stent, endovascular embolization,

**Abbreviations:**

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| *AVAA* | *Abdominal visceral artery aneurysm* |
| *AVAPA* | *Abdominal visceral artery pseudoaneurysm* |
| *CT* | *Computed tomography* |
| *ET* | *Endovascular treatment* |
| *SMA* | *Superior mesenteric artery* |
| *SMV* | *Superior mesenteric vein* |
| *VAA* | *Visceral artery aneurysm* |

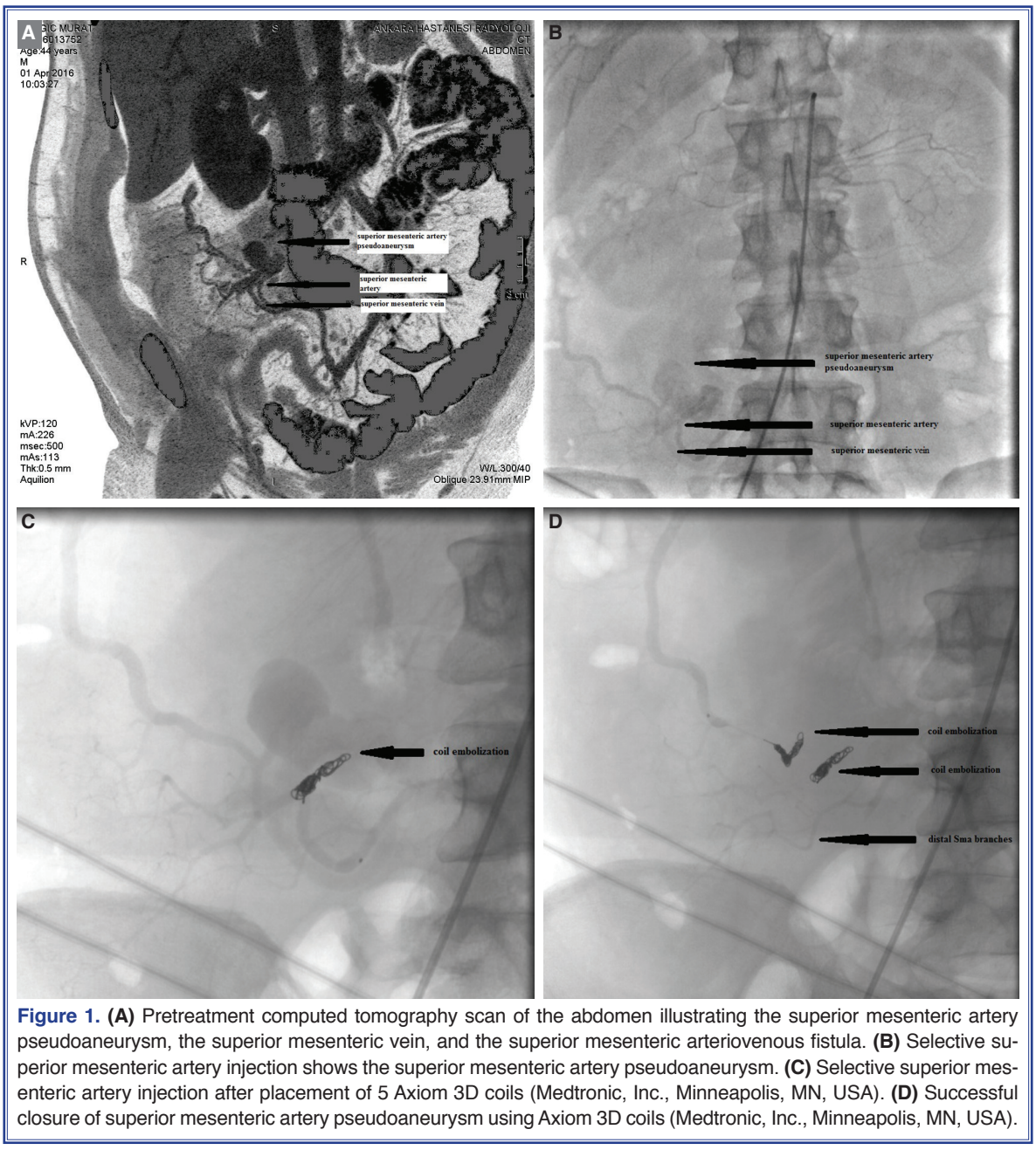


**Figure 1.** **(A)** Pretreatment computed tomography scan of the abdomen illustrating the superior mesenteric artery pseudoaneurysm, the superior mesenteric vein, and the superior mesenteric arteriovenous fistula. **(B)** Selective superior mesenteric artery injection shows the superior mesenteric artery pseudoaneurysm. **(C)** Selective superior mesenteric artery injection after placement of 5 Axiom 3D coils (Medtronic, Inc., Minneapolis, MN, USA). **(D)** Successful closure of superior mesenteric artery pseudoaneurysm using Axiom 3D coils (Medtronic, Inc., Minneapolis, MN, USA).

or coil embolization). Selective angiography of the SMA was performed in anterior-posterior and lateral projections with a 6-F internal mammary artery guiding catheter. The selective superior mesenteric arteriogram revealed a 3.66x2.03 cm pseudoaneurysm, the SMV, and a superior mesenteric arteriovenous fistula (Figure 1b). Hi-torque Whisper MS guide wire (Abbott Vascular, Inc., Santa Clara, CA, USA) was used to pass the lesion. A 2.5x12 mm angioplasty balloon was advanced into the SMA, and balloon occlusion angiography of the SMA was then performed. The SMA pseudoaneurysm and fistula were then well shown. The first afferent artery of pseudoaneurysm was approached using an Echelon 10 micro catheter (Medtronic, Inc., Minneapolis, MN, USA). Five Axiom 3D coils (Medtronic, Inc., Minneapolis, MN, USA) were introduced (Figure 1c). The same type of micro catheter was used to position 4 Axiom 3D coils (Medtronic, USA) in another afferent artery (Figure 1d). The final selective image taken from the SMA indicated that the pseudoaneurysm and fistula were completely closed. Blood flow to the SMA was preserved with normal distal SMA branches (Figure 1d). The procedure was well tolerated and there were no complications afterwards. The patient was discharged 1 day after coil embolization. He remained asymptomatic at 1-month follow-up visit.

## DISCUSSION

Endovascular treatment includes covered stents, coil packing, liquid embolic agents, and percutaneous thrombin injection.[6] ET for AVAA is a safe, minimally invasive, highly successful alternative to surgery for selected cases.[7] The largest case series reported was conducted at the Mainz Clinic in Germany. Among 233 patients, the rate of rupture was much higher in pseudoaneurysm than true aneurysm (76.3% vs. 3.1%). Fifty-nine AVAA were treated with intervention (n=45) or surgery (n=14). Thirty-five cases with ruptured VAA were treated on an emergency basis. After interventional treatment, the 30-day mortality was 6.7% in ruptured VAA compared with no mortality in non-rupture cases.[2] In a case series from Fudan University in China with 155 patients, 106 patients were treated with ET, and the remaining 49 patients were treated with open surgery repair or conservative therapy. The 1-month mortality rate was 2.8% for all patients. Symptomatic VAA has a significantly higher 1-month mortality rate than asymptomatic VAA.[7] The general thought in cases of AVAA leans toward early elective intervention rather than conservative approach in order to decrease the risk of rupture.

SMA-SMV fistulae are exceedingly rare; the etiology of SMA-SMV fistulae can include abdominal surgery and traumatic injury, including gunshot wounds and penetrating abdominal injuries.[8,9] Untreated SMA-SMV fistulae can lead to portal hypertension, high cardiac output state, or bowel ischemia. The treatment of SMA-SMV fistulae may be surgical or endovascular.[8] Noninvasive treatment has involved the use of coil embolization and covered stents.[6] To the best of our knowledge, the present case is one of few to report the use of coil embolization to treat AVAPA and SMA-SMV arteriovenous fistula. Coil embolization can be used for saccular aneurysms with a narrow neck, fusiform aneurysms with adequate collateral flow, and aneurysms of vessels that are not the only source of arterial flow to the organ.[10] Covered stents are a suitable treatment in wide-necked aneurysms, but not suitable for small or tortuous arteries or close to bifurcations. In this case, a covered stent was not feasible because of the narrow neck of the pseudoaneurysm originating in the SMA.

For the use of a covered stent, important considerations include the risk of abnormal vessel straightening, vessel injury, stent deformation, and stent thrombosis. This situation can potentially lead to acute organ ischemia and infarction. Another negative aspect of covered stents is that patients have to use dual antiplatelet therapy of aspirin and a thienopyridine in the postimplantation period and subsequent life-long treatment with aspirin. Closure of the pseudoaneurysm with a coil embolization was considered as the best option in the present case. Migration and misplacement are common complications of coil embolization. Use of detachable coils, such as those of the Interlock Fibered IDCTM Occlusion System (Boston Scientific, Corp., Marlborough, MA, USA), the HydroCoil Embolic System (HES; MicroVention, Inc.; Aliso Viejo, CA, USA), and Amplatzer vascular plugs (St. Jude Medical, LLC, St. Paul, MN, USA) has decreased the risk. Misplaced or lost coils can be retrieved using contemporary retrieval devices such as the En Snare System (Merit Medical Systems, Inc., South Jordan, UT, USA), a Dormia basket, Amplatz Goose Neck (Medtronic Inc., Minneapolis, MN,

USA) or grasping forceps. The retrieval procedure is simple and easy: The existing sheath is replaced using a 9-F sheath, when femoral arterial access is present. The catheter is advanced beyond the misplaced coil using the guide wire. The snare is sent through the catheter and opened. It is then advanced to trap the coil by advancing the sheath or the guiding catheter, and then removed through the sheath.

In conclusion, a good result was achieved in the present case. The advantages of ET with coil embolization are that it is useful and minimally invasive; however, the long-term result of this method is unknown. While further studies and data are needed, we believe that ET may play a significant role in the repair of AVAPA and SMA-SMV fistulae.

***Informed constent:*** Informed consent form was obtained.

***Conflict-of-interest:*** None declared.

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*Keywords:* Coil embolization; pseudoaneurysm; superior mesenteric artery.

*Anahtar sözcükler:* Mikrosarmal embolizasyon; yalancı anevrizma; süperior mezenterik arter.