Sutureless telescoping aortic anastomotic technique for hybrid surgical treatment of aortoiliac occlusive disease

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Sutureless Telescoping Aortic Anastomotic Technique for Hybrid Surgical Treatment of Aortoiliac Occlusive Disease

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Purpose: To describe a new technique to assist aortoiliac stent-graft implantation in the presence of severe and extensive calcification.

Technique: The use of an aortic stent-graft telescoped into the aorta and deployed partly within and partly outside the aorta is illustrated in 2 cases. In the first, the bifurcated stent-graft was deployed with the proximal end and body intraluminally within the aorta; the distal ends (legs) were extended in an extravascular fashion with surgical grafts to reach the femoral bifurcation. In the second case, a tapered tubular stent-graft was deployed through the aortic wall to land partially inside the aortic lumen and partly inside a bifurcated standard surgical graft; the distal ends of the surgical graft were anastomosed to the iliac arteries by a standard anastomosis on the left and by an intraluminal telescoped stent-graft anastomosis on the right. Follow-up was uneventful in both patients. The sutureless telescoping anastomosis was stable at 5 years and 6 months, respectively, on computed tomographic angiography.

Conclusion: These favorable outcomes underscore that this technique should be considered in patients with aortoiliac occlusive disease in whom aortic cross-clamping and/or a standard aortic anastomosis is expected to be difficult or impossible.

Key words: aortoiliac occlusive disease, porcelain aorta, cross-clamping, anastomosis, endoclamping, sutureless anastomosis, telescoping anastomosis, VORTEC

Surgical treatment of aortoiliac occlusive disease (AOD) might be challenging in cases with extensive calcification that renders cross-clamping a hazardous procedure, potentially leading to plaque embolization and/or extensive aortic wall disruption that might be very hard to control. Moreover, incising and suturing an aortic wall with residual thrombus and/or weakened by endarterectomy might be difficult and may lead to complications, such as bleeding or pseudoaneurysm. We present a new sutureless and clampless technique to perform infrarenal aortic anastomoses.

TECHNIQUE

The technique is illustrated in 2 patients. The first, a 74-year-old man with chronic claudication, presented with acute bilateral critical...
limb ischemia. Computed tomographic angiography (CTA) demonstrated AOD extending from the infrarenal aorta to the femoral arteries. Due to the extent of the occlusion, endovascular treatment was deemed impossible. In addition, CTA showed extensive and largely circumferential calcification, as well as atherosclerotic plaque in the infrarenal and pararenal aortic segments that would have required a thoracoabdominal approach to clamp the relatively normal supraceliac aortic segment. However, thoracoabdominal surgery was judged to be too risky due to the presence of significant coronary artery disease and severe chronic obstructive lung disease. A decision was taken to perform transaortic balloon occlusion of the aorta for bleeding control. After full midline laparotomy, a 12-F sheath and balloon catheter were introduced through the infrarenal aorta, and the balloon was inflated in the supraceliac position. The aorta was then transected at the level where the sheath and balloon catheter were introduced, and endarterectomy was performed. Unfortunately, this resulted in extensive damage to the infrarenal aorta. Therefore, a 16-cm-long trunk of an Excluder stent-graft (W.L. Gore Inc., Flagstaff, AZ, USA), 23 mm in diameter proximally and 12 mm in diameter at the distal limbs, was telescoped into the open aorta and deployed partially within the infrarenal aorta and partially distal to the divided aorta. A second balloon was introduced through one limb into the body of the stent-graft. The first balloon was then deflated, pulled back within the 12-F sheath and removed. To avoid stent-graft migration, four 4–0 Prolene sutures were placed from outside, penetrating the aortic wall as well as the stent-graft. Then a local endarterectomy of the distal aorta was performed and closed with a 4–0 Prolene running suture. The limbs of the stent-graft were extended with 9-mm polyester grafts that were suture anastomosed to the respective common femoral arteries in standard fashion (Fig. 1A). In a 62-month follow-up period, the patient has had an uneventful course; CTA has demonstrated a patent aortoiliac reconstruction without signs of stent-graft migration (Fig. 1B).

In the second case, a 59-year-old man presented with progressive, severe, intermittent claudication and rest pain. The CTA demonstrated extensive AOD, with long segments of occlusion that did not qualify for percutaneous intervention. Preoperatively, severe coronary artery disease was detected, and aortocoronary bypass was performed first. A transjugular intrahepatic portosystemic shunt (TIPS) carried out 10 years before for cirrhosis and portal hypertension was found to be patent and functioning well. A left-sided retroperitoneal exposure of the aorta revealed, in addition to the severe calcification detected on the preoperative CT, severe periaortic inflammation, inhibiting safe dissection of the aortic neck for infrarenal or suprarenal cross-clamping. Therefore, a tapered E-vita tubular endograft (Jotec, Hechingen, Germany) measuring 16 mm proximally, 20 mm distally, and 50 mm in length was first inserted into the lumen of a standard bifurcated polyester graft (16×8 mm) before it was inserted by Seldinger technique through the anterior wall of the infrarenal aorta (Fig. 2A,B). The stent-graft was then partly deployed within the infrarenal aortic lumen and partly within the bifurcated polyester graft that was then approximated to the aortic
wall with forceps. To avoid migration of the stent-graft and the bifurcated surgical graft, the E-vita endograft and the vascular graft were fixed by four 4–0 Prolene stitches to the aortic wall. The E-vita stent-graft was dilated with a catheter-mounted balloon at the trans-aortic penetration site to achieve full expansion. The left limb of the surgical polyester bifurcated graft was anastomosed end-to-side to the proximal external iliac artery. Due to the severe perivascular inflammation, the anastomosis of the right limb to the right distal common iliac artery was performed with a similar sutureless anastomosis technique (known as the Viabahn open rebranching technique or VORTEC)\textsuperscript{1,2} with an 8-mm×50-mm Viabahn stent-graft (W.L. Gore). Over the 6 months since the procedure, the patient’s course has been uneventful; CTA showed a patent aortoiliac reconstruction (Fig. 2C).

**DISCUSSION**

Endarterectomy, patch-enlargement angioplasty, and bypass surgery have been shown to be durable options to treat AOD.\textsuperscript{3–10} However, cross-clamping, which is required to control blood flow in all these treatment options, might be difficult in some cases. Cross-clamping the calcified aorta might lead to plaque rupture and embolization of plaque material or to aortic wall injury that might be impossible to repair, especially in heavily calcified aortas. In some instances, cross-clamping the relatively normal or healthy aorta will require a thoracic or thoracoabdominal approach just to perform the procedure at the level of the infrarenal aorta. Endoclamping with a catheter-mounted balloon is an attractive alternative to conventional aortic cross-clamping. However, inflating the balloon in a diseased or calcified aorta might lead to balloon rupture, aortic wall rupture, or embolization of debris after balloon deflation. Thus endoclamping, like standard clamping, also requires a relatively disease-free aortic segment. Another concern in bypass surgery is that performing a sutured anastomosis in a vessel wall that might not be cleared completely of calcification or that is weakened by endarterectomy may result in a poor quality anastomosis, leading to complications (e.g., bleeding or pseudoaneurysm).

Telescoping stent-graft devices into the aorta, as was successfully performed in our
cases, is another surgical option that has not been previously described insofar as we know. In our first case performed in 2004, we used balloon catheter inflow control and performed aortic transaction to introduce the stent-graft under visual control. However, we realized that this is not necessary if an appropriate soft area is present in the aortic wall to allow puncture, introduction, and deployment of the stent-graft using the Seldinger over-the-wire technique. We therefore performed our second case without endoclamping with a balloon catheter. In both cases, we achieved satisfactory stent-graft anchorage and sealing after balloon dilation and fixation of the stent-graft in combination with suture fixation of the bifurcated graft to the aortic wall. Although our 5-year results with the first case are quite satisfactory, we would currently recommend landing the distal end of the stent-graft within a surgical graft as in our second case. The rationale for this is related to concerns about the long-term durability of the stent-graft fabric. In case of failure of the stent-graft fabric, the unprotected stent-graft would probably be more prone to bleeding complications than one protected inside a standard surgical graft. Also, in the event of stent fractures, the uncovered stent-graft struts might perforate the bowel, which would not happen were it placed inside a surgical graft.

Conclusion

We suggest a novel treatment option to deal with a calcified or unclampable aorta in aortoiliac occlusive disease. The sutureless telescoping technique allows safe and durable aortic anastomosis even in so-called porcelain aortas. The sutureless telescoping technique can be performed using the Seldinger approach to insert and deploy a stent-graft device directly through the aortic wall, thereby rendering aortic clamping completely unnecessary. The technical and clinical success in our 2 patients is encouraging and underscores the attractiveness of this technique in patients in whom infrarenal aortic clamping and/or suture anastomosis might be difficult or impossible.

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REFERENCES