Endovascular salvage of an aortic anastomotic pseudoaneurysm following deep vein reconstruction

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ABSTRACT
Aortoiliac reconstruction using autologous deep femoral vein (neoaortic iliac system bypass [NAIS]) is a therapeutic option for management of prosthetic aortic graft infection. Complications after NAIS are complex and reported management strategies few. Endovascular procedures offer a minimally invasive alternative to high-risk, complex open surgery. We report a case of early aortic anastomotic failure after NAIS associated with a pseudoaneurysm and significant retroperitoneal hemorrhage, which was successfully treated by endovascular stent grafting. (J Vasc Surg Cases and Innovative Techniques 2020;6:637-40.)

Keywords: Prosthetic graft infection; Deep vein reconstruction; Pseudoaneurysm; Endovascular; Case report

Prosthetic aortic graft infection is rare. However, it is associated with significant morbidity and mortality, which may be as high as 25%. There are some cases that can be managed conservatively with the long-term administration of suppressive antibiotic therapy. However, where there is systemic sepsis or hemorrhage, a surgical approach is required. Options include explant of the infected graft and reconstruction using a rifampicin-bonded prosthetic graft with or without an omental wrap or reconstruction using autologous vein.

Clagett et al first described the use of autologous deep vein to reconstruct the aortoiliac system. The technique, which is commonly referred to as neoaortic iliac system bypass (NAIS), is associated with low mortality rates and fewer complications than other surgical strategies. Therapeutic options for managing the complications associated with NAIS are by definition complex and generally associated with adverse outcomes.

We describe a novel endovascular salvage for aortic anastomotic failure after NAIS. Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editor-in-chief of this journal on request.

CASE REPORT
A 56-year-old man presented emergently with an infection around the limbs of an aortic bifurcation graft, with a large abscess in the right groin associated with both a physiologic and biochemical severe systemic inflammatory response.

His vascular history was complex. In 2016 an aortobifemoral graft (14 mm x 7 mm Dacron) had been performed for lifestyle-limiting claudication (exercise tolerance of 50 yards). Past medical history included medication controlled hypertension and a previous transient ischemic attack in 2013. He re-presented with short distance claudication after acute occlusion of the left limb of the graft approximately 12 months later. An attempt to thrombectomize the limb of the aortic bifurcation graft was unsuccessful and a femoral crossover graft performed (8 mm Dacron). The clinical outcome from this treatment was good.

However, 6 months later the patient re-presented with acute right groin pain, with swelling and erythema. An abscess was identified on a computed tomography (CT) scan around the right limb of the graft, which was drained surgically. Proteus mirabilis, Staphylococcus epidermidis, and Enterococcus faecalis were cultured and he completed 4 weeks of intravenous daptomycin and teicoplanin, with oral ciprofloxacin. Surgical re-exploration was performed where inflammatory fluid and tissue were identified at the aortic anastomosis and both limbs of the graft. A decision was made to proceed with explant of the aortobifemoral graft and the femoral crossover graft, replacing them with a rifampicin-bonded graft (16 mm x 8 mm Dacron) with an omental wrap. The treating surgical team at the time elected not to use sartorius muscle flaps over the femoral anastomoses.

At the time of the re-presentation, there was evidence of a severe systemic inflammatory response with pyrexia, tachycardia, and a large right groin abscess with associated anterior abdominal wall and groin cellulitis. CT
angiography demonstrated a large collection in the right groin, with significant inflammatory changes seen to the level of the aortic anastomosis and around the left limb of the graft. The right common and internal iliac arteries were patent. Both common femoral arteries were patent as were both profunda femoris arteries. The right superficial femoral artery was occluded; the left had a severe stenosis at the adductor hiatus.

Surgical options were considered and a decision made to proceed with NAIS. At surgical exploration, there was evidence of small bowel fistulae onto the graft (duodenum to the main body of the graft; distal ileum to the right limb of the graft in the right pelvis), which was stained with small bowel content. An infrarenal aortic clamp was placed immediately below the left renal artery and the Dacron graft was completely excised from the aortic wall (the proximal anastomosis was 43 mm distal to the lowest renal artery). There was arteriosclerosis of the aortic wall without luminal compromise. A decision was made to use the previous aortotomy rather than ligate the distal aorta to preserve pelvic circulation. The configuration of the NAIS is demonstrated (Fig 1). The distal anastomoses were to the common femoral arteries where the Dacron had also been completely excised. Sartorius flaps were performed on both sides.

In the early postoperative period, the patient was managed in the intensive care unit because there was a 3-day requirement for both vasopressor support and renal replacement therapy. The etiology of the organ dysfunction was multifactorial and included sepsis, major surgery, and the lower limb ischemia/reperfusion injury. On day 2, four-compartment fasciotomy of the left leg was performed for compartment syndrome, a consequence of the ischemia/reperfusion compounded by venous hypertension, as a result of deep venous harvest.

On the postoperative day 11, the patient developed severe abdominal pain and back pain, associated with hypovolemic shock. A CT angiogram demonstrated a large, contained false aneurysm at the aortic anastomosis (Figs 2 and 3).

A decision was made to perform endovascular salvage, as the patient was de-conditioned. It was felt that this strategy would minimize physiologic insult and could achieve hemorrhage control and restore the infrarenal circulation more quickly than any other salvage intervention. A team of consultant vascular surgeons and interventional radiologists performed the procedure. Under general anesthesia, the left axillary artery was surgically exposed and directly punctured. A 33-cm 16F GORE Dry Seal sheath (W. L. Gore & Associates, Flagstaff, Ariz) was advanced over a stiff wire to the suprarenal aorta. The patent native right common iliac artery and distal aorta were occluded using three Amplatzer vascular plugs (two 16 mm and one 22 mm) because there was concern about the potential for a type Ib endoleak causing ongoing expansion of the pseudoaneurysm. A 16/24 × 93 mm Medtronic flared limb (Medtronic, Minneapolis, Minn) was used to manage the caliber mismatch between the native aorta and the deep vein (with a 20% oversize for the aorta and NAIS). As access was via the patient’s upper limb, the flared stent graft was being deployed upside-down with the wider segment in the native infrarenal aorta and the narrower segment in the deep vein (effectively creating a tapered graft). A second stent graft limb (16/16 × 82 mm) was used to extend down to the level of the NAIS bifurcation. Completion angiography demonstrated successful exclusion of the pseudoaneurysm (Fig 4), without disruption of the common femoral vein (an appreciated risk given that the vein would not yet have been arterialized).

The patient was discharged on postoperative day 10. He returned on an outpatient basis to complete a 6-week course of intravenous ertapenem and daptomycin to treat the multidrug-resistant *E coli* and
vancomycin-resistant *Enterococcus* cultured from the Dacron graft and surgical wounds. This regimen has been converted to oral doxycycline and trimethoprim, which will be continued indefinitely. At the 3-month follow-up he remained well (white cell count, 6.8; C-reactive protein, 9; albumin, 32). A surveillance CT angiogram performed did not demonstrate inflammatory change around the aortic reconstruction (Fig 5). Aortic surveillance will continue with CT angiography.

**DISCUSSION**

Aortoiliac reconstruction using autologous deep femoral vein is a therapeutic option for management of prosthetic aortic graft infection and has advantages over both aortic ligation with extra-anatomic bypass or replacement with a rifampicin-bonded prosthesis. Potential benefits include a decrease in the risk of stump blow-out from aortic ligation and a decrease in recurrent infection by avoiding replacement with prosthetic material. Importantly, there seems to be a decrease in perioperative mortality with improved long-term patency when compared with extra-anatomic bypass.

There is a limited description in the literature about management of the complications of NAIS. The most common reported complication of NAIS is stenosis. Failure of the aortic anastomosis has been described. In this particular case, the reason for proximal graft failure is unclear. At the time of the primary procedure, there was recognition of aortic arteriosclerosis but it was not felt that this finding would prejudice the proximal anastomosis. However, given subsequent clinical course, this factor may have been contributory. An unrecognized technical issue may have been relevant, although the timing of this is unusual. Residual infective change within the wall of the aorta also merits consideration. Ehsan et al reported 4 false aneurysms from a total of 46 deep vein reconstructions, only 1 of which was related to the aortic anastomosis. This condition was managed surgically with relocation of the aortic anastomosis. In this case, an endovascular strategy was chosen to avoid a fourth laparotomy and to minimize the physiologic

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**Fig. 3.** Computed tomography (CT) image of aortic anastomotic pseudoaneurysm in the coronal plane.

**Fig. 4.** Fluoroscopic image demonstrating stent graft position above the venous reconstruction with exclusion of the pseudoaneurysm and absence of filling of the native aorta.
insult that would have been associated with further lap-
arotomy in a patient who was physiologically and nutri-
tionally deconditioned. It was considered to be
important to occlude the distal aorta to decrease the po-
tential for a type Ib endoleak. By placing a
flared stent
graft limb from above, we were able to manage the
discrepancy in the aortic and deep vein diameters and
ensure seal with a consignment device. To the best of
the authors’ knowledge, this method of endovascular
salvage has never been described in this context.

CONCLUSIONS
This novel salvage strategy was chosen to minimize
physiologic and surgical stress in a patient decondi-
tioned after NAIS. The configuration of the deep vein
reconstruction lent itself to this method of salvage. The
long-term durability of this procedure is uncertain and
will be dictated by the etiology of aortic anastomotic fail-
ure. Surveillance will be essential.

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