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Diagnosis and relining techniques for delayed type IIIB endoleaks with the second-generation AFX endograft

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ABSTRACT

Type IIIB endoleaks resulting from endograft fabric tear are an uncommon but serious late complication of endovascular aortic aneurysm repair. The Strata fabric used in the earlier generation AFX endograft (updated to Duraply in October 2014) has been associated with an increased frequency of these events. Herein we report on two patients exhibiting delayed type IIIB endoleaks after AFX device insertion to treat an abdominal aortic aneurysm and discuss optimal relining techniques. (*J Vasc Surg Cases and Innovative Techniques* 2019;5:51-3.)

Keywords: Type III endoleak; EVAR relining; AFX endograft

CASE REPORTS

Each patient has reviewed and consented to the publication of this article.

Patient 1. A 77-year-old man presented with an asymptomatic 7.8-cm infrarenal abdominal aortic aneurysm (AAA). His medical history was significant for creatinine of 1.5 mg/dL, compensated congestive heart failure, coronary artery disease, and severe aortic valve stenosis. The patient elected to undergo percutaneous endovascular aneurysm repair (EVAR) in January 2013 with on-label placement of the AFX (Endologix, Irvine, Calif) device coupled with two Vela (Endologix) aortic extensions to correct a type IA endoleak. Component overlap was observed to be 6.5 cm. Surveillance computed tomography angiogram (CTA) scans obtained at 3 months showed no endoleak and that the aneurysm sac size had decreased to 7.3 cm. A CTA at 12 months after EVAR noted new contrast filling in the aneurysm sac and conformational change of the stent struts suspicious for a type IIIB endoleak (Fig 1, A). The patient underwent a diagnostic angiogram confirming a type IIIB endoleak (Fig 1, B). A Palmaz stent (Cordis Corporation, Miami Lakes, Fla) and Vela extension were placed to resolve the endoleak, obtaining a good angiographic result (Fig 1, C).

A follow-up CTA at 1 and 6 months confirmed aneurysm shrinkage to 6.8 cm with resolution of the endoleak. However, at 2 years after EVAR, a type IIIB endoleak redeveloped (Fig 1, D). Owing to its location relatively close to the original type IIIB endoleak, it was believed to be a recurrence of the same endoleak. The graft was then relined with an Ovation (Endologix) stent graft (Fig 1, E). Access to the centerline lumen was obtained with a three-pronged technique to ensure that the repair was not trapped behind stent struts by spinning an angled glide catheter to preferentially select the centerline lumen under fluoroscopy, using intravascular ultrasound examination to visualize stent struts that are echo opaque, confirming that the catheter stays in the centerline lumen and using a partially inflated balloon, whereby a 12-mm balloon is retracted and advanced over the wire watching for areas of stent deformation. Subsequent CT scans have revealed no endoleak and aneurysm diameter shrinkage to 6.4 cm and 5.7 cm at 1 and 2 years, respectively.

Patient 2. A 70-year-old man presented with an enlarging 5.5 cm infrarenal AAA with a 1.6 cm left common iliac aneurysm. His medical history was significant for coronary artery disease with hypertrophic cardiomyopathy, atrial fibrillation, compensated congestive heart failure, implantable automated cardioverter defibrillator and pacemaker, and chronic obstructive pulmonary disorder.

He was on warfarin for anticoagulation. He was not felt to be a good candidate for open repair and, in March 2014, underwent on-label placement of an AFX 1 device with a Vela suprarenal extension. A delayed type II endoleak was noted on completion imaging. Surveillance imaging at the 8-month follow-up demonstrated aneurysm shrinkage to 4.4 cm without an endoleak. The patient then presented approximately 1 year postoperatively with a 1-day history of abdominal and back pain. A CTA scan confirmed a ruptured AAA with a type IIIB endoleak (Fig 2, A, B). Component overlap was noted to be 58 mm. He was taken emergently to the operating room to deploy a second endograft for relining. An Omni flush catheter was spun as it was advanced under fluoroscopy to ensure intraluminal passage through the endograft. This device was then exchanged for a

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Author conflict of interest: A.B. is the site PI for Endologix ELEVATE study. H.E.G. has a consulting contract with Endologix, Inc.

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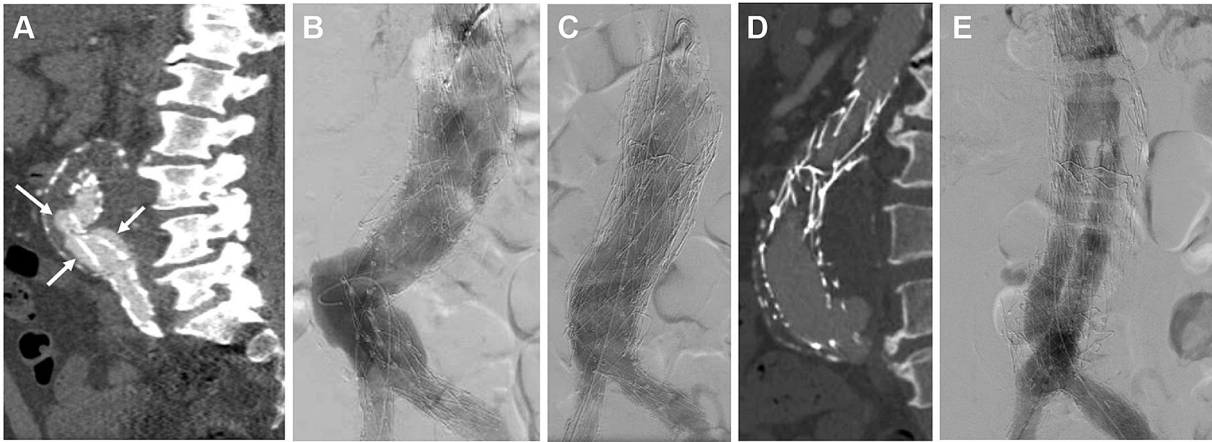


Fig 1. Patient 1: **A**, Twelve-month computed tomography (CT) scan revealed new stent deformation and contrast within the aneurysm sac consistent with type IIIB endoleak despite decreasing sac size (arrows pointing to the endoleak). **B**, Intraoperative imaging with provoked angiogram (injection of contrast agent above both balloon-occluded iliac limbs to verify the endoleak) demonstrating type IIIB endoleak and absence of type IA endoleak. **C**, Completion angiogram after Palmaz stent and cuff placement (initial type IIIB treatment). **D**, Twelve-month CT scan after an initial type IIIB endoleak relining shows a new type IIIB endoleak, after two scans showing no endoleak. **E**, Completion angiogram after redo endovascular aneurysm repair (EVAR) with a Trivascular Ovation graft.

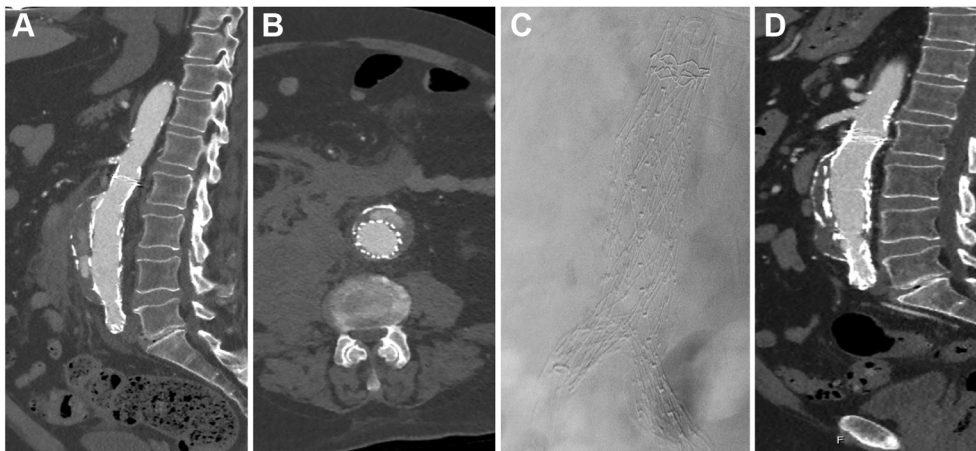


Fig 2. Patient 2: **A** and **B**, Twelve months after implantation, the patient presented emergently. A computed tomography (CT) scan revealed aortic sac rupture with retroperitoneal hemorrhage. A focal endoleak was discovered adjacent to the endograft immediately distal to the overlap site. **C**, Intraoperative image demonstrating extensive wireframes from four endograft components after relining. Note the two proximal aortic extension marking rings. **D**, A CT scan approximately 2 months after relining with dense wireframe signal showing intact repair and resolution of the endoleak.

stiff Amplatz wire and a partially inflated molding balloon that was advanced through the entire graft to verify that there was no wireframe entrapment. Deployment of an AFX 1 main body and aortic extension was accomplished. Completion imaging confirmed successful endoleak repair (Fig 2, C, D). The patient required 4 units of packed red cells for transfusion and experienced a prolonged hospital stay owing to shock liver (aspartate aminotransferase of >600) and alcohol withdrawal. He recovered and was last seen 3 years later where his maximum AAA diameter was 4.3 cm without an endoleak.

DISCUSSION

All Endologix endografts (Powerlink/AFX1 and AFX2) have an endoskeleton design that may complicate guidewire and device entry on redo procedures with the potential for device entrapment between the wireframe and fabric. These cases reflect the unpredictable and variable presentation of type IIIB endoleaks found with the first and second generation AFX endografts covered by Strata material. The majority of these endoleaks occurred before the manufacturer's replacement

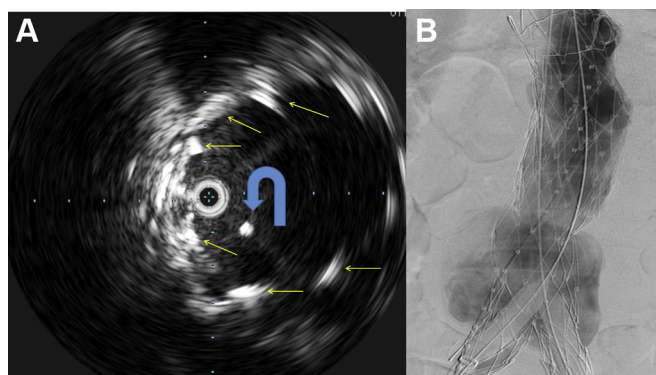


Fig 3. A, Intravascular ultrasound examination demonstrating wireframe (*straight arrows*) and Sure Pass wire (*curved arrow*) and central lumen of endograft. **B,** Provoked angiogram image of a type IIIb endoleak demonstrating adequate overlap and contrast extravasation during iliac balloon occlusion.

of the Strata graft material with Duraply in October 2014, although additional devices with Strata may have been inserted after that date. Type IIIb endoleaks have been documented with all commercially available endografts, occurring as early as 1 month to beyond 5 years after implantation, emphasizing the need for ongoing surveillance.¹⁻⁶ Catheter-based aortic interventions after endograft placement have been associated with increased development of type IIIb endoleaks.⁷⁻¹² Some type IIIb endoleak cases present emergently, often after uneventful image surveillance, so increased awareness of this possibility should be emphasized.³

Technical tips to facilitate graft relining include the following:

- Eliminating parallax.
- Avoiding wireframe entrapment by using a reformed catheter to advance through the endograft and confirming passage of a partially inflated balloon through the entire endograft while observing for wireframe movement or deformation.
- Using adjunctive intravascular ultrasound emanation to further assess wireframe entrapment in select cases (although wireframe artifact scatter can make image interpretation challenging; Fig 3, A).
- Using a provoked angiogram with contrast injection above the balloon occlusion of iliac limbs to better demonstrate occult endoleaks (Fig 3, B).³
 - Relining of the entire endograft to avoid recurrent IIIb fabric tears.

Most type IIIb endoleaks from Endologix endografts occur from fabric tears that propagate from the bifurcation split of the main body. We have experienced repeat type IIIb events (as seen in patient 1) unless complete endograft relining has been performed. Because additional component replacements increase the metallic

burden within the endograft, it is these authors' recommendation to completely reline every type IIIb endoleak case with a second complete endograft system. As there are no data to support any endograft type as superior, and endograft relining should be performed with the stent graft that vascular surgeons are most familiar with to provide the same principles of adequate proximal and distal seal zone with secure fixation and adequate component overlap as an original EVAR placement.

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