

## *Case Report*

# Transcatheter Coil Embolization of an Iatrogenic Superior Mesenteric Arteriovenous Fistula: Report of a Case

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### **Abstract**

A 37-year-old male patient presented with abdominal pain and diarrhea. Computed tomography showed a large superior mesenteric vein aneurysm. The patient had a history of Crohn's disease and underwent an ileocecal resection 7 years previously. A selective angiogram of the superior mesenteric artery revealed that a dilated branch of this artery fed directly into the superior mesenteric vein. The iatrogenic superior mesenteric arteriovenous fistula was successfully closed by transarterial coil embolization. Successful endovascular treatment for a superior mesenteric arteriovenous fistula has been recently reported; however, the complications of this new modality are not well understood. We herein review the current literature and discuss endovascular treatment.

**Key words** Iatrogenic arteriovenous fistula · Superior mesenteric artery · Coil embolization · Complication

### **Introduction**

Iatrogenic superior mesenteric arteriovenous fistulas (AVF) are rare entities. If left untreated, serious complications such as portal hypertension, congestive heart failure, or gastrointestinal tract hemorrhage may occur.<sup>1</sup> We herein describe a case of an iatrogenic superior mesenteric AVF treated by transcatheter coil embolization, and review the current literature.

### **Case Report**

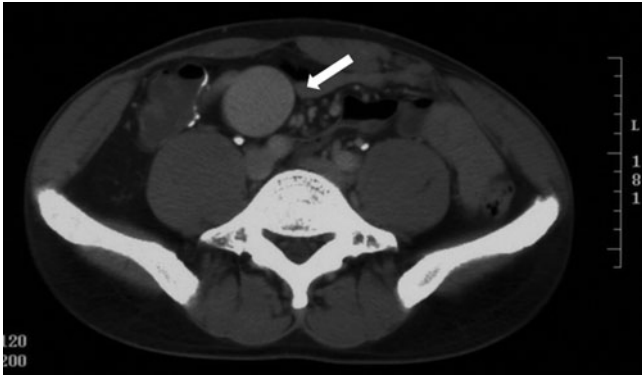
A 37-year-old male patient presented with abdominal pain and diarrhea. The patient had undergone an ileoce-

cal resection 7 years previously for stenosis of the terminal ileum due to Crohn's disease. The laboratory findings were within normal limits. Computed tomography (CT) revealed a superior mesenteric vein aneurysm (Fig. 1), and a selective angiogram of the superior mesenteric artery revealed a dilated branch of this artery that fed directly into the superior mesenteric vein (Fig. 2). An upper endoscopic examination showed no sign of esophageal varices, and a colonoscopy revealed no ischemic findings or active signs of Crohn's disease. The patient was finally diagnosed with a superior mesenteric AVF.

A 4-F catheter (Shepherd Hook; Terumo, Tokyo, Japan) was placed at the origin of the superior mesenteric artery using a right femoral approach. A 2.4-F microcatheter (Renegade; Boston Scientific, Natick, MA) was coaxially advanced into the feeding branch, and one 10-mm, two 9-mm, three 8-mm, and three 7-mm platinum–tungsten alloy embolization coils (Interlock Fiberned IDC Occlusion System; Boston Scientific) were placed just prior to the fistula. The final angiogram showed successful embolization with no visualization of the fistula (Fig. 3). Computed tomography revealed the completely thrombosed vein aneurysm (Fig. 4a), without extension of the thrombus into the portal vein or other branches of the superior mesenteric vein. The postoperative course was uneventful. The patient was discharged the following day. Although the patient experienced abdominal discomfort a week after the procedure, the symptom faded with the reduction in the size of the thrombosed venous aneurysm (Fig. 4b).

### **Discussion**

The superior mesenteric AVF is a rare entity. The most common cause is abdominal trauma, followed by abdominal surgery.<sup>2</sup> The postulated source of fistula formation following abdominal surgery is a transfixion



**Fig. 1.** Contrast-enhanced computed tomography (CT) showing the superior mesenteric venous aneurysm (arrow)



**Fig. 2.** Selective superior mesenteric angiogram showing the dilated branch of the superior mesenteric artery (arrowhead) and the superior mesenteric venous aneurysm (arrow) that was fed directly by the artery

suture through the artery and vein simultaneously or mass ligation of the mesentery.<sup>3</sup> Our patient underwent an ileocecal resection, and an angiogram of the superior mesenteric artery showed that the fistula originated from the resected mesentery. Therefore, the fistula in the present case was iatrogenic.

Clinical symptoms of iatrogenic superior mesenteric fistulas vary from asymptomatic to cramping abdominal pain, with or without diarrhea and bleeding from the varices and ascites.<sup>1,3,4</sup> Gastrointestinal symptoms such as abdominal pain or diarrhea may be due to either coexistent bowel disease or bowel ischemia because of the fistula.<sup>3</sup> Our patient presented with abdominal pain



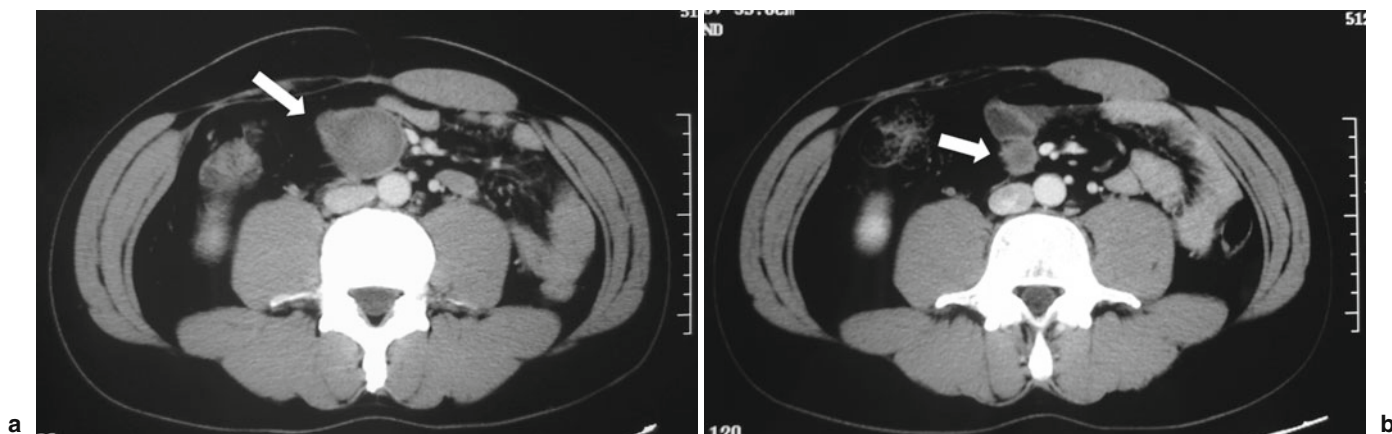
**Fig. 3.** Final angiogram showing successful embolization of the fistula

and diarrhea; however, clinical evidence suggested no direct relationship between the abdominal pain and the fistula.

Because of the rarity of this clinical event, a high level of care and consideration is required to correctly diagnose it. Computed tomography is useful for detecting abnormalities such as a superior mesenteric aneurysm.<sup>5-7</sup> Selective angiography is instrumental in appreciating the hemodynamics of AVF. Angiographic features include aneurysmal changes in the superior mesenteric vein, filled directly by the dilated superior mesenteric artery through the fistula.

Delayed treatment of a superior mesenteric fistula may cause disastrous complications, such as portal hypertension, congestive heart failure, or gastrointestinal tract hemorrhage.<sup>8</sup> Surgical treatment has traditionally been the most common approach.<sup>3</sup> Recently, endovascular treatment has been increasingly performed owing to the development of interventional technology. Since the first report by Uflacker and Saadi,<sup>4</sup> 13 cases of endovascular treatment for iatrogenic superior mesenteric AVF have been reported (Table 1). Coil embolization was performed in 12 cases and a vascular plug was used in 1 case. Although no mortality after endovascular treatment was reported, this treatment has several potential problems.

The first consideration is inadvertent coil deployment and migration of the coils into the portal system. This complication can be avoided by precisely measuring the diameter of the feeding artery and carefully deploying



**Fig. 4.** **a** Contrast-enhanced CT performed 1 month after the procedure showing complete thrombosis of the superior mesenteric venous aneurysm (*arrow*). **b** Contrast-enhanced CT

performed 1 year after the procedure showing marked shrinkage of the thrombus (*arrow*)

**Table 1.** Endovascular treatment of patients with an iatrogenic superior mesenteric fistula

Case	First author <sup>Ref.</sup>	Year	Age (years)	Sex	Symptoms	Previous surgery	Treatment	Complications
1.	Uflacker <sup>4</sup>	1982	41	M	Abdominal pain, diarrhea	Small bowel resection	Coil emboli	None
2.	Keener <sup>9</sup>	1995	46	M	None	Pancreatic transplantation	Coil emboli	None
3.	Cekirge <sup>8</sup>	1998	53	M	None	Aortobifemoral bypass	Coil emboli	None
4.	Angle <sup>10</sup>	1999	36	M	Weakness, malaise, hematuria	Pancreatic transplantation	Coil emboli	None
5.	Phillips <sup>11</sup>	2000	30	F	None	Pancreatic transplantation	Coil emboli	Inadvertent coil deployment
6.	Purow <sup>7</sup>	2002	62	F	Abdominal pain, melena	Small bowel resection	Coil emboli	Portal vein thrombosis
7.	Mick <sup>12</sup>	2003	62	F	Abdominal cramp, melena	Small bowel resection	Coil emboli	Portal vein thrombosis
8.	Bhatia <sup>13</sup>	2003	51	F	Exertional dyspnea	Intestinal bypass	Coil emboli	None
9.	Sonnenschein <sup>14</sup>	2004	35	M	Abdominal pain, vomiting	Partial pancreatectomy	Coil emboli	Coil migration into portal vein
10.	De Gregorio <sup>15</sup>	2004	64	F	Abdominal pain	Lysis of adhesion	Coil emboli	None
11.	White <sup>16</sup>	2009	60	M	Diarrhea	Right hemicolectomy	Vascular plug	None
12.	Lau <sup>2</sup>	2009	50	M	Hematemesis	Sigmoidectomy	Coil emboli	None
13.	Present case	2009	37	M	Abdominal pain, diarrhea	Ileocecal resection	Coil emboli	None

the coils at the target artery using a microcatheter system. If coil migration is a concern, larger coils should be used.<sup>14</sup> Furthermore, an occlusion balloon is used to stop the flow in the AVF, which reduces the risk of coil migration during deployment.<sup>10</sup> The second problem is the extension of the thrombus into the portal system. Although this complication is unavoidable, it can be treated safely with anticoagulant therapy.<sup>7,12</sup>

One study was concerned with bowel ischemia after occlusion of the feeding artery.<sup>6</sup> This complication may not occur with iatrogenic mesenteric AVF because an iatrogenic fistula is usually U type<sup>3</sup>: the artery connects directly with the vein, and occlusion of the feeding artery does not theoretically affect the blood supply of the distal bowel. In fact, there are no reports of bowel ischemia after both surgical and endovascular treatment.<sup>3,5</sup>

In our case, the patient experienced abdominal discomfort after treatment. The patient's symptom was considered to be caused by the thrombus, because his abdominal discomfort was localized to this area. The patient was finally relieved of the abdominal discomfort after the size of the thrombus significantly decreased. Thrombosis will occur on the venous side, even if the fistula is surgically ligated.<sup>6</sup> The patient should be informed about this consequence prior to the surgical and endovascular treatment.

In conclusion, we herein described the successful transcatheter coil embolization of an iatrogenic superior mesenteric AVF; however, there is no current consensus as to whether surgical or endovascular treatment is optimal. Surgical treatment is well established, but a remaining problem is the mobilization of the bowel through adhesions from previous surgery. Endovascular treatment is a promising modality, but we do not yet have experience with the facets of this method. If the physicians select endovascular treatment, they should be fully aware of the complications and consequences following this treatment.

## References

1. Kato S, Nakagawa T, Kobayashi H, Arai E. Superior mesenteric arteriovenous fistula: report of a case and review of the literature. *Surg Today* 1993;23:73–7.
2. Lau KY, Lo SW, Sy NL. Emergency transcatheter embolisation of superior mesenteric arteriovenous fistula complicated by recurrent haematemesis. *Singapore Med J* 2009;50:e12–5.
3. Donnell ST, Hudson MJ. Iatrogenic superior mesenteric arteriovenous fistula. *J Vasc Surg* 1998;8:335–8.
4. Uflacker R, Saadi J. Transcatheter embolization of superior mesenteric arteriovenous fistula. *AJR* 1982;139:1212–4.
5. Iwai M, Kashiwadani M, Suyama Y, Miyoshi M, Kashima K. Iatrogenic superior mesenteric arteriovenous fistula: ultrasonographic, CT and angiographic features and histological findings of the liver biopsy. *J Gastroenterol Hepatol* 1990;5:586–9.
6. Chen YC, Tan GA, Lin BM, Khor C. Superior mesenteric arteriovenous fistula presenting 10 years after extensive small bowel resection. *Aust N Z J Surg* 2000;70:822–3.
7. Puroow DB, Maltz C. Superior mesenteric arteriovenous fistula: a rare cause of esophageal variceal bleeding. *J Clin Gastroenterol* 2002;35:284–5.
8. Cekirge S, Ozmen M, Akata D, Akhan O, Balkanci F, Besim A. Endovascular treatment of a superior mesenteric arteriovenous fistula by a transhepatic portal venous approach. *AJR* 1998;171:1283–4.
9. Keener TS, Cyr DR, Mack LA, Barr D, Althaus SJ. Sonographic diagnosis of arteriovenous fistula in pancreas transplant. *J Ultrasound Med* 1995;14:149–52.
10. Angle JF, Matsumoto AH, McGraw JK, Hagspiel KD, Spinosa DJ, McCullough CS. Percutaneous embolization of a high-flow pancreatic transplant arteriovenous fistula. *Cardiovasc Intervent Radiol* 1999;22:147–9.
11. Phillips BJ, Fabrega AJ. Embolization of a mesenteric arteriovenous fistula following pancreatic allograft: the steal effect. *Transplantation* 2000;70:1529–31.
12. Mick SL, Bush HL Jr, Barie PS. Superior mesenteric arteriovenous fistula causing massive hematemesis. *Surgery* 2003;134:102–4.
13. Bhatia S, Morrison JF, Bower TC, McGoon MD. Pulmonary hypertension in the setting of acquired systemic arteriovenous fistulas. *Mayo Clin Proc* 2003;78:908–12.
14. Sonnenschein MJ, Anderson SE, Lourens S, Triller J. A rare case of jejuna arterio-venous fistula: treatment with superselective catheter embolization with a tracker-18 catheter and microcoils. *Cardiovasc Intervent Radiol* 2004;27:671–4.
15. De Gregorio MA, Gimeno MJ, Medrano J, Schonholz C, Rodriguez J, D'Agostino H. Ileocolic arteriovenous fistula with superior mesenteric vein aneurysm: endovascular treatment. *Cardiovasc Intervent Radiol* 2004;27:556–9.
16. White RD, Ananthakrishnan G, Bhat R. Arteriovenous fistula of a colic branch of the superior mesenteric artery: endovascular therapy. *Cardiovasc Intervent Radiol* 2009 Jul 30. [Epub ahead of print]