Use of ViaBahn Open Revascularisation Technique for Above-knee Femoro-popliteal Anastomosis: A Technical Note

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Abstract
We describe a ViaBahn Open Revascularization TECHnique (VORTEC) application in peripheral femoro-popliteal polytetrafluoroethylene (PTFE) graft bypass in 13 patients.

Anastomosing synthetic bypass to target artery using a bridging self-expanding covered stent (ViaBahn Open Revascularization TECHnique (VORTEC)) has been recently published.1–3 Here, we report the use of this technique for anastomosis of a prosthetic bypass to the above-knee (AK) popliteal artery.

Standard anastomotic technique to popliteal artery requires exposure, circumferential dissection and occlusion of vessels usually with clamping. Performance of the anastomosis to a diseased and calcified AK popliteal artery can be difficult. The intra-operative damage to arterial wall is a well-recognised contributing factor to intimal hyperplasia, anastomotic stricture and failure of grafts.

In the subgroup of patients with severe claudication and critical ischaemia with multiple co-morbidities, the procedure of femoro-AK popliteal bypass can be non-trivial. The exposure of the AK popliteal artery might be very distal and difficult, resulting in postoperative wound complications. Every attempt to shorten the procedure in these morbid patients would be desirable.

Guided by these considerations we decided to apply the VORTEC to the distal anastomosis in femoro-AK popliteal bypass. We report on the first 13 patients in whom this technique was applied successfully.

Patient Series

Thirteen patients have undergone VORTEC for popliteal artery in our department from April 2010 to October 2010. The patients suffered from severe claudication or critical ischaemia, and demonstrated long superficial femoral
artery (SFA) occlusions favouring open surgery over endovascular intervention. In the absence of saphenous vein, we used synthetic grafts with VORTEC for distal anastomosis. All patients signed an informed consent. Since both the prosthetic graft material and the ViaBahn are standard approved vascular grafts used in our daily practise, as is the VORTEC technique, no ethics committee approval was requested apart from our internal departmental committee.

Technical Details

The principal technique of VORTEC is outlined in the original report by Lachat et al.1

A brief description of this technique applied to AK popliteal artery follows.

Preoperative imaging included computed tomographic (CT) or digital angiography to delineate the anatomy, vessel diameter, location of collaterals and length of the suitable landing zone in the popliteal artery. The AK popliteal artery was then exposed through a short longitudinal incision. The common femoral artery (CFA) was exposed through a transverse or longitudinal approach. Only about a 1-cm length of the wall of the AK popliteal artery wall was exposed. An external supported, 5- or 6-mm diameter expanded polytetrafluoroethylene (ePTFE) vascular graft (W.L. Gore, Flagstaff, USA) was tunnelled subfascially between the two incisions and heparin was provided (polyester vascular grafts tend to dilate and are therefore inappropriate conduits in this hybrid VORTEC technique). The AK popliteal artery was punctured and a 0.035-inch guide wire introduced into the artery. The ePTFE-covered external Nitinol Stent (ViaBahn, W.L. Gore, Flagstaff, USA) size was selected to match the popliteal artery diameter. The 5 or 6 mm in diameter and 10-cm-long ViaBahn stent graft was introduced from the inguinal incision through the graft and on the guide wire down to the popliteal artery (Fig. 1-A). The distal portion of the ViaBahn stent graft desired to be lodged into the artery was marked for its adequate introduction length, and then pushed into the artery up to the mark (Fig. 1-B). The distal part of the ePTFE graft was bevelled and advanced distally over the ViaBahn stent graft up to the arterial wall, and keeping all parts stable, the ViaBahn stent graft was deployed. At this stage, the stent graft was sutured to the artery and to the graft by one or two 5/0 Prolene stitches (Fig. 1-C). A ballooning of the stent graft with a 5- or 6-mm balloon was performed to achieve haemostatic sealing and waist smoothing (Fig. 2). Completion angiography in flexion and extension was performed (Fig. 3).

The proximal anastomosis was completed end to side using a regular standard running suture technique. Fig. 4 is a three-dimensional reconstructed CT angiography of one of the cases.

Immediate Results

All patients underwent the procedure successfully. Our single complication was that in one patient the primary needle puncture perforated the artery and entered into the vein. The error was discovered during completion angiography. The stent graft was withdrawn from the vein, that was repaired, and the technique was accomplished successfully through another puncture. There were no other intra-procedural complications (Table 1).

Discussion

Femoro-AK popliteal bypass, along with various endovascular revascularisation techniques, is implemented to save limbs that might otherwise require amputation in patients with ischaemic rest pain or tissue loss, and to improve walking distance in patients with severe life-limiting claudication. Current practise uses autologous vein, ePTFE, heparin-bonded ePTFE or polyester as a bypass conduit. Autologous vein bypasses have the best long-term patency rates even in the femoro-AK popliteal bypass. However, a suitable vein is not always available.

One of the vulnerable points of any bypass is the intimal hyperplasia with potential occasional graft loss. Any advance in preventing its occurrence is appreciated and would probably be translated into better graft patency. Impressed by the high early and mid-term patency of the VORTEC in central and visceral vascular beds,2,3 we assumed that it would have the same positive effect on the
AK popliteal artery. We hypothesised that the minimal handling and less injury to the artery would translate into lower rate of intimal hyperplasia and presumably improved graft patency. We are well aware of edge stenosis developing at the end of stentgrafts, but think that despite this possible drawback the net effect on long-term patency results will be in favour of the described technique.

We believe that this technique also allows for faster recovery and ambulation. We therefore think that this technique could be considered in high-risk patients if no saphenous vein is available.

Narayanan et al. described a single case report of a bail-out situation using three ViaBahn endoprosthesis for relining a failed femoro-AK popliteal bypass. Their distal

Figure 2  Schematic drawing of VORTEC deployment in the AK popliteal artery. (Reproduced and modified from Mario Lachat’s manuscript, with permission).

Figure 3  Completion angiography demonstrating the landing zone at the knee level (in flexion) with good run off.

Figure 4  A 3-Dimensional CT reconstruction of the VORTEC.
deployment zone, very briefly mentioned, was indeed the AK popliteal artery, but the main point of their article was to describe a sutured ViaBahn to native artery anastomosis to the femoral artery. Although the distal deployment zone is the same as in our article, their manuscript deals with repairing by relining the existing AK anastomosis and not creating a new one.

Two significant drawbacks of our technique are the considerable extra cost of the covered stent (2500 euro in our country) and the obliteration of the retrograde popliteal flow when present. In our view, the extra cost is justified by the ease of this anastomotic technique in these sick patients with heavily diseased arteries. Collateral circulation can mostly be preserved by choosing the most proximal possible landing zone distal to the occlusion, while major collaterals originating from the landing zone might be considered as a contraindication to this technique.

Conflict of Interest
None.

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Appendix
Supplementary material

Supplementary data related to this article can be found online at doi:10.1016/j.ejvs.2011.03.024.

References