Relining of infrarenal stent-graft with preloaded modified Gore Excluder for occult endoleak with sac expansion

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ABSTRACT

Endoleaks remain one of the most common indications for reintervention after endovascular aortic repair. Occasionally, aneurysm sac expansion will occur in the absence of a visible endoleak or due to endotension. We describe a case of continued sac expansion without an identifiable endoleak after endovascular aortic repair. Technical challenges during the case included a short distance from the renal arteries to the flow divider and a significant metal artifact. These challenges were addressed by shortening the gate of a Gore Excluder (W.L. Gore & Associates, Flagstaff, Ariz) to the desired length. The contralateral gate was preloaded to allow for use of the snare-ride technique for gate cannulation and overcome the metal artifact that was hindering visualization. (J Vasc Surg Cases Innov Tech 2021;7:669-74.)

Keywords: Cannulation; Contralateral gate; Endovascular aortic repair; Infrarenal abdominal aortic aneurysm; Metal artifact; Occult endoleak

The most frequent indication for reintervention after endovascular aortic repair (EVAR) has continued to be endoleak.[1,2] In general, type I and III endoleaks or those with sac enlargement are treated.[2] The reported incidence of sac enlargement after EVAR has ranged from 0.2% to 41% and typically occurs in the setting of an identifiable cause.[3] In as many as 5% of cases, the source of sac enlargement will not be visualized, and the etiology will be presumed to be endotension or a type V endoleak.[4-6] Relining stent-grafts with various devices and components has been described.[7,8] We report the case of relining an EVAR for an occult endoleak with sac expansion, using a technique that addresses several technical challenges. The patient provided written informed consent for the report of his case and associated images.

CASE REPORT

An 86-year-old man presented with continued abdominal aortic aneurysm sac expansion after undergoing EVAR with a Zenith Flex stent-graft (Cook Medical Inc, Bloomington, Ind) and "coil and coverage" of the right hypogastric artery 10 years previously. Postoperatively, his aneurysm had been initially stable at 5.2 cm from 5.5 cm, and a type II endoleak was noted from the patent inferior mesenteric artery and lumbar arteries. At 5 years, this had expanded to 6.3 cm, and the lumbar arteries and inferior mesenteric artery underwent coil embolization. During the ensuing 3 years, a slow expansion occurred to 7.6 × 8.1 cm in double oblique dimensions. Thus, he underwent computed tomography-guided translumbar polyvinyl alcohol, large particle embolization of the sac. Surveillance imaging studies included multiple 1-mm-slice, computed tomography angiograms (CTAs), duplex ultrasound scans, and a transfemoral aortogram that failed to demonstrate a source of sac filling in the setting of continued growth to 9.1 × 10.4 cm at 10 years (Fig 1). He was, therefore, referred to us owing to the large diameter and expansion of 7 mm within 6 months. We recommended intervention to prevent further expansion and rupture.

We planned for total relining of the infrarenal repair to address both the occult endoleak and endotension (Video, online only). Center-line flow imaging demonstrated a 26-mm main body with suprarenal fixation and 13-mm limbs. The distance from the lowest renal artery to the flow divider was 60 mm (Fig 2, *A*). We elected to use a 31-mm Gore Excluder (W.L. Gore & Associates, Flagstaff, Ariz) with a technique we have previously reported to preload the contralateral gate.[9] The 31-mm Excluder measures 80 cm from the top of the device to the bottom of the gate, with a 30-mm-long flow divider (Fig 2, *B*). We planned to shorten this by 20 mm to allow for placement within the 60-mm space left by the previous graft.

With the patient under general endotracheal anesthesia, we obtained bilateral percutaneous femoral access. A 24F Gore Dry-Seal (W.L. Gore & Associates) sheath was advanced to the level of the renal arteries. A 31-mm × 14.5-mm × 15-cm Gore Excluder

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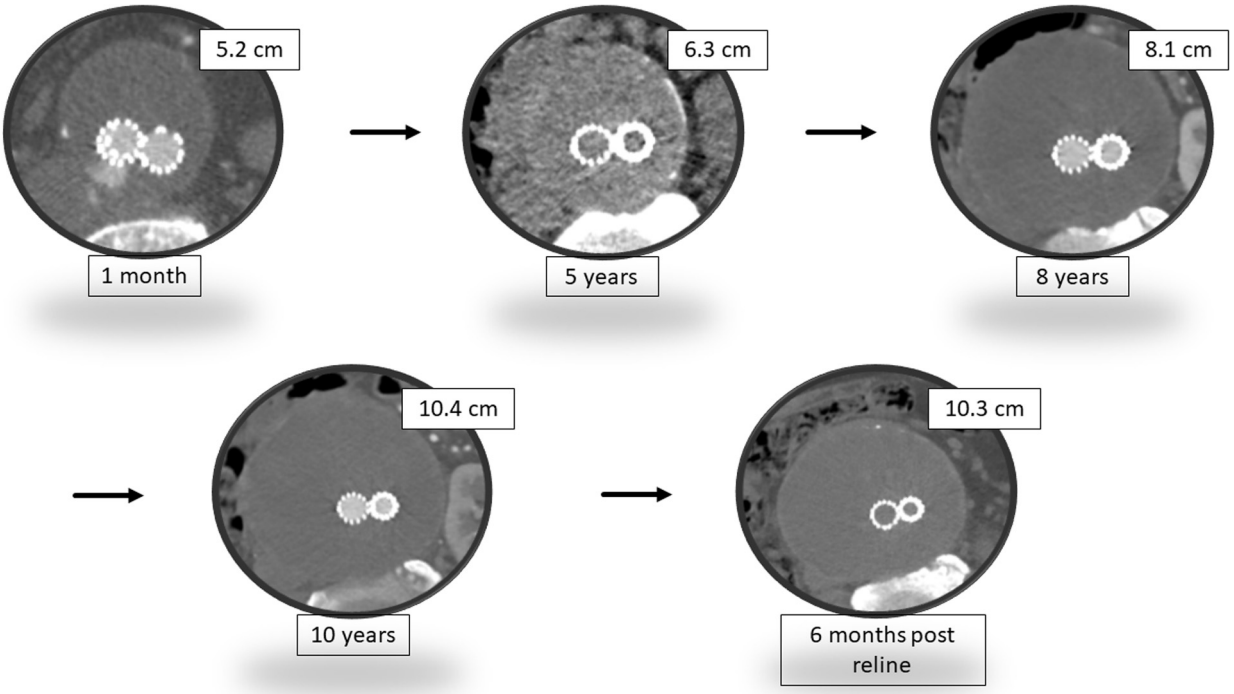

Fig 1. Select axial images from computed tomography angiogram (CTA) performed at 1 month and at 5-, 8-, and 10-year intervals after the index operation and 6 months after total relining.

(W.L. Gore & Associates) was advanced over the stiff wire, such that the distalmost portion of the contralateral gate was just outside the sheath (Fig 3, *A*). The first trigger wire was released, deploying to the contralateral gate while leaving the ipsilateral limb constrained. We identified the externalized portion of the gate, which had flowered open (Fig 3, *B*). The lowest 20 mm of the gate was trimmed with heavy scissors (Fig 3, *C*). Under direct vision, this was cannulated with a 5F × 10-cm sheath, permitting passage of a 0.018-in. wire through the gate as a preloaded wire. The 5F sheath was then withdrawn, and the main body with the 0.018-in. wire were advanced together to the lowest renal artery through the DrySeal sheath.

The DrySeal sheath was withdrawn over the device to deploy to the gate. Significant metal artifact was noted, making visualization near impossible even with magnification (Fig 4). After exchanging the 0.018-in. wire for an Amplatz wire, an Indy Snare (Cook Medical Inc, Bloomington, Ind) was advanced just above the old flow divider from the ipsilateral side (Fig 4, *A*). A glide wire was advanced from the contralateral side and immediately captured by the snare (Fig 4, *B*). Using the snare-ride technique,[10] the Indy snare carried the contralateral wire through the gate. The procedure was completed by raising the bifurcation by 2 cm with kissing iliac limbs. We have previously described the use of contralateral gate precannulation combined with the snare-ride technique to facilitate immediate gate cannulation in challenging anatomy.[9] These steps are summarized in Fig 5.

The patient's postoperative course was uneventful, and the patient was discharged home the next day. At 1 month, the CTA showed stability of the aneurysm, and at 6 months, the aneurysm had regressed to 8.7 × 10.3 cm.

DISCUSSION

In the present case, we have demonstrated an approach of total relining of an infrarenal stent-graft to address a suspected occult endoleak or endotension with sac expansion. Multiple high-resolution contrast studies, including multiphase CTAs could not identify any source of sac filling, including a type I, II, or III endoleak. At least 10 to 12 mm of proximal graft apposition was still present, and a transfemoral arteriogram also failed to demonstrate any endoleak, including a slow type Ia endoleak. Proximal extension for an occult type Ia endoleak could still be performed; however, after rigorous evaluation, we were not confident that taking the additional risks of fenestrated endovascular rescue of this infrarenal device would result in sac stability or regression. Furthermore, at our institution, it would have required a four-vessel physician-modified endograft and, possibly, a physician-modified inverted limb for distal extension.[11] Endoanchors have been advocated by some; however, our preference for pararenal aortic degeneration is fenestrated or branched rescue, even in octogenarians. Although graft explantation is another option, our patient's comorbidities and preferences were prohibitive.

After a thorough evaluation of his imaging studies, we suspected either an occult type III endoleak or endotension as the etiology of the sac expansion and

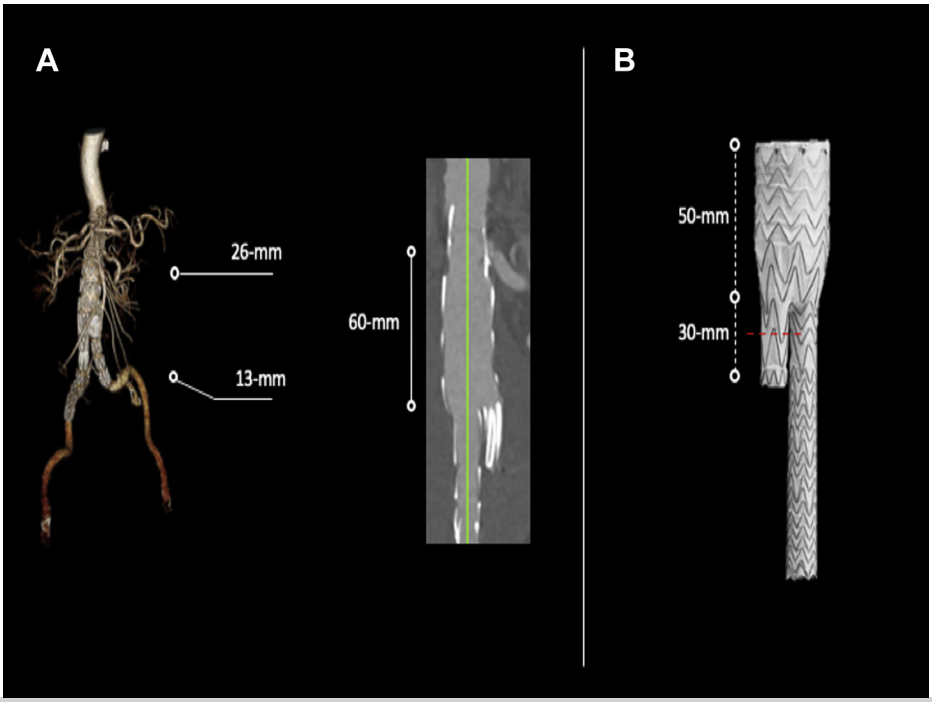

Fig 2. A, Three-dimensional reconstruction of preoperative computed tomography angiogram (CTA) demonstrating a 26-mm main body endograft and 13-mm iliac limb. **B,** Illustration showing a 31-mm Gore Excluder with an 80-mm distance from the top of the graft to the contralateral gate, including a 30-mm-long seal zone that was trimmed as a part of device modification.

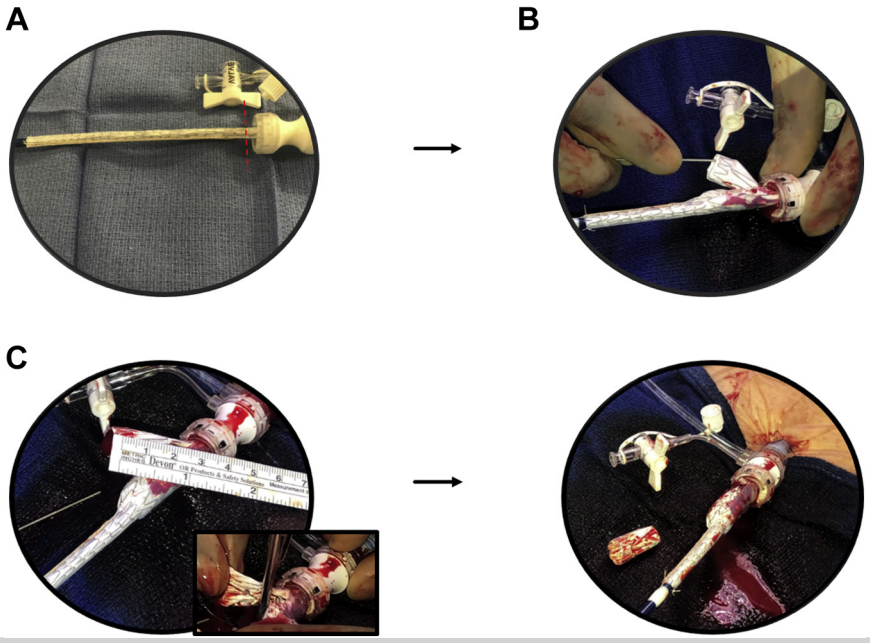

Fig 3. A, Photograph of the Gore Excluder partially advanced into the Gore DrySeal sheath to the level of the contralateral gate (*dashed red line*). **B,** Photograph of the Gore Excluder after the first trigger wire was released to deploy the main body down to the gate, with the ipsilateral limb remaining constrained. **C,** Photograph of the contralateral gate being measured and then shortened by 2 cm with heavy scissors to achieve the desired length of 60 mm from the distal end of the graft to the bottom of the gate.

recommended total infrarenal relining as the most likely approach to achieve sac sealing. This would not preclude subsequent fenestrated endovascular repair if needed nor type II embolization, which would hinder visualization during any future fluoroscopic procedures, if performed first.

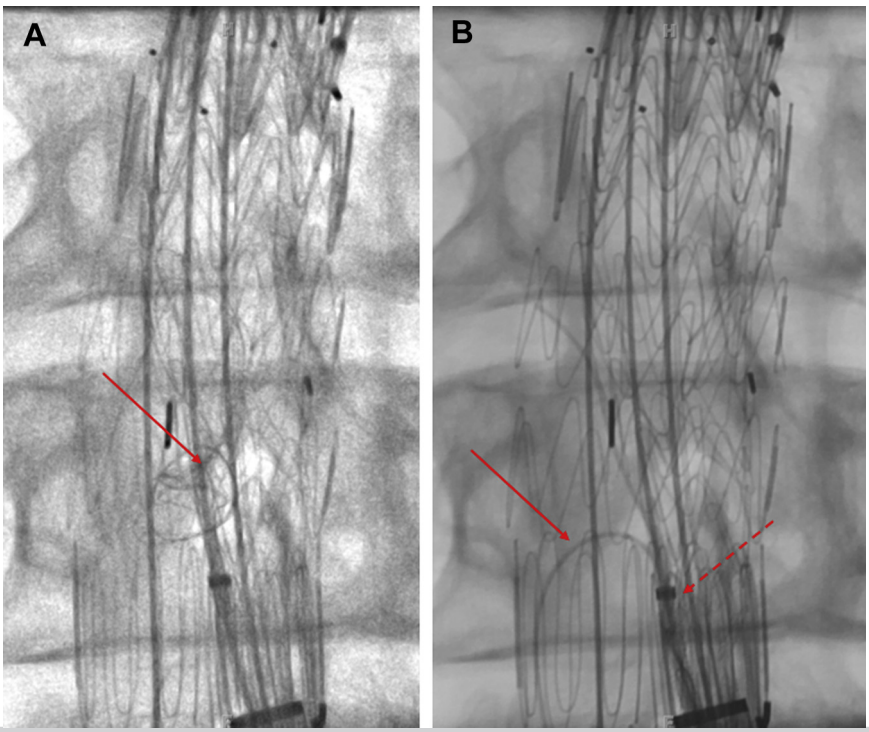

Fig 4. A, Fluoroscopic images demonstrating significant metal artifact and poor visualization once the Gore Excluder had been deployed within the previous stent graft and the deployed Cook Indy snare (*red arrow*). **B,** Fluoroscopic image of the contralateral glide wire (*solid red arrow*) captured by the Indy snare (*dashed red line*).

Multiple options are available for relining the stent-graft. Using individual iliac limbs or aortic cuffs alone for targeted relining would not have been appropriate because the exact location of the leak was unknown. A combination of limbs and cuffs or the CERAB (covered endovascular reconstruction of the aortic bifurcation) technique to re-create a bifurcated device could have been used.[7,8,12] However, we believed the risk of a gutter leak around these components was greater compared with the use of a bifurcated device. The manufactured options included the Gore iliac branch endoprosthesis, which not only was the appropriate length at 5.5 cm, but also has a preloaded catheter in the contralateral gate or hypogastric branch. However, the 23-mm device was not appropriately sized to reline a 26-mm stent-graft. Custom-manufactured inverted limb bifurcated devices are available to physicians with investigational device exemptions.[13] However, these are not preloaded or available to us. We have reported our experience with physician-modified inverted limbs.[11] However, this would not eliminate the need to modify a device as we did with the Excluder and, again, would not allow for simple preloading of the gate.

There were several advantages to using the modified preloaded EVAR technique. By shortening the gate, we were able to use a bifurcated device to minimize possible areas of type III endoleak. Although this left 1 cm of seal zone within the contralateral gate, this was addressed by raising the bifurcation with kissing iliac limbs by 2 cm. In addition, although no graft integrity issues were noted after shortening the gate, raising the bifurcation also mitigated this concern. This technique also preserves the re-constraining function such that the device could be precisely repositioned. Furthermore, slow withdrawal of the sheath over the main body for deployment facilitated accurate and controlled device placement, which is critical in a case in which no room for error exists. Finally, the existing stent-graft with suprarenal fixation caused a metal artifact that made visualization of the new device's gate, contralateral glide wire, and differentiation of the new and existing device components extremely difficult even with magnification, increasing the fluoroscopy frame rate, and the use of cones and shutters to focus the image. Although gate cannulation could have been accomplished eventually, it is likely that a significant fluoroscopy time and radiation dose would have been required. Reactive adjuncts such as contralateral snaring and upper extremity access could have been implemented; however, neither of those would have addressed the poor visualization due to the metal artifact and both require additional time. The proactive approach of preloading and shortening the contralateral gate was accomplished in <3 minutes. By deploying the Indy snare with its 40-mm radius just

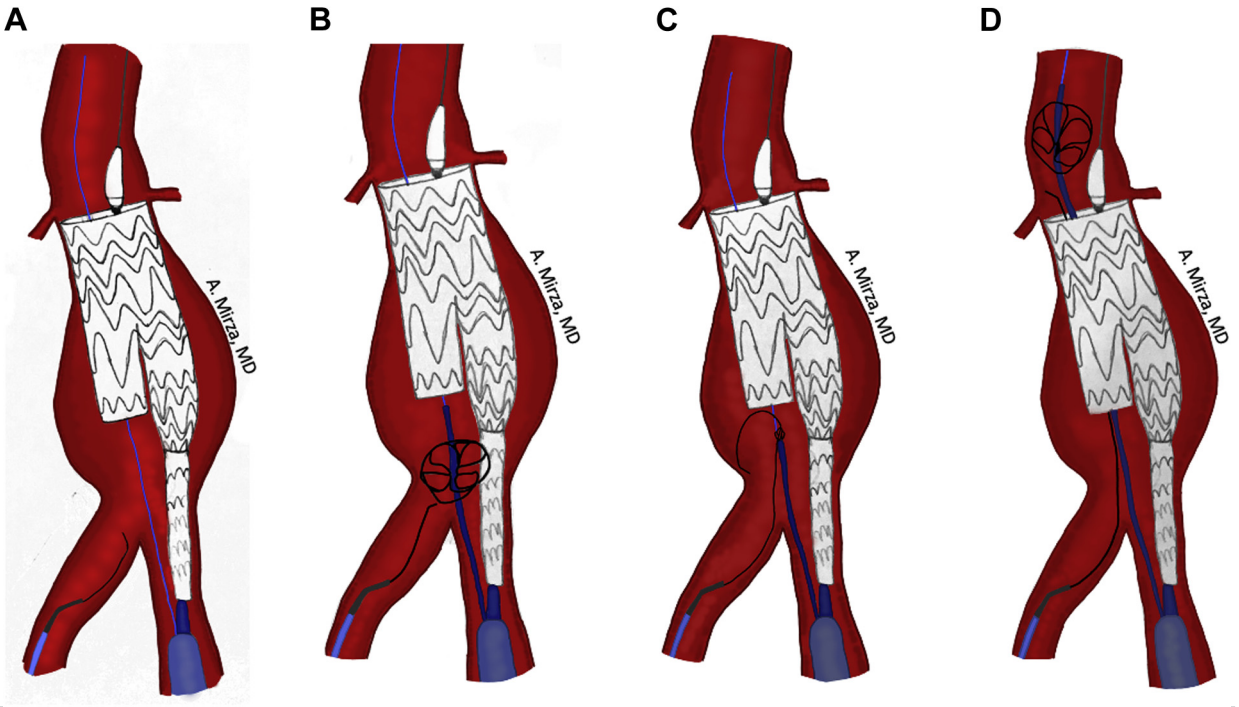

Fig 5. Illustrations demonstrating the steps of the "snare-ride" technique to facilitate immediate gate cannulation for a Gore Excluder with a precannulated contralateral gate. **A,** Gore Excluder deployed to the contralateral gate with the ipsilateral limb still constrained. The large Gore DrySeal sheath had been withdrawn into the ipsilateral common iliac artery. The 0.018-in. wire has been exchanged for a stiff 0.035-in. wire. **B,** The Cook Indy OTW snare is advanced over the stiff 0.035-in. wire and deployed immediately opposite the origin of the contralateral common iliac artery. **C,** A soft angled glide wire was advanced into the aorta with nowhere to go but through the deployed Indy snare and was immediately captured. **D,** With the captured contralateral glide wire, the Indy snare was advanced over the 0.035-in. preloaded wire through the contralateral gate and into the suprarenal aorta. The wire was released, and the remainder of the procedure was performed in standard fashion.

above the existing flow divider, immediate capture of the contralateral wire was guaranteed. The snare was first withdrawn slightly over the Amplatz wire, confirming that it was captured. The snare-ride technique was then used to push the captured wire through the gate for automated cannulation. This prevented the need for precise visualization during gate cannulation.

CONCLUSIONS

Preloading the contralateral gate of a bifurcated stent-graft has many potential applications but can be especially useful in situations with significant metal artifact. This includes relining of previous EVAR and in conjunction with fenestrated repair of failed EVAR. Modifications to shorten the gate allow for its use when the renal to bifurcation distance is short.

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