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CASE REPORT

Complex Vascular Access

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In the past, one of the major problems and causes of failure in hemodialysis (HD) has been the lack of suitable vascular access (VA) options. Over the last few decades, the advent of prosthetic arteriovenous grafts (AVGs) and central venous catheters (CVCs) has given physicians the opportunity to choose the most appropriate VA for HD patients. However, the native arteriovenous fistula (AVF) remains the first choice for VA, especially because of the infectious and thrombotic complications more frequently associated with AVGs and CVCs.[1] Due to improved HD technique and treatment of comorbidities, dialysis patients now have a longer life expectancy. Because HD patients are now living longer, they require improved performance from their VAs so that the access can potentially last for decades. Prosthetic AVGs consist of an AVF made with prosthetic interposition between an artery and a vein and serves two purposes: (1) to be able to link two vessels that cannot be connected due to their distance,[2] and (2) to interpose a high-capacity prosthetic segment (between an artery and a vein) that can also be used for the insertion of HD needles. AVG creation is the second step of treatment, following AVF creation with native vessels.[3]

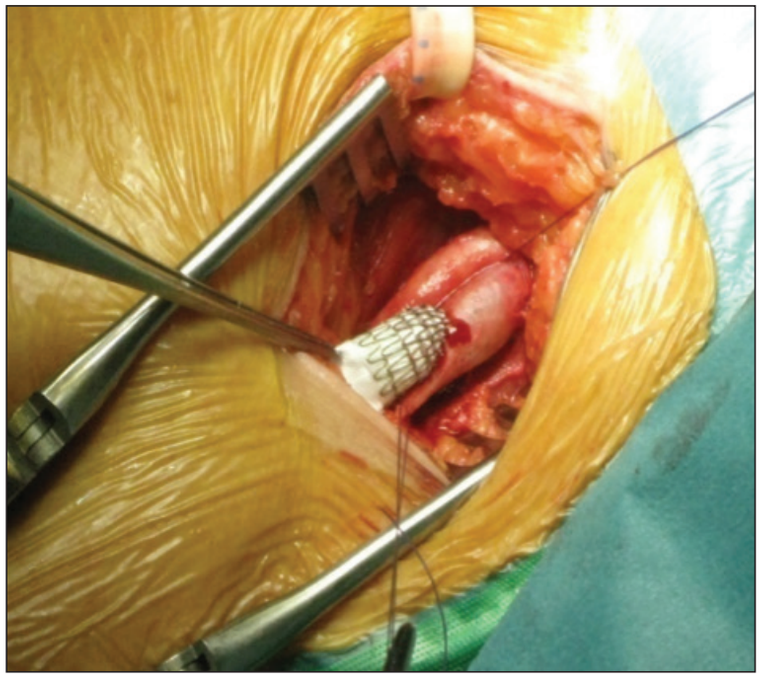

Figure 1. Venous anastomosis between the nitinol-reinforced section and the axillary vein.

In selected cases, an AVG is indicated as the first line of treatment, such as in cases of paucity of autologous material; for those only needed for a short, predictable period of hemodialytic treatment (eg, in children)[4]; in patients with short obese limbs, in which the superficial veins are deep in the subcutaneous tissue; and finally, in patients with extreme vascular fragility (thrombocytopenic purpura), in whom a simple venous puncture produces wounds and serious hematomas.[5] In the following case report, we describe a patient who underwent GORE® Hybrid Vascular Graft (HVG) implantation for HD access placement.

CASE REPORT

A 65-year-old man presented with end-stage renal disease and had significant comorbidities, including obesity (body mass index, 42 kg/m^2), hypertension, type 2 diabetes, dyslipidemia, coronary artery disease (48% left ventricular ejection fraction), and advanced chronic obstructive and restrictive pulmonary disease. He was also grade IV on the American Society of Anesthesiologists classification scale. A preoperative ultrasound scan demonstrated no available autologous veins for native AVF creation; thus, the patient was clearly unfit to receive a native AVF and underwent implantation of a 7 mm x 10 cm HVG in axillo-axillary configuration.

The procedure was performed under locoregional plexus block in a dedicated operating room equipped with a mobile fluoroscopic C-arm (BV Pulsera, Philips Volcano), because contrast angiography was required. Antibiotic prophylaxis with cephalosporin was given before the surgical incision.

The device implantation technique has previously been reported in detail.[6] Briefly, the selection of graft size and access configuration is made by the surgeon,[7] keeping in mind that because the graft, by design, occludes the distal venous outflow, the Nitinol Reinforced Section (NRS) should be placed as distal as is reasonable, based on vein diameter. The aim is to allow the chance for

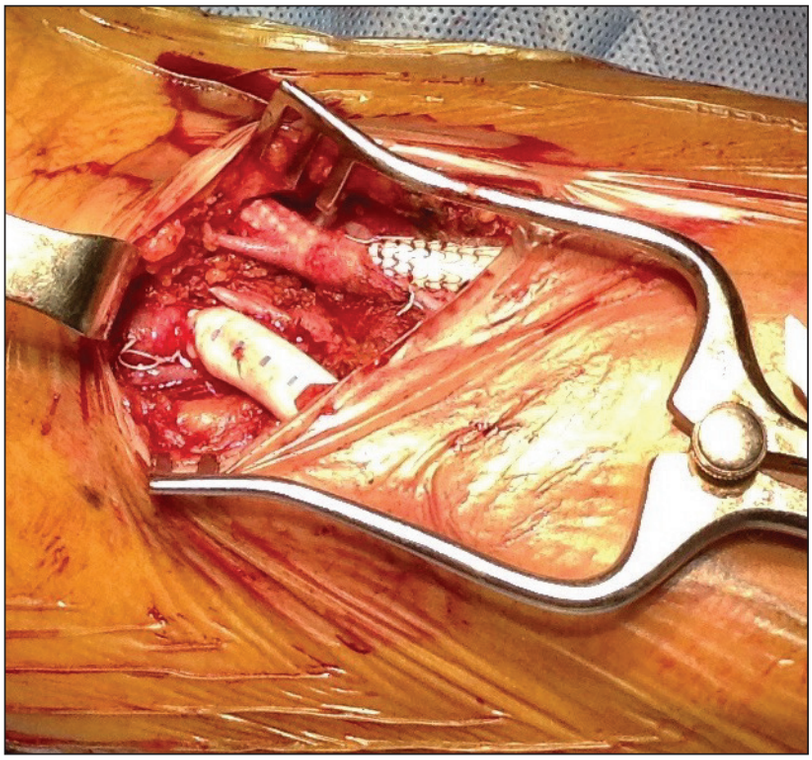

Figure 2. The axillo-axillary loop of the AVG.

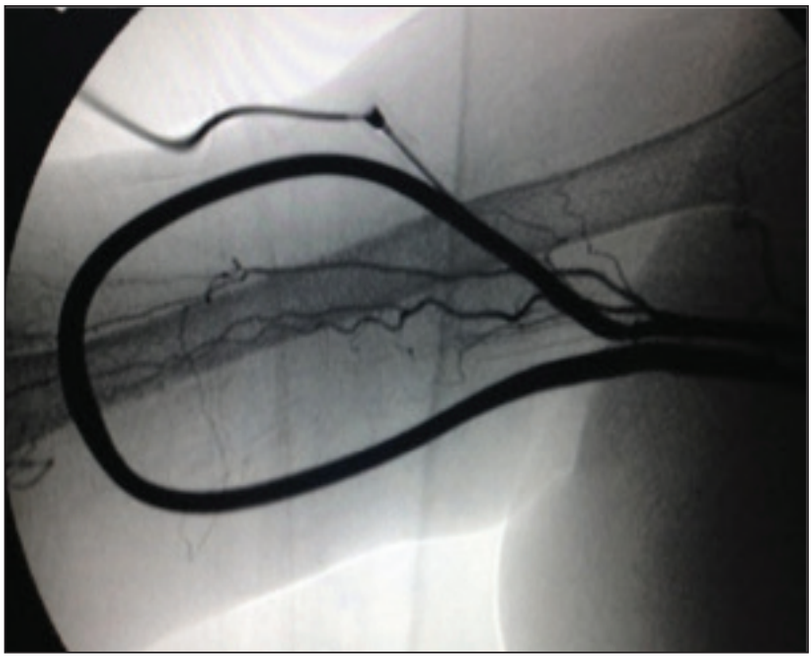

Figure 3. Final angiogram.

future access placements and to preserve the confluence of venous branches whenever possible. Optimal NRS oversizing is considered to be 5% to 20%, as suggested in the instructions for use. In the reported case, an axillo-axillary loop AVG was implanted through an axillary incision in the armpit. The nonstented part of the device was stretched and tunneled in the subcutaneous tissue. The NRS was inserted into the axillary vein through a venotomy. The NRS was then positioned into the vein, leaving the last 2 cm outside. It was then deployed and secured to the vein with two 6–0 polypropylene stitches (Figure 1) to prevent graft dislocation during the procedure, as suggested by the manufacturer. The arterial anastomosis was performed in an end-to-side fashion, as with traditional grafts. As a final step, balloon dilation of the stent was performed through direct puncture of the prosthesis. Completion control imaging was performed at the end of the procedure via contrast angiography (Figure 2) and confirmed technical success (Figure 3). The patient had an uneventful recovery.

CONCLUSION

The unique aspect of the HVG is its 5 or 10 cm NRS, instead of the sewn venous anastomosis. Because of this feature, the venous anastomosis is easier to perform and presents a straight geometry, which in turn might theoretically reduce the amount of turbulent flow.

Turbulence is a well-established factor in the development of intimal hyperplasia. Fillinger et al[8] demonstrated a significant correlation between Reynolds number and intimal medial thickening at the venous anastomosis. The influence of the anastomotic angle on flow was studied using a porcine model.[9] This consisted of an aortic graft interposition with an end-to-side configuration. Distal anastomoses were performed with angles of 90°, 45°, or 15°. The anastomoses of both 90° and 45° showed a recirculation zone, whereas no turbulence of the flow was documented in the 15° anastomoses. Nonetheless, the occurrence of intimal hyperplasia with HVG cannot be totally excluded, and further studies are necessary for any conclusion to be drawn in this regard.

The duration of intervention is comparable to that of standard AVG implantation. Time spared by sutureless

anastomosis offsets the additional angiographic time. The HVG seems to be safe and effective and represents an improvement compared to standard polytetrafluoroethylene AVGs. ■

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