External polytetrafluoroethylene reinforcement of varicose autologous vein grafts in peripheral bypass surgery produces durable bypass function

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ABSTRACT

Objective: Use of autologous veins as peripheral bypass graft may become critical in the presence of significant varicose degeneration of the harvested vein. External support of such dilated veins with standard polytetrafluoroethylene (PTFE) prostheses was recommended as an option to use these veins for peripheral bypass. A single-center experience with this technique regarding long-term graft function, secondary reinterventions, and potential graft degeneration is presented.

Methods: Between January 1995 and January 2006, there were 54 patients with varicose veins who underwent 57 consecutive infrainguinal vein bypass operations with PTFE reinforcement in 57 limbs. Indications for surgery consisted of disabling claudication (5), chronic critical ischemia (40), popliteal aneurysm (11), and acute ischemia (1). Grafts were observed with duplex ultrasound scan supplemented by additional angiography in case of recurrent ischemia, with prospective documentation of follow-up data in a computerized vascular database. Graft patency, limb salvage, and possible degeneration of the vein grafts were retrospectively analyzed.

Results: Mean follow-up was 79 months (range, 1-219 months). The 30-day mortality was 2%. Secondary procedures to maintain or to restore bypass patency were necessary in 12 grafts (21%). Primary, primary assisted, and secondary patency rates were 54%, 73%, and 73% after 5 years for all bypasses, with a limb salvage rate for limbs operated on for chronic critical or acute ischemia of 83%. Significant stenosis of a reinforced vein segment was detected in one case after 56 months, with subsequent replacement of the vein graft with a biologic vascular prosthesis.

Conclusions: Good late graft patency and limb salvage combined with a low rate of late vein graft degeneration justify the use of external PTFE reinforcement of varicose vein segments in infrainguinal bypass surgery. (J Vasc Surg 2018;67:1778-87.)

Great saphenous vein (GSV) is regarded as the graft material of first choice for all infrainguinal bypass operations. Various studies have underlined the superiority of autogenous veins over synthetic prosthetic grafts with respect to long-term bypass patency and limb salvage.[1-5] Unfortunately, the use of autologous vein may become limited by previous harvest, small caliber, postinflammatory wall changes, and varicose degeneration (VD) of various extents.[6] VD may need repair of the dilated vein segments to allow its use in the arterial circulation. In addition, VD theoretically can predispose to aneurysmal graft degeneration of the dilated or thin-walled vein segment if it is exposed to arterial pressure. Besides local repair of the dilated vein segments with vein patch angioplasty, plication of the vein wall, and oversewing or resection of the dilated vein segment with reanastomosis, preservation of the dilated vein segment with external reinforcement with special mesh tissue, flexible metal meshes, or prosthetic material has been described with results similar to those obtainable with normal vein.[7-11] To enable use of veins with limited VD as bypass grafts in infrainguinal arterial reconstructions, external polytetrafluoroethylene (PTFE) wrapping has been reported previously.[8,11,12] This study evaluates the late outcome of a single-center series of varicose infrainguinal vein bypass grafts externally reinforced with segments of PTFE vascular prostheses.

METHODS

Patients. From a total of 1633 infrainguinal vein bypass operations performed between September 1995 and January 2006, all bypass grafts with external PTFE wrapping were identified. Characteristics of the patients, perioperative details, and follow-up data were prospectively documented in a computerized database and evaluated in a retrospective analysis.

VD of the vein was defined as >100% increase in diameter of the dilated segment compared with the residual normal vein or a significant eccentric bulging with clearly visible reduction of wall thickness of the affected vein

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segment. Angioscopic evaluation of the vein was not used. If possible, preoperative vein assessment was performed with duplex ultrasound. In case of an available normal contralateral vein, this was preferred for grafting, and harvesting of the varicose vein was avoided if significant contralateral peripheral arterial disease (PAD) was absent. However, use of a single-segment GSV graft was considered the best option even in the presence of VD. To achieve a complete autogenous vascular reconstruction, it was necessary to use these dilated veins in all cases. Besides ipsilateral or contralateral GSV with VD, normal arm vein segments and small saphenous vein (SSV) were used as spliced vein grafts if necessary. Excision of the dilated vein segments with venovenostomy of the residual normal vein was used only in the presence of extensive additional postphlebitic changes of the vein wall. The dilated thin-walled vein segments were externally reinforced by wrapping with PTFE prosthesis of adequate length and caliber.

Technique. The harvested GSV was assessed for its suitability as a bypass graft by gentle distention with heparinized saline solution. Veins with massive VD involving the complete length of the excised vein and postphlebitic wall induration were not accepted as possible bypass grafts and discarded. A PTFE prosthesis of appropriate diameter was chosen according to the diameter of the distended normal vein graft determined with a caliper. The varicose segments were covered by gently pulling the nondistended vein through the PTFE prosthesis, paying attention to cover the area of VD including an additional section of 5 to 10 mm of the normal-appearing vein. Multiple VD sites were reinforced with multiple PTFE segments (Fig 1). Only veins with longer segments of multiple varicose changes or extensive dilation were reinforced with one long PTFE prosthesis covering the complete diseased segment. Bypass grafts were preferentially placed in a subfascial layer using a tunneling device, leaving the vein distended with saline solution during the tunneling procedure. In general, the nonreversed orientation of the vein graft was preferred, with destruction of the competent valves with a modified Mills valvulotome. If the in situ technique was used, a longitudinally incised piece of prosthesis was placed around the dilated vein under distention and closed with a running suture to achieve a normal vein graft diameter. The PTFE prosthesis was included in the anastomotic suture line only if the anastomosis had to be constructed with a dilated vein segment. Bypass flow was documented by intraoperative transit time flow measurement (CardioMed Medi-Stim, Oslo, Norway). Postoperatively, graft patency was confirmed with duplex ultrasound and angiography. Long-term oral anticoagulation with the vitamin K antagonist phenprocoumon (Marcumar) was the preferred antithrombotic regimen.

ARTICLE HIGHLIGHTS

- **Type of Research:** Retrospective cohort study
- **Take Home Message:** There were 57 infrainguinal bypasses performed with external polytetrafluoroethylene reinforcement of segments of varicose great saphenous vein, with a primary and secondary 5-year patency of 54% and 73%, respectively, and a limb salvage of 83%.
- **Recommendation:** The authors suggest using external polytetrafluoroethylene reinforcement of varicose vein segments in infrainguinal bypass surgery.

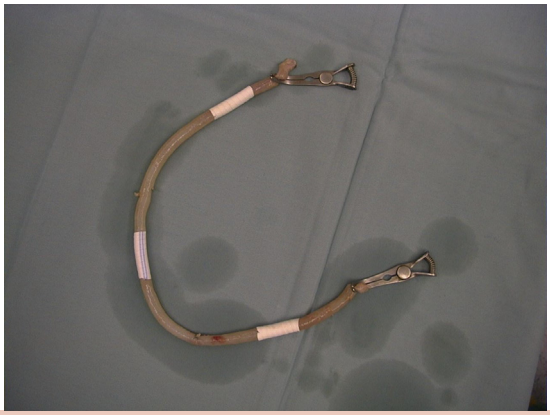

Fig 1. Distended vein after coverage of three varicose segments with polytetrafluoroethylene (PTFE) prosthesis.

Patients were enrolled in a regular follow-up scheme with duplex ultrasound of the bypass graft and clinical examination at 3, 6, 12, 18, and 24 months postoperatively and annually thereafter as long as the patient was able to ambulate independently. Data were completed with additional information from the attending general practitioner in case of deterioration of the patient's health status when she or he became unable to attend the scheduled visits. Analysis of late outcome included a minimum follow-up of 12 months. Grafts were classified as patent according to the suggested standards for reports dealing with lower extremity ischemia.[13] In case of replacement of a patent but significantly degenerated graft with a new bypass, this was regarded as graft failure for statistical analysis. A major adverse limb event (MALE) was defined as amputation or major reintervention, like the placement of new bypass graft; use of thrombectomy or thrombolysis; or major surgical revision of the graft, such as a jump or interposition graft.

All follow-up data were prospectively entered into a computerized database (ACCESS 2000 for Windows; Microsoft, Redmond, Wash) and retrospectively analyzed (SPSS 23.0 for Windows; IBM Corp, Armonk, NY) with