Case Reports

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Aortic Graft Enteric Erosion Following EVAR: A Multidisciplinary Approach to Repair

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INTRODUCTION

Aortic graft infection is a rare but highly morbid complication of both open and endovascular aortic surgery, with reported incidence ranging from 0.05–5% [1]. With the increasing adoption of endovascular aneurysm repair (EVAR), aortic endograft infections are a more frequently encountered clinical challenge. An endograft infection may result from graft seeding during bacteremia from a separate infection, contiguous intraabdominal or retroperitoneal infection, or erosion into a hollow viscus. Endograft-enteric fistulas are a particularly challenging complication of EVAR. Management requires source control with explantation of the endograft, vascular, and enteric reconstruction. Presentations range from indolent chronic infection to septic shock in acute infection, to acute gastrointestinal hemorrhage from an aorto-enteric fistula. Surgical management of these cases requires complete explantation of the prosthetic material and vascular reconstruction, which may be performed *in situ* or in an extra-anatomic fashion. There are several options for *in situ* reconstruction, including antimicrobial-treated prosthetic (e.g. rifampin-soaked Dacron), reconstruction with autologous femoral vein as in neoaortoiliac system (NAIS) reconstruction, or reconstruction with cryopreserved aortic homograft. Extra-anatomic reconstruction involves ligation of the infrarenal aorta after prosthetic removal with axillo-bifemoral bypass.

Here, we describe a case of infrarenal aortic endograft erosion into the duodenum, treated with graft explantation, *in situ* reconstruction with cryopreserved aortic homograft, and resection of the third portion of the duodenum with reconstructive duodenojejunostomy.

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CASE REPORT

A 61-year-old male with a history of ruptured infrarenal aortic aneurysm treated with EVAR five years prior was transferred to our hospital for a higher level of care, after presenting to an outside facility with abdominal pain, fever, and bacteremia. Initial blood cultures grew *Klebsiella pneumoniae* and *Streptococcus anginosus*. Imaging showed significant fat stranding around the endograft, which prompted evaluation with esophagogastroduodenoscopy. The study demonstrated visible endograft fabric and metallic struts eroding into the duodenum (Figure 1). Urgent transfer to our quaternary center was arranged.

His comorbidities included type 2 diabetes, hypertension, hyperlipidemia, coronary artery disease for which he had previously undergone coronary artery bypass, prior stroke without residual deficits, prior tobacco use, and peripheral arterial disease. His history was also notable for a left iliopsoas abscess three years prior to presentation, treated with incision, drainage, and a prolonged course of antibiotics. Follow-up with a vascular surgeon for further assessment of graft infection had been planned, but the patient was lost to follow-up.

He had not had any hematemesis or melena. He reported that ambulation was significantly limited by bilateral calf claudication, brought on by walking 20 feet.

On admission to the intensive care unit at our institution, he was febrile to 38.9°C and hemodynamically

Figure 1 Preoperative esophagogastroduodenoscopy demonstrates extensive graft erosion into the third portion of the duodenum.

stable. Computed tomography angiogram (Figure 2) demonstrated the presence of an infrarenal aortobiiliac stent graft with suprarenal fixation struts. There was significant fat stranding and soft tissue thickening around the endograft. Imaging was also notable for occlusion of the left common femoral and right superficial femoral arteries. He was started on empiric broad-spectrum antibiotic coverage with piperacillin–tazobactam and vancomycin, total parenteral nutrition. A multidisciplinary surgical plan was developed for definitive surgical management consisting of graft excision, duodenal resection and reconstruction, and vascular reconstruction.

Surgically, he was explored through a midline laparotomy, and circumferential supraceliac aortic control was obtained. After mobilizing the small bowel, we identified the duodenum as densely adherent to the aorta, and it was carefully dissected free. This revealed a 5 cm aortic defect with exposed endograft at and below the flow divider (Figure 3). The defect in the duodenum was temporarily closed. We then clamped the supraceliac aorta and extended the defect in the anterior wall of the aorta cephalad, enough to expose the suprarenal fixation struts. These were divided with wire cutters, freeing the proximal portion of the endograft and leaving the suprarenal struts in the aorta. The supraceliac clamp was then moved to the suprarenal aorta. An appropriately sized cryopreserved aorta was brought onto the field and the proximal anastomosis was created in an end-to-end fashion to the infrarenal aorta using running 3-0 Prolene suture. At this point, the clamp was moved down onto the graft, restoring flow to the viscera and kidneys. The distal portion of the endograft was then removed from the iliac arteries and the aortic bifurcation was oversewn.

Due to the bilateral iliac occlusive disease, we elected to perform the distal anastomoses to the common femoral arteries. Both common femoral arteries were exposed. A left common femoral endarterectomy was performed given the extensive occlusive disease at this level. The external iliac arteries of the cryopreserved aortic homograft were anastomosed to cryopreserved superficial femoral artery homograft to gain the necessary length for femoral anastomoses. The limbs were tunneled to the groin incisions in the standard fashion, and anastomosed to the common femoral arteries in an end-to-side fashion with running 6-0 Prolene suture.

The previously oversewn duodenal perforation was resected with gastrointestinal anastomosis (GIA) staplers, leaving the distal third and proximal fourth portions of the duodenum as a blind end. The proximal jejunum was then freed from the ligament of Treitz and brought through the colonic mesentery. A generous Kocher maneuver was performed to further mobilize the duodenum so that the anastomosis would lie in the right upper quadrant. A side-to-side anastomosis was performed between the distal duodenum and proximal jejunum using a 60 mm GIA stapler. The enterotomy was closed with a running polydioxanone suture. A feeding nasojejunal tube and a decompressing nasogastric tube were placed. An omental flap was interposed between the vascular and enteric reconstructions.

Postoperatively, the patient had a slow return of bowel function, and nutrition was maintained with parenteral nutrition, transitioned to enteral nutrition as bowel function returned. His antibiotics were narrowed to ceftriaxone and doxycycline based on susceptibilities of the *Streptococcus anginosus* and *Klebsiella pneumoniae*, with plans for close follow-up with infectious

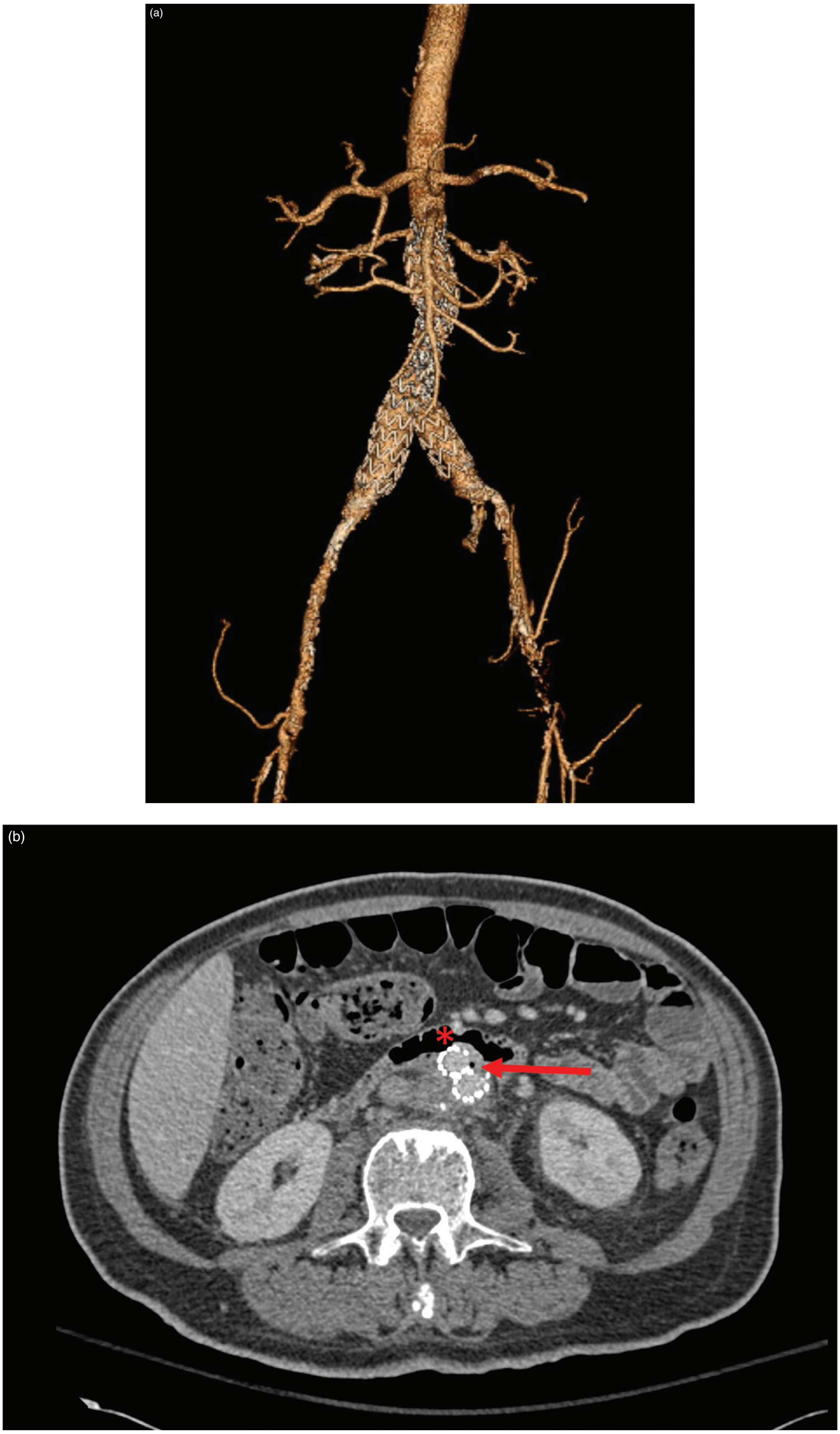

Figure 2 Preoperative imaging. **(a)** The configuration of the aorto-bi-iliac endograft with suprarenal fixation. **(b)** The duodenum (marked with *) coursing over the aorta immediately below the endograft flow divider. The arrow notes the focus of air within the aneurysm sac.

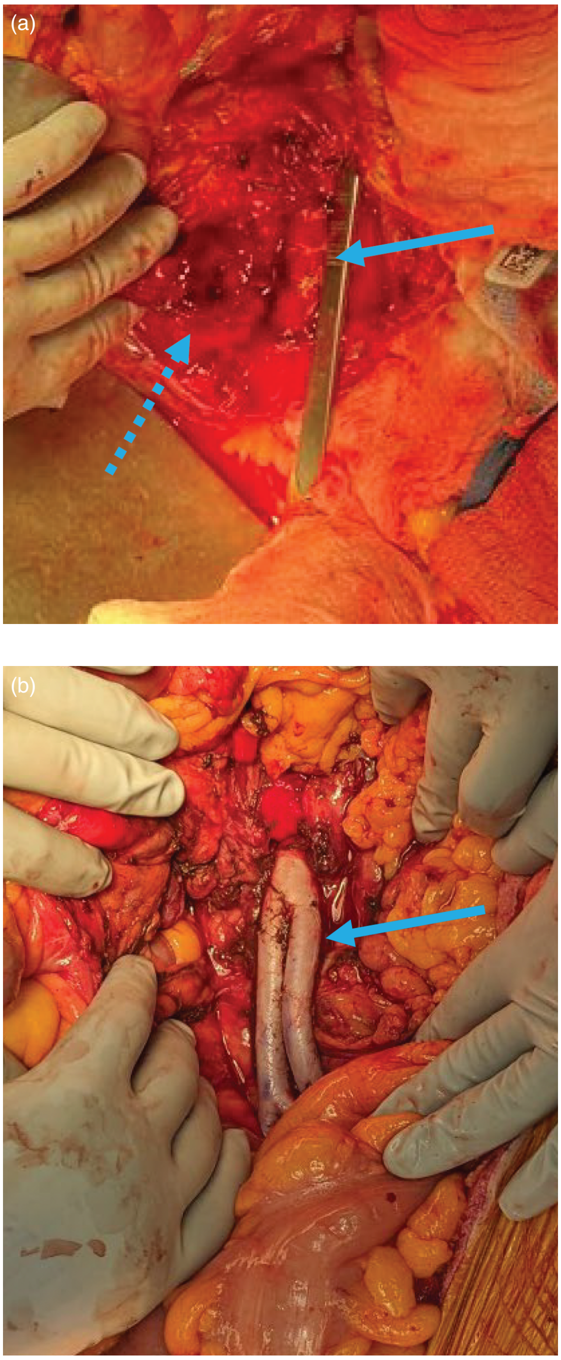

Figure 3 Operative findings. **(a)** The aortic defect with exposed endograft (solid arrow) after dividing the aortoduodenal fistula. The duodenal defect shown with a dashed arrow. **(b)** The completed vascular reconstruction (solid arrow). Photos oriented with the superior aspect of the field at the top of the photo.

disease specialists and indefinite antibiotics. He was discharged home on postoperative day 20.

Ethical Approval and Informed Consent

Ethical approval to report these cases was not required. Written informed consent was not required.

DISCUSSION

Graft-enteric erosion following endovascular aortic aneurysm repair represents a complex and challenging pathology that can have a mortality rate of up to 30–100% [1–3]. Definitive surgery requires open explantation of the stent graft, complex aortic revascularization, and gastrointestinal reconstruction. A multidisciplinary approach is optimal in the care of these complex patients.

Graft-related complications following open abdominal aortic repair have been well studied, with an approximate incidence of graft-enteric erosion/fistula estimated to be 0.4–1.6% [4,5]. Commonly, more than half of these complications involve the third and fourth portions of the duodenum due to its fixation in the retroperitoneum and proximity to the aorta [6]. A multi-institutional study from Italy found the incidence of aorto-enteric fistulas following EVAR to be 0.8%, with an incidence of 0.46% in patients with atherosclerotic aneurysmal disease, and 3.9% in patients with the development of a postoperative pseudoaneurysm [7]. The pathogenesis of graft-enteric erosion/fistula following EVAR is complex. Local/systemic infection, pulse-synchronous repetitive trauma between the graft and bowel, and endoleaks have been previously implicated [8]. In our patient, a history of localized infection from an iliopsoas abscess and repetitive pulse trauma likely led to his presentation.

In the setting of a graft-enteric erosion following EVAR, the goal of operative management are to prevent hemorrhage, control infection, maintain adequate distal perfusion, and recreate gastrointestinal continuity. The management of the bowel defect is based on the size of the defect as well as the quality of the surrounding intestinal walls [8]. Studies have reported that gastrointestinal leaks or other gastrointestinal complications increase the risk of postoperative mortality by up to three times [9]. If the defect is greater than one-third, concern for poor tissue quality, or if there is any risk of anastomotic tension, a resection and primary anastomosis or reconstruction are likely to be required. Despite the size of the defect in our patient, given the proximity to the second portion of the duodenum, we were able to resect the affected portions and reconstruct with a duodenaljejunal anastomosis. The placement of a distal jejunostomy tube should be considered, in addition to an omental flap between the vascular and gastrointestinal reconstructions [10,11].

Vascular reconstruction can be undertaken with a variety of options. Given the mechanical erosion of the stent graft, there is no definitive endovascular treatment option. Definitive management requires explanation of the entire graft, and reconstruction using any of a number of conduits and configurations: *in situ* aortic reconstruction with autogenous femoral vein, cryopreserved allograft, rifampin-soaked Dacron, or extra-anatomic bypass grafting, often with axillofemoral bypass with ringed polytetrafluoroethylene

[9,12]. There are a few important considerations in this regard – each strategy will have its own benefits and consequences with regard to the risk of re-infection, cross-clamp time, overall procedure time and longevity of the revascularization. With regard to anatomic versus extra-anatomic, for example, while a staged extra-anatomic bypass might induce the least physiologic stress, it would not be as durable as an aortobifemoral bypass [13]. However, an overly contaminated field might be best approached with an extra-anatomic approach.

With regard to conduit choice, there is no overarching consensus, and we recommend that the choice be made based on clinical and operative characteristics on a case-by-case basis. While autogenous femoral vein harvest may have decreased cost and has been theorized to have lower re-infection rates, this would likely add operative time and morbidity that could be avoided with cryopreserved graft if available, as described in a single institution retrospective study by Navelsteen et al. [14]. Additionally, studies such as this retrospective single-institution study by Tabiei et al. compared cryopreserved arterial allografts versus rifampin-soaked Dacron for the treatment of infected aortic and iliac grafts and found that while five-year mortality and five-year freedom from re-infection was similar, the Dacron group had lower freedom-from-reintervention rates (66.2% versus 92.5% at five years) [15]. Given graft availability and this patient's fitness for open surgery, we judged an *in situ* reconstruction with cryopreserved homograft would be optimal.

A multidisciplinary approach to the operative and perioperative management of this patient was critical. Trauma surgery, vascular surgery, surgical critical care, cardiac anesthesia, gastroenterology, and infectious diseases were all involved to optimally care for this patient.

CONCLUSION

Aortic graft infection and associated graft-enteric erosion represent a rare but highly morbid complication following open or endovascular repair of the aorta. Definitive treatment requires explantation and reconstruction of the viscera and vessels. The method of gastrointestinal and vascular reconstruction should be determined on a case-by-case basis, and the literature supports using a variety of different approaches. Importantly, a multidisciplinary approach to perioperative care and operative intervention is optimal.

Ethics Statement

(1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.

(2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Author Contributions

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