''Two Is Better than One'': A Composite Graft Made of Two Different Vascular Prostheses for Urgent Hemodialysis Access in a Troublesome Case

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Background: Multiple failed hemodialysis access and poor vascular anatomy can jeopardize an end-stage renal disease patient's survival, frequently leading to the urgent need for rapid and durable new vascular access. In these circumstances, the extensive use of central venous catheters (CVC) can led to serious complications, such as infection, thrombosis, and often vessel scarring with obstruction of the central veins. More recently, new self-sealing prosthetic grafts may be cannulated within a few days after implantation, avoiding the need for extensive CVC. However, similar to all synthetic arteriovenous grafts (AVG), the new grafts are prone to rapid and aggressive venous neointimal hyperplasia (VNH), which is responsible for outflow stenosis and access thrombosis. Endoluminal sutureless anastomosis has been demonstrated to have better hemodynamics at the venous outflow with a supposed reduction of VNH, thus potentially improving graft patency.

Methods: We report a case of a successful creation of a composite prosthetic access in a patient with severe comorbidities and nearly complete exhaustion of all vascular sites and with the need for immediate access for hemodialysis. Two relatively novel vascular expanded polytetrafluoroethylene prostheses were used jointly in this patient for a brachial-axillary AVG to allow early cannulation and with the aim of being less vulnerable to outflow stenosis. A multilayer self-sealing graft and a graft with a nitinol reinforced section, which permits endoluminal sutureless anastomosis, were sewed together to create a unique prosthesis with both features.

Results: The composite graft was cannulated 48 hr after implantation and continued to function well at 10 months of follow-up without signs of venous stenosis.

Conclusions: This simple technique allows the creation of a customized composite graft with self-sealing properties and improved hemodynamics at the venous outflow.

The number of patients with multiple failed hemodialysis access and poor vascular anatomy is increasing, as are the associated serious comorbidities.[1] Within this population, there is a subset of patients whose vascular sites are either troublesome for a new surgical access or for placing a catheter, and they often need an ''urgent'' access to survive. In addition, the use of catheters is associated with a heightened risk of mortality and morbidity[2]; therefore, when an arteriovenous fistula (AVF) cannot be constructed, a graft could be a better choice rather than a central venous catheter (CVC)

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Ann Vasc Surg 2015; 29: 1016.e7–1016.e10
http://dx.doi.org/10.1016/j.avsg.2014.12.015

Manuscript received: August 5, 2014; manuscript accepted: December 22, 2014; published online: February 26, 2015.

in many cases. The expanded polytetrafluoroethylene (ePTFE) grafts are the most widely used vascular prostheses for hemodialysis worldwide, but a period of 2 to 3 weeks after implantation is needed for healing and the incorporation of fibrous tissue before safe cannulation.[3] Moreover, such grafts tend to be vulnerable to stenosis at the venous outflow.[4] Today, advances in prosthetic technology have recently provided a new multilayer wall graft for early cannulation, and an innovative prosthesis has been designed for sutureless venous anastomosis that can prolong access patency. These improvements allow better performance and broader use of arteriovenous grafts (AVG), thus reducing the use of CVC, but as yet there is no prosthetic device with all the optimal features combined. Herein, we report a successful case in which the potential benefits of a customized composite graft are emphasized.

CASE REPORT AND TECHNIQUE

A 49-year-old man, a heart transplant recipient as of 1994, with a past medical history significant in showing hypertension, diabetes, Crohn's disease, osteomyelitis of the left lower limb, and peripheral arterial disease, had been on hemodialysis for end-stage renal disease secondary to cyclosporine nephrotoxicity since 2009. The patient had a history of multiple AVF and graft thromboses revised by several surgical and endovascular interventions on both arms. After the thrombosis of a right forearm loop graft, it was clear that no surgical or endovascular access rescue was possible because of the extension of the outflow obstruction. He presented with a left brachiocephalic vein obstruction and complete exhaustion of the right forearm veins with a malfunctioning temporary dual lumen catheter in the right femoral vein as the only mean of hemodialysis. Peritoneal dialysis was not practical because of the inflammatory bowel disease. To obtain a prompt and durable access for hemodialysis, we decided to perform a prosthetic vascular access using 2 grafts with different features sewed together (Fig. 1). On the bench, a 3-cm-long stump of an ePTFE GORE Hybrid Vascular Graft (W. L. Gore & Associates, Inc., Flagstaff, AZ) with a 7-mm diameter nitinol reinforced section (NRS) was sewed in an end-to-end fashion to a trilaminar GORE Acuseal self-sealing Vascular Graft using a Gore-Tex suture CV6 (Fig. 2). Both grafts have an inner lumen with the surface covalently bound to heparin (Carmeda BioActive surface). Thus, the composite graft had optimal features for this case: reduced thrombogenesis, self-sealing properties, and the possibility of sutureless endoluminal anastomosis to minimize outflow stenosis. Before implantation, ultrasound vein mapping showed a patent axillary vein nearly 6 mm in diameter in the right upper limb, while at the arm level, the cephalic vein was thrombosed and the basilic vein had a diameter of

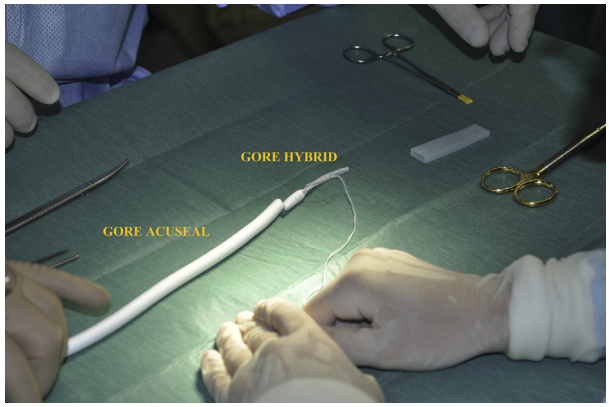

Fig. 1. The stump of the GORE Hybrid Vascular Graft with NRS and the GORE Acuseal Vascular Graft.

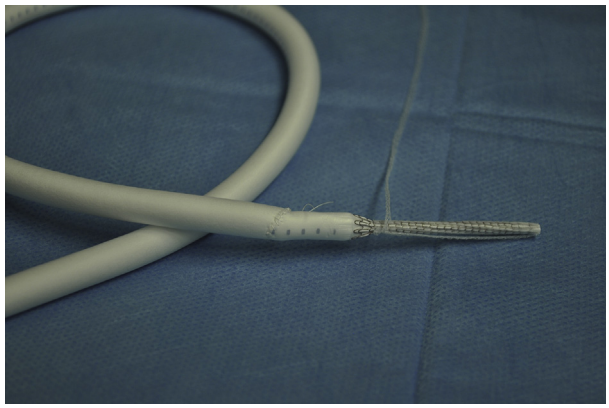

Fig. 2. The composite graft with the nitinol reinforced section.

2.5 mm. The axillary vein at the armpit was chosen as the target vessel for endoluminal sutureless anastomosis. The brachial artery was also patent.

The surgical procedure was performed under regional anesthesia using a supraclavicular brachial plexus block with the patient in a supine position and with the right upper limb abducted with an angle of 90°. Cefazolin was delivered intravenously, 1 hr before surgery. Two small incisions were made on the right arm, allowing exposure of the brachial artery at the elbow level and of the axillary vein at the armpit. Endoluminal sutureless venous anastomosis was performed first with the constrained NRS of the graft advanced into the vein by approximately 3 cm and then deployed. Two Prolene 7/0 stiches were placed at 0° and 180° of the end-to-end anastomosis to secure it. The composite graft was then tunneled subcutaneously in the arm in a straight configuration (Fig. 3) and anastomosed in an end-to-side fashion to the brachial artery using a running suture with Gore-Tex. Vascular clamps were then released, and the patency of the graft was confirmed by the presence of a vigorous thrill on the arterial side. Hemodialysis was started 48 hr after implantation, the graft was cannulated using 17-gauge needle with a low pump