

From the Midwestern Vascular Surgical Society

Novel open technique for repair of endograft migration

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ABSTRACT

Widespread adoption of endovascular aneurysm repair has led to increased incidence of late complications, such as endograft migration. Treatment options have to be tailored to the patient's health, quality of proximal aorta, and extent of migration. Complete or partial endograft removal is associated with significant morbidity and mortality. We describe a case in which open repair with endograft preservation was employed, with the additional benefit of a sutured proximal anastomosis. (*J Vasc Surg Cases and Innovative Techniques* 2019;5:88-90.)

Keywords: Endovascular aneurysm repair (EVAR); Abdominal aortic aneurysm; Endograft migration; Type I endoleak; Reintervention

The first case of endovascular repair of abdominal aortic aneurysm (AAA) was performed by Parodi in 1991.¹ The adoption of endovascular aneurysm repair (EVAR) is largely due to its lower operative morbidity and mortality and patients' preference.² As long-term outcomes become available, unique complications associated with EVAR are increasingly appreciated, one being proximal migration of the stent graft.³ Multiple techniques have been described to treat this complication, using both endovascular and open approaches.⁴ We describe a novel technique for open repair of proximal graft migration with complete endograft preservation, decreased endograft manipulation, and advantages of sutured proximal anastomosis and decreased clamp time (*Video*). Consent was obtained from the patient for the publication of this case.

CASE REPORT

A 69-year-old man with history of hyperlipidemia, chronic obstructive pulmonary disease, and tobacco use presented for evaluation of AAA. Computed tomography (CT) was performed, demonstrating an infrarenal AAA with a maximum diameter of 5.4 cm and anatomy suitable for EVAR. The patient underwent EVAR in November 2015 using Gore Excluder AAA Endoprosthesis

(23 mm × 14.5 mm × 14 cm; W. L. Gore & Associates, Flagstaff, Ariz) without complications and absence of endoleak at completion. The patient was observed with surveillance CT scans at 1 month and 6 months and then annually. The first annual CT scan did not demonstrate any endoleak, and the diameter of the aneurysm decreased to 4.2 cm. However, surveillance CT at 2 years of follow-up demonstrated migration and bending of the proximal stent graft, resulting in type IA endoleak (*Fig 1*) and increase of aneurysm size to 5.5 cm. Interventional options were discussed at our multidisciplinary conference. Because of the unfavorable aortic neck anatomy and poor relative position of the endograft in the aortic sac, an open conversion was considered the best option for our patient. Appropriate consent was obtained, and open repair was performed in February 2018. A transperitoneal approach with infrarenal aortic clamp was planned. After exposure of the infrarenal aorta, bilateral renal arteries, and common iliac arteries (*Fig 2, A*), the patient was heparinized, and the common iliac vessels and infrarenal aortic neck were clamped. The aneurysm sac was opened, and the previously placed endograft was noted to have good distal seal, prompting us to preserve the stent graft. The proximal aortic neck was extended using a 20-mm-diameter Dacron cuff, thus creating a synthetic neo-aortic neck. The trunk of the migrated endograft was then carefully folded by the partially closed jaws of a large right-angle clamp and reintroduced and appropriately positioned into the neoneck. The size of the Dacron cuff was chosen preoperatively to allow excellent expansion and apposition of the stent graft into the neoneck; hence, no further dilation of the trunk of the endograft was deemed necessary. The risk of future graft migration was reduced by placing a Prolene stitch to approximate the anterior to the posterior edge of the distal Dacron neoneck just caudal to the bifurcation of the endograft, securing the synthetic graft akin to a pantaloons around the trunk of the endoprosthesis. To limit the potential of future dilation of the Dacron cuff with a possible type IA endoleak, we reinforced the overlapping segment of the native endograft and the Dacron cuff by encircling the region with a 2-cm-wide Teflon felt strip. The strip was secured onto the neoneck with placement of sutures while care was taken not to penetrate the fabric of the

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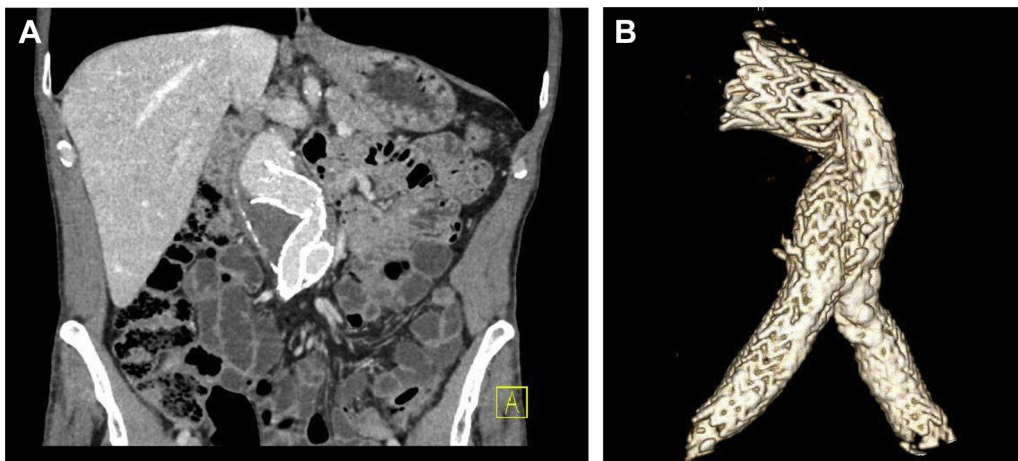


Fig 1. **A**, Coronal view of the computed tomography (CT) scan of the aortoiliac endoprosthesis inside the aortic aneurysm. **B**, Three-dimensional reconstruction demonstrating the migration and significant kink of the original endograft.

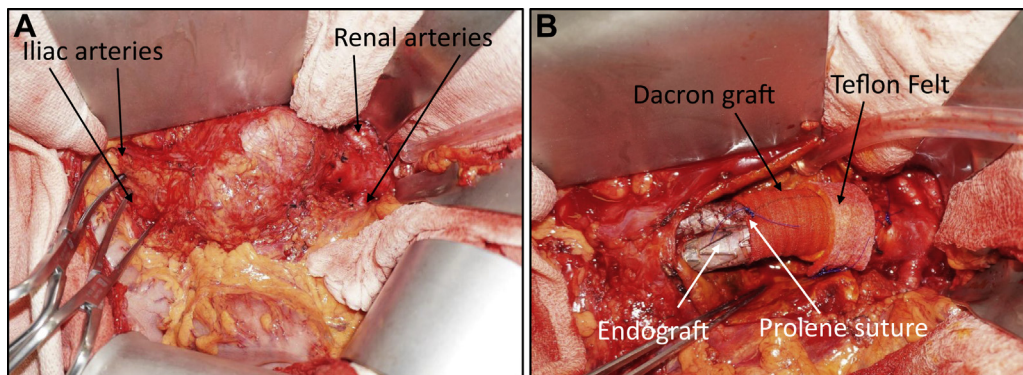


Fig 2. **A**, Initial dissection of the infrarenal abdominal aortic aneurysm (AAA). The pararenal aorta and bilateral common iliac arteries are controlled. **B**, Final assembly of the trunk of the endograft positioned inside the Dacron neoneck. Teflon felt circumferentially reinforces the proximal attachment site. Prolene suture at the distal Dacron neoneck just caudal to the bifurcation of the endograft secures the synthetic graft, akin to a pantaloon around the trunk of the endoprosthesis.

endoprosthesis (Fig 2, B). The aneurysm sac was then approximated over the repaired graft, and the abdominal wall was closed in standard fashion. The patient had an uneventful postoperative course and was able to resume routine activities. Surveillance CT scan at 5 months demonstrated the aortic repair to be intact with no migration or endoleak.

DISCUSSION

With widespread adoption of EVAR, successful long-term aneurysm exclusion requires treatment of unique endograft-related complications, such as endoleaks and graft migration.⁵ The definition of device migration varies between different authors, resulting in a measured stent migration rate that varies from 3.6% to 16.6% (subject to the definition used).³ Unfavorable anatomy, poor device selection, and progressive degeneration of

the native vessels at the attachment sites are all associated with higher probability of migration.^{4,6} Proximal endograft migration is most commonly treated with endovascular placement of an aortic extender cuff.⁴ This approach has been found to have good initial success but high likelihood of ongoing long-term complications.⁷ Open surgical conversion is necessary when the anatomy of the aneurysm exceeds the limitations of the available endoluminal techniques. An open conversion and repair can be associated with significant morbidity and mortality⁸ but allows management of unique problems of EVAR, such as endoleak and graft migration, and also reduces the need for frequent surveillance that is necessary for endografts. The decision to manage our patient with an open operation was based on the patient's age and functional status, the

poor relative position of the endograft in the aortic sac, and the unfavorable aortic neck anatomy. Early failure of the original endovascular repair despite suitable anatomy further influenced our decision toward an open repair.

Open repair with partial or complete modification or removal of the endograft can be technically challenging, whereas modification or suturing onto the endograft and its components has unknown long-term effects on the integrity and durability of the endoprosthesis. Limited or partial graft explantation results in reduced clamp time and is thought to reduce the complication rate.⁹ Complete preservation of the endograft with reinforcement of the neck to achieve proximal seal has also been described to treat type IA endoleak,¹⁰ although in our experience the long-term success of this technique is limited, and this is not an option with migrated and kinked graft.

Our novel treatment strategy offers distinct advantages. Cross-clamping time is reduced, required only during the completion of the proximal anastomosis. There is minimal manipulation of the graft and native vessels, which decreases blood loss and offers protection to proximal neck degeneration or further graft migration. In addition, the ability to avoid excision or modification of the endograft components reduces the operative time and the risk of iatrogenic injury. Furthermore, the elimination of the need for sewing onto the endoprosthesis can prevent bleeding from needle holes and long-term degeneration of the endograft at the sutured sites.

Partial explantation of the trunk of the endograft with preservation of the endograft limbs can also be used to treat proximal endograft migration. In comparison, the technique described here involves one less anastomosis and avoids the need to sew the new graft to the residual endograft limbs. Partial or complete preservation of the in situ proximal graft has also been described by Georgiadis et al¹¹ in patients having complicated proximal graft anastomotic sites or endografts with complications of their suprarenal fixation that are difficult or impossible to explant. These approaches, however, are usually employed as last-resort attempts in unstable patients.

Endovascular salvage for migration and endoleaks is still the favored approach. However, we believe that in selected patients, without appropriate anatomy or geometry for endovascular treatment, an open approach with preservation of endograft is preferred. Our current technique is versatile and can be used in the treatment of a wide variety of proximal or distal endoleaks. In the case of a graft that uses suprarenal fixation, the sutures connecting the suprarenal metallic crown to the fabric

of the body of the graft are divided using a No. 15 blade. The crown is thus separated from the rest of the graft, allowing repair of the endoleak or migration following the steps presented herein.

The approach we present allows the correction and repair of endograft migration, minimizes suprarenal cross-clamp time, obviates the need for endograft excision or modification, and eliminates sewing onto the endoprosthesis and its components. It has the durability and long-term advantages of an open conversion.

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