Ann Vasc Dis Vol. 12, No. 1; 2019; pp 91–94

Online February 19, 2019
doi: 10.3400/avd.cr.18-00095

Case Report

Endovascular Treatment for a Perforated Superficial Femoral Vein Graft for an Infected Abdominal Aortic Aneurysm

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The patient had an infected abdominal aortic aneurysm. Aneurysmectomy and in situ reconstruction of the abdominal aorta using the bilateral superficial femoral veins with omentopexy were performed. On postoperative day 18, hematemesis and melena occurred. Computed tomography showed extravasation from the right graft limb, and gastrointestinal endoscopy showed a duodenal fistula. Covered stent implantation was performed for the limb. Bleeding from the contralateral graft limb occurred the next day, and the patient underwent covered stent graft implantation for that limb followed by partial duodenectomy and duodenojejunostomy. Intraoperative findings demonstrated a pinhole leakage from the branch ligation site on both vein grafts.

Keywords: infected abdominal aortic aneurysm, femoral vein, covered stent

Introduction

An infected abdominal aortic aneurysm (IAAA) is a rare clinical entity. The management of IAAAs is complicated by several problems, such as selection of appropriate timing for surgical intervention, route for reconstruction, selection of graft materials, prevention of recurrent infection, and systemic management of infection in a compromised host. Today, open repair with the aggressive debridement of infected tissue and in situ reconstruction is the gold standard. Graft material is an important issue to avoid recurrence of infection for in situ graft replacement.[1)] Reconstruction using bilateral autologous superficial femoral vein grafts (FVGs) is an important option for an IAAA because biological material may be resistant to infection. Here, a case of FVG rupture with a graft-duodenal fistula after reconstruction of the IAAA with bilateral FVGs is reported. The patient underwent successful partial duodenectomy and duodenojejunostomy with covered stent implantation into the FVG.

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Received: August 26, 2018; Accepted: December 21, 2018
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Case Report

A 61-year-old man was admitted to our hospital because of persistent abdominal pain and fever. The patient had a history of alcoholic pancreatitis. He was on medication for moderate hypertension, atrial fibrillation, and emphysema. Computed tomography (CT) showed a 45-mm, saccular, infrarenal abdominal aortic aneurysm with periaortic fluid collection (**Fig. 1A**). Laboratory data showed an elevated white blood cell (WBC) count of 16,930/μL and a C-reactive protein (CRP) value of 18.4 mg/dL. Although the blood culture was negative, a diagnosis of IAAA was made. Antibiotic therapy with sulbactam/ampicillin was started in the previous hospital. Two weeks later, a second CT showed that the IAAA was larger (**Figs. 1B** and **1C**); subsequently, patient was transferred to our hospital for surgical management. When he was transferred to our hospital, the WBC and CRP remained high, at 11,700/μL and 3.8 mg/dL, respectively. Because the IAAA was resistant to antibiotics, it was treated surgically.

In situ aorto-iliac reconstruction of the IAAA was performed using autologous bilateral FVGs. First, bilateral superficial femoral veins were harvested in Hunter's canal. The deep femoral veins were preserved as collateral tracts. The abdomen was then opened and firm inflammatory

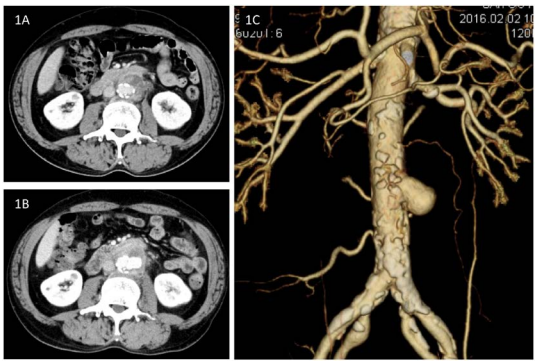

Fig. 1 Preoperative enhanced computed tomography (CT) of the abdomen.
(**A**) CT shows a 45-mm saccular, infrarenal abdominal aortic aneurysm on admission. (**B**) The second CT taken 2 weeks after the first CT shows growth of the aneurysm. (**C**) Three-dimensional imaging shows the saccular, infrarenal abdominal aortic aneurysm.

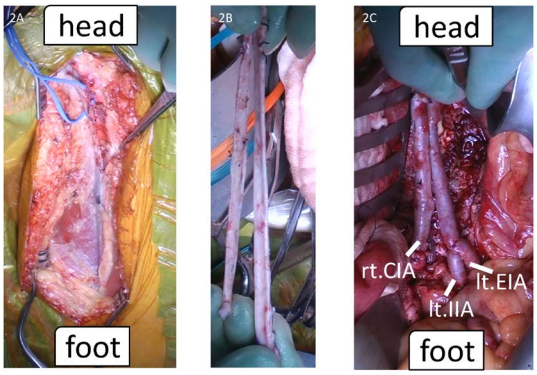

Fig. 2 Intraoperative findings.
(**A**) Harvesting of bilateral femoral veins. (**B**) Y-shaped graft made of bilateral reversed femoral veins before implantation. (**C**) Y-shaped graft replacement from the infrarenal aorta to the right common iliac artery and left external iliac artery/internal iliac artery is performed followed by omentopexy.

adhesions of the aneurysm to the duodenum were found. Despite careful division, the duodenum was lacerated and repaired by direct closure. After thorough debridement and irrigation, the abdominal aorta was replaced using Y-shaped bilateral FVGs in reverse manner (**Figs. 2A** and **2B**). The right common iliac artery, the left external iliac artery, and the left internal iliac artery were reconstructed (**Fig. 2C**). The FVGs were covered with omentum to isolate them from the duodenum. Antibiotic therapy (sulbactam/ampicillin, 4.5 g/day) was continued postoperatively. The bacterial culture of the surgical specimen was negative. A nasogastric tube was placed to decompress the gastrointestinal tract until the start of oral intake.

The patient was allowed oral intake following a successful upper gastrointestinal X-ray fluoroscopic examination on postoperative day (POD) 4. The patient was transferred back to the previous hospital on POD 14. Four days after discharge, he was re-admitted to our hospital because of hematemesis and melena. CT showed leakage of contrast media from the limb of the right graft (**Figs. 3A–3C**). A covered stent graft with Fluency® (Bard Peripheral Vascular, Tempe, AZ, USA) implantation was performed immediately to avoid massive hematemesis. Gastrointestinal endoscopy after endovascular treatment showed a fistula between the duodenum and the graft limb. The next day, he had moderate hematemesis and melena. CT showed enlarged leakage of contrast media from the left limb of the FVG. The same covered stent implantation was performed into the left limb (**Figs. 3D–3F**) followed by partial duodenectomy and duodenojejunostomy. Intraoperative examination showed ruptures of the FVGs at the ligation sites of branches and perforation of the duodenum at the direct repair site. There was no infection of the FVG itself.

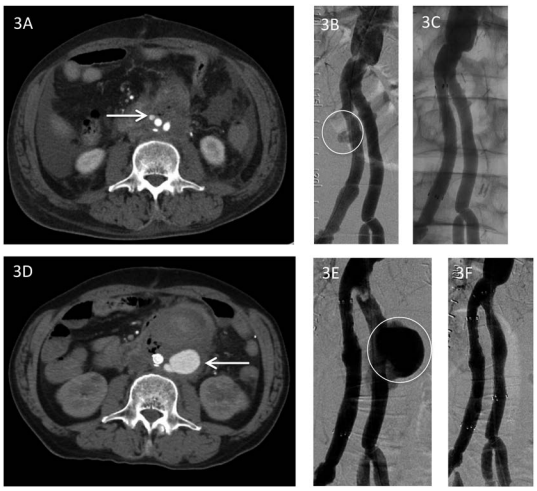

Fig. 3 Endovascular treatment of postoperative leakage from the vein grafts.
(**A**) CT scan shows leakage of contrast media from the right graft limb (white arrow). (**B**) Angiographic image shows extravasation (white circle). (**C**) After the endovascular procedure, there is no extravasation. (**D**) CT scan shows leakage of contrast media from the left graft limb (white arrow). (**E**) Angiography shows extravasation from the limb of the left graft (white circle). (**F**) Angiography after the endovascular procedure shows no leakage from the graft.

The patient's postoperative course after the second operation was uneventful. He was transferred and continued on lifelong administration of antibiotics, and there has been no recurrence of infection and bleeding for 2 years.

Discussion

An IAAA is a relatively rare but life-threatening condition.

There is no consensus about the reconstruction method. Open surgical repair with resection of infected tissue, aggressive debridement, and in situ graft replacement or extra-anatomical bypass is considered the standard.[1] The disadvantages of extra-anatomical reconstruction are rupture of the aortic stump and extra-anatomical graft failure.[2] In situ reconstruction is better; however, relapse of infection is a concern. To avoid re-infection, extensive debridement of all the infected tissues and use of the optimal graft materials are crucial. There are some graft options for in situ reconstruction. Rifampicin-soaked grafts, cryopreserved allografts, bovine pericardial grafts, and FVGs are used for in situ reconstruction.[1] Recently, some studies have shown that in situ reconstruction with FVGs is a useful and durable option for IAAAs.[3–6] Daenens et al. reported good results following in situ replacement of aortofemoral infected prosthesis grafts with FVGs. They showed a 5-year primary patency rate of 91%, a 5-year limb salvage rate of 98%, no cases of the dilatation of vein grafts, and no re-infection.[2] Clagett et al. reported that aorto-iliac/femoral reconstruction using FVGs provided excellent long-term patency. At 5 years, the primary patency rate was 83%, and the secondary patency rate was 100%. Although 4 of 41 patients had chronic limb edema controlled by compression stockings, no venous ulceration or dilatation of grafts occurred. They concluded that FVG is a durable option.[7] With either in situ bypass or extra-anatomical bypass, infected aneurysms must be completely resected and maximally debrided along with the surrounding tissue to prevent postoperative recurrence.[1,8] During the IAAA operation, the dissection of firm adhesions is necessary. In some cases, adhesiolysis has the potential risk of damaging the duodenum and iliac veins. In the present case, in situ infrarenal abdominal aorta replacement with a Y-shaped graft made of the bilateral reversed FVGs was performed with complete debridement of infected tissue. The FVGs were free of bleeding during the operation; however, there was FVG hemorrhage after surgery. The bleeding was likely caused by local infection resulting in loosening of silk ligation of a branch. Bleeding from the graft could be controlled using a covered stent, and graft re-infection was avoided, although duodenal injury during surgery was suspected to have contributed to residual infection. Placement of a covered stent in an infected environment is a concern, and there is room for improvement in the way branches are ligated. Retrospectively, a 4-day decompression of the upper gastrointestinal tract was too short to protect the duodenal anastomotic site from pancreatic juice. We should have placed the nasogastric tube longer and delayed oral intake. However, FVGs have a high resistance to infection. There are some reports regarding the outcome of endovascular treatment with veins. Dale et al. treated 21 patients with the Fluency® covered stent for venous rupture during percutaneous hemodialysis intervention, and they concluded that Fluency® was effective in controlling bleeding.[9] Thus, in the present case, intravenous covered stent replacement was appropriate, and the FVGs showed durability with infected lesions, even when containing artificial material. Strict follow-up is necessary to determine the long-term outcome.

Conclusion

A case of FVG replacement for an IAAA followed by covered stent implantation was presented. The use of FVGs is a good option for the treatment of IAAA.

Acknowledgments

This paper was read at the Union Internationale de Phlébologie (UIP) Chapter Meeting: Seoul UIP 2015 from August 27 to 29, 2015 in Seoul, Korea, and a travel award for young investigators was received.

Disclosure Statement

The authors have no conflicts of interest to declare.

Author Contributions

Initial draft of the article: MC
Writing: NK, ST, IF
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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