

Patches and Cuffs Improve the Results of Polytetrafluoroethylene Bypasses to Tibial Arteries

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Background

Saphenous vein is the ideal conduit for lower extremity bypass to a tibial artery. As the population ages and efforts at limb salvage become more aggressive, an increasing number of patients require tibial bypass without available vein. Despite the use of duplex ultrasonography, up to 30% of patients undergoing primary bypass lack acceptable veins as do 50% of those undergoing secondary procedures.¹ Alternative conduits for distal bypass to tibial arteries have led to disappointing results.^{2,3} Tibial bypass with expanded polytetrafluoroethylene (ePTFE) results in 1-year patency rates between 20 and 50% with 3-year patency between 12 and 43%.^{2,4,5} A prospective randomized trial showed a reduced patency rate of 34% for ePTFE grafts at 2 years.⁶ In an attempt to improve the results of prosthetic grafts in this challenging patient population, venous tissue has been interposed at the distal anastomosis in the form of patches, cuffs, collars, and boots.⁷⁻¹⁰

Methods and Results

Our distal vein patch (DVP) combines a standard vascular technique (the Linton patch) with a PTFE bypass.¹⁰ Our initial experience with the DVP involved 80 bypasses in 79 patients without vein available for tibial bypass including 53% with diabetes mellitus and 17% with renal failure.¹¹ Since that report, our total experience has grown to 249 DVP bypass grafts representing 27% of the total tibial experience (841 cases) at our institution from 1994 to 2004. The indication for revascularization was limb-threatening ischemia in all patients with rest pain in 49% and gangrene or nonhealing ulceration present in 51%. Reasons for the lack of adequate saphenous vein included failed lower extremity bypass in 59%, previous coronary bypass in 26%, unsuitable vein quality in 10%, and absence of vein owing to varicose vein stripping in 5%. Grafts originated from the external iliac artery in 43%, to avoid hostile groins, the SFA in 8% and the remainder originating at the common femoral artery. Recipient arteries included the peroneal artery (44%), the PT (35%), and the AT (21%). Some of the PT bypasses were to inframalleolar plantar branches, and some were to the DP. Primary graft patency was 90% at 6 months, and 82%, 78%, 69%, and 62% at respective 12-month intervals to 48 months. Twenty-six grafts remain patent beyond 48 months.

Discussion

The interposition of venous tissue between PTFE and a recipient tibial artery may improve graft results in several ways. The bypasses are technically demanding requiring an anastomosis between a small, diseased tibial artery and a fairly noncompliant prosthetic material. The interposed venous tissue does make the bypass less technically demanding. The venous tissue effects thrombogenicity at the interface between the high resistance outflow artery and the large prosthetic graft.¹²

There is also evidence that the venous tissue reduces myointimal hyperplasia and improves graft patency. Several theoretic explanations are proposed for this decreased hyperplastic response.¹³ There appears to be a beneficial alteration of hemodynamic factors such as compliance and shear stress.^{14,15} Mechanical considerations such as anastomotic surface area and the angle of the cuffed anastomosis are also altered contributing to improved graft function and patency.¹⁶ We favor the concept of a biologic "buffer zone" created by the endothelium of the venous segment resulting in decreased hyperplasia and thrombosis.¹⁷

Conclusion

Acceptable long-term patency and limb salvage can be achieved using the DVP technique with PTFE grafts in those patients with limb-threatening ischemia and no autogenous conduit. The results suggest improved patency as compared to PTFE alone which is a concept theoretically supported by published research. However, this issue would best be answered by a prospective randomized trial of prosthetic bypasses in patients with unavailable vein requiring tibial bypass. Currently, in our practice the DVP technique is preferred to PTFE bypass or primary amputation.

References

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