VASCULAR AND ENDOVASCULAR TECHNIQUES

Thomas L. Forbes, MD, Section Editor

The upside down Gore Excluder contralateral leg without extracorporeal predeployment for aortic or iliac aneurysm exclusion

Tim J. van der Steenhoven, MD,[a] Jan M. M. Heyligers, MD, PhD,[a] Ignace F. J. Tielliu, MD, PhD,[b] and **Clark J. Zeebregts, MD, PhD,[b]** *Tilburg and Groningen, The Netherlands*

Endovascular techniques, including branched devices to preserve the internal iliac artery are evolving rapidly, but in cases in which the diameter of the proximal sealing zone is larger than that of the distal sealing zone, a reversed tapered device is needed. We describe the off label use of the Gore Excluder contralateral leg endoprosthesis in an upside down configuration to accommodate this diameter mismatch. The preinsertion technical steps of stent graft preparation, which do not require extracorporeal predeployment, are described in detail. As such, an aneurysm of the internal iliac artery and a saccular abdominal aortic aneurysm were successfully excluded. (J Vasc Surg 2011;53:1738-41.)

Open repair of saccular abdominal aortic aneurysms (AAAs), and aneurysms of the common iliac artery (CIA) and internal iliac artery (IIA) is technically challenging and associated with considerable morbidity and mortality.[1,2] Isolated iliac artery aneurysms are rare, comprising only 7% of AAAs. Endovascular repair of solitary aneurysms of the CIA with both conventional and branched stent grafts has been described previously.[3-5] For the conventional stent graft exclusion of any isolated aneurysm, adequate sealing and fixation at the proximal and distal landing zones is required. The iliac bifurcation is often included in the aneurysm. Therefore, the stent graft needs to extend into the external iliac artery, which generally has a smaller diameter than the CIA. For these cases where the diameter of the proximal sealing zone is larger than that of the distal sealing zone, upside down techniques with the Zenith flared extension limb stent grafts (Cook Inc, Bloomington, Ind) have been successfully applied previously.[6,7] With this technique, extracorporeal predeployment, stent graft reversal, and reinsertion into the delivery device is necessary. This extracorporeal predeployment and reinsertion is tedious and could therefore initiate device damage and failure.[6] The Gore Excluder contralateral leg endoprosthesis (W. L. Gore & Associates Inc, Flagstaff, Ariz) does not require extracorporeal predeployment for use as an upside down device. It was successfully used in an upside down configuration to treat an aneurysm of the IIA and a saccular AAA.

From the Department of Surgery, St. Elisabeth Hospital, Tilburg[a]; and the Department of Surgery, Division of Vascular Surgery, University Medical Center Groningen, University of Groningen, Groningen.[b]

Competition of interest: none.

Reprint requests: Clark J. Zeebregts, MD, PhD, Department of Surgery, Division of Vascular Surgery, University Medical Center Groningen, PO Box 30001, 9700 RB Groningen, The Netherlands. (e-mail: czeebregts@hotmail.com).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a competition of interest.

0741-5214/$36.00

doi:10.1016/j.jvs.2010.11.108

TECHNIQUE

Stent graft preparation. The procedure starts by disconnecting the Excluder contralateral leg from the delivery catheter. The olive at the end of the catheter is removed by bending and breaking (Fig 1, *A*) or cut with scissors (Fig 1, *B*). The deployment knob is unscrewed and retracted only minimally so as to create a small gap between the knob and catheter. In this way, the prosthesis is not deployed. The deployment line is cut (Fig 1, *C*). This allows removal of the sleeved prosthesis from the catheter by sliding it off the end of the catheter. The deployment line comes out of the catheter, attached to the distal part of the prosthesis (Fig 1, *D*).

Stent graft introduction and deployment. After an angiogram, the stent graft is introduced over a super stiff guidewire and through a 30 cm 18F sheath that is positioned with the tip in the intended proximal sealing zone. The device is introduced upside down, with the deployment line entering the introducer sheath first. To create a pusher to further advance the stent graft over the guidewire and into the sheath, the tip of the 18F sheath's dilator (PG183000; W. L. Gore & Associates Inc) is cut for no more than 1 cm. The cutting of more than 1 cm results in leakage through the dilator's central lumen. Cutting of <1 cm creates a pusher that may enter the lumen of the stent graft and tend to open it up. The prosthesis is introduced

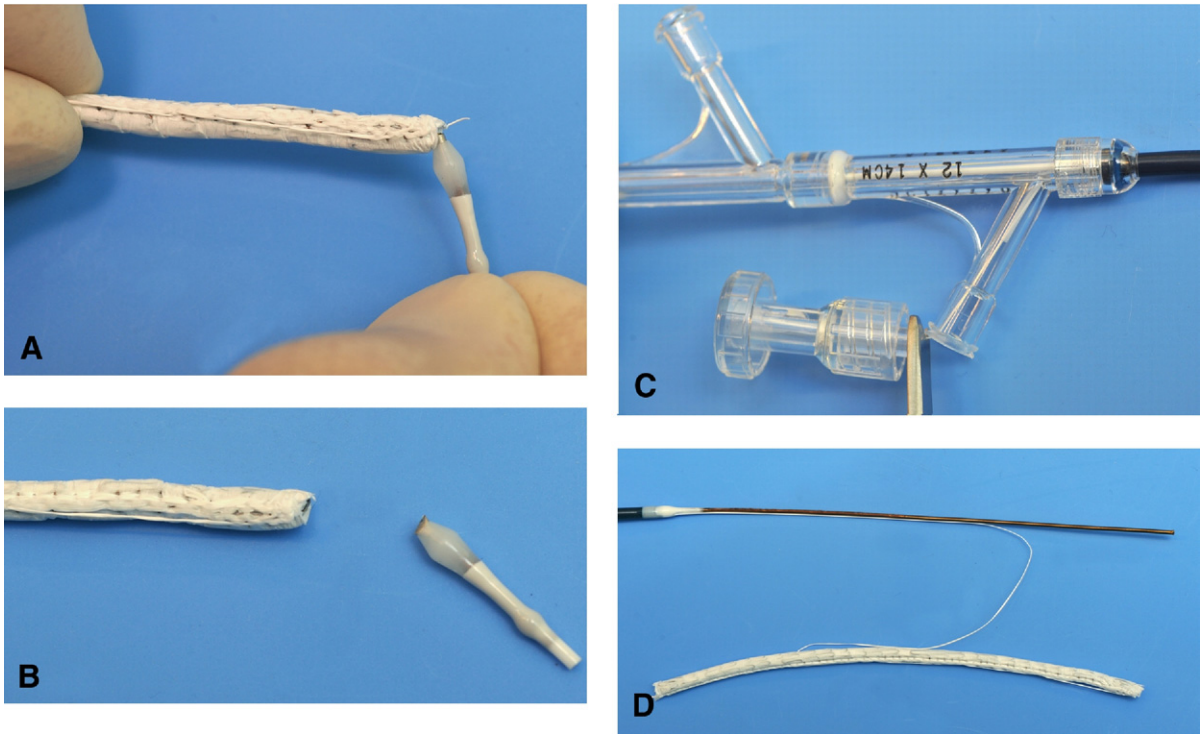

Fig 1. Preinsertion technical steps of stent graft preparation. **A,** Bending and breaking off the olive at the end of the catheter. **B,** Cutting off the olive at the end of the catheter when breaking off is unsuccessful. **C,** Cutting the deployment line after unscrewing the deployment knob. **D,** Removing the stent graft with the attached deployment line from the delivery catheter.

through the valve of the sheath and pushed with the cut dilator. The prosthesis is now positioned at the desired spot and deployed within the sheath by pulling the deployment line and keeping the dilator in place. The stent graft is now deployed by retracting the sheath over the dilator while keeping the dilator in place. The proximal and distal ends of the stent graft are ballooned by using a compliant balloon. A completion angiogram is performed to check for endoleaks.

CASES

Two patients were treated with the upside down Excluder stent graft technique. The first patient was a 68-year-old man with a 41-mm large aneurysm of the left IIA. The CIA had a mean diameter of 16.4 mm and the external iliac was measured at a mean diameter of 12 mm (Fig 2, *A*). An upside down procedure was performed using a 10-cm long Excluder contralateral leg, which, once implanted, has a proximal diameter of 20 mm and a distal diameter of 16 mm (PXC 201000; Fig 2, *B*). To prevent retrograde endoleak into the IIA aneurysm, separate branches of the IIA were coil embolized 1 day before surgery. As a result, the patient complained of mild buttock claudication. He was discharged from the hospital 1 day after the procedure. Two months later, a computed tomography angiogram was made which showed exclusion of the aneurysm without endoleak. The buttock claudication subsided with supervised walking exercise and the patient is symptom free now 3 months after the procedure.

The second patient was a 66-year-old woman with a growing 32-mm large saccular aneurysm of the distal abdominal aorta. The diameter of the aorta cranially and caudally to the aneurysm measured 16 mm and 14 mm, respectively (Fig 3, *A*). We selected the patient for an upside down procedure using a 10-cm long Excluder contralateral leg. Once implanted, the contralateral leg had a proximal diameter of 18 mm and a distal diameter of 16 mm (PXC 181000). The procedure was uncomplicated (Fig 3, *B*) and the patient left the hospital 1 day after the procedure. Deliberately, a computed tomography scan was not performed at follow-up. A four-view plain X-ray of the abdomen showed no abnormalities. On a duplex ultrasound scan that was performed 7 weeks after the procedure, the aneurysm had disappeared. The ankle brachial index was 123% on both sides.

DISCUSSION

The technique with the upside down Excluder contralateral leg is outside the standard instructions for use of the device. Therefore, this technique should be reserved only for those cases in which an alternative size stent is unavailable or less practical. Aorto-uni-iliac (AUI) grafts, tapered thoracic, and untapered tubular iliac extensions should be considered first for the treatment of IIAs or saccular AAAs. However, in many situations these stent grafts will be too big, too long, undersized, or oversized. For example, for patient number 1 a

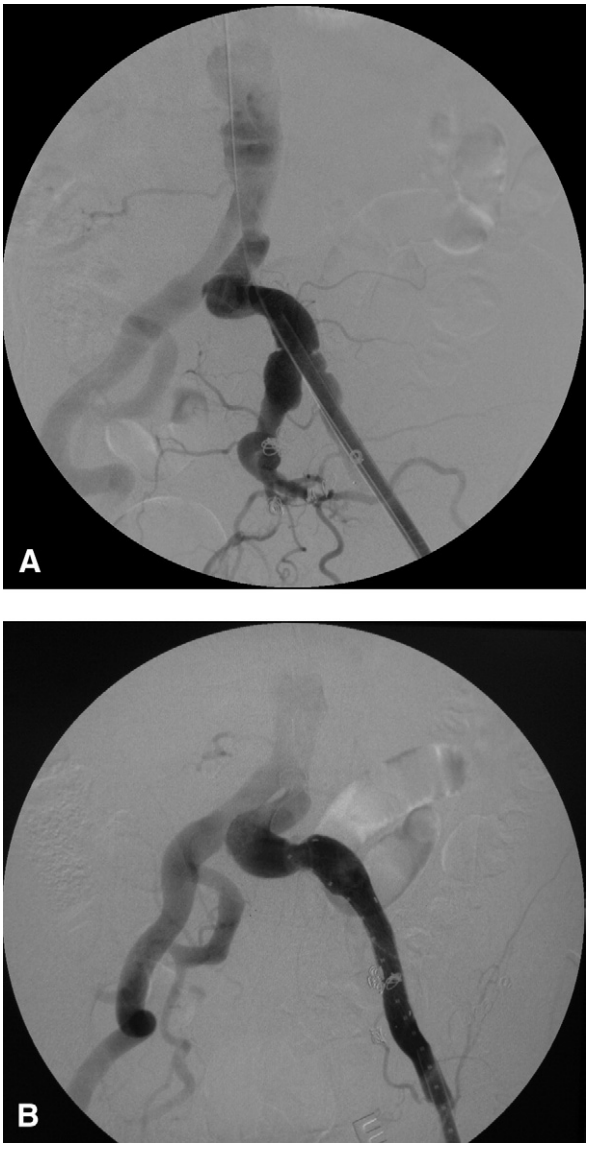

Fig 2. Internal iliac artery aneurysm **(A)**, successfully excluded using an upside down Gore Excluder contralateral leg after coil embolization of the internal iliac artery **(B)**.

Fig 3. Saccular aneurysm of the distal abdominal aorta **(A)**, successfully excluded with an upside down Gore Excluder contralateral **(B)**.

Zenith AUI converter 24 to 12 mm would have been oversized proximally and undersized distally.

In contrast to similar techniques with other devices, we describe an upside down technique in which the stent graft is not deployed outside the body and remounted on the delivery device. Instead, it is removed from the catheter in a constrained way and reintroduced, after which it is deployed in the sheath. This has considerable advantages regarding operating time, maintenance of sterility, and most of all it simplifies the whole procedure. It reduces the theoretic risk of damaging the stent, fabric, or sheath that could cause accelerated stent fatigue and fracture. Furthermore, with the upside down Excluder technique, the stent graft is constrained by an expanded polytetrafluoroethylene/fluorinated ethylene propylene sleeve, which reduces the risk of twisting the prosthesis upon delivery, which could result in incomplete opening of the stent graft. Other device manufacturers can provide reverse-mounted devices for use as a reverse tapered stent graft. This, however, requires a certain delivery time and these devices are therefore not readily available for use in emergent situations.

Deployment of the upside down Excluder stent graft is a very controlled technique in which exact placement is established by pulling back the sheath over the dilator. This is a standard endovascular technique that does not require specific training other than the knowledge of the Excluder device deployment technique, in addition to some tips as described above.

CONCLUSIONS

The upside down Excluder contralateral leg technique offers an easy endovascular approach, albeit an off-label technique, to exclude an aneurysm with a proximal sealing zone that is larger in diameter than the distal sealing zone. It was applied successfully in 2 cases: one aneurysm of the internal iliac artery after coil embolization and one saccular aneurysm of the infrarenal abdominal aorta. The technique precludes extracorporeal deployment and remounting of the stent graft and is therefore readily available also for emergent situations.

REFERENCES

1. Krupski WC, Selzman CH, Floridia R, Strecker PK, Nehler MR, Whitehill TA. Contemporary management of isolated iliac aneurysms. J Vasc Surg 1998;28:1-11; discussion 11-3.
2. Richardson JW, Greenfield LJ. Natural history and management of iliac aneurysms. J Vasc Surg 1988;8:165-71.
3. Tielliu IF, Verhoeven EL, Zeebregts CJ, Prins TR, Oranen BI, van den Dungen JJ. Endovascular treatment of iliac artery aneurysms with a tubular stent-graft: mid-term results. J Vasc Surg 2006;43:440-5.
4. Tielliu IF, Zeebregts CJ, van den Dungen JJ, Verhoeven EL. A modified technique for iliac artery branched endografting using a "tromboned" sheath. J Vasc Surg 2008;48:1605-8.
5. Tielliu IF, Bos WT, Zeebregts CJ, Prins TR, van den Dungen JJ, Verhoeven EL. The role of branched endografts in preserving internal iliac arteries. J Cardiovasc Surg (Torino) 2009;50:213-8.
6. Hiramoto JS, Reilly LM, Schneider DB, Rapp JH, Chuter TA. The upside-down zenith stent graft limb. Vascular 2009;17:93-5.
7. Leon LR Jr, Mills JL Sr. Successful endovascular exclusion of a common iliac artery aneurysm: off-label use of a reversed Cook Zenith extension limb stent-graft. Vasc Endovasc Surg 2009;43:76-82.

Submitted Sep 24, 2010; accepted Nov 13, 2010.