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## SHORT REPORT

# Experience with Pre-tibial Routing in Femoro-tibial In situ Vein Bypass

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### Introduction

Femorodistal bypass is now accepted as a durable procedure in patients with critical ischaemia. This has been made possible within the last three decades with the concomitant refinement in surgical techniques and the increased life expectancy of patients with peripheral vascular disease. This report describes our experience of using autologous in situ vein bypass onto the anterior tibial artery in an unselected group of patients over a 15-year period using the pre-tibial route for the vein.

### Material and Methods

A retrospective search was performed of all patients who had a femorotibial bypass over a 15-year period. A total of 50 bypasses to the anterior tibial artery were identified, 25 of which were performed with in situ long saphenous vein bypass using the pre-tibial route. There were 14 females and 11 males with a mean age of 76 years (range 60–87).

All patients had critical limb ischaemia as defined by the European Working Group on Critical Leg Ischaemia.<sup>1</sup> The unit had no routine surveillance program but all patients were followed up at regular intervals for the first 18 months and thereafter on a yearly basis. During each visit, the graft was palpated over its pre-tibial route, while a hand held Doppler with an 8 MHz probe was used to confirm flow in the graft. Morbidity and mortality within 30 days were

recorded. Mean follow-up was 23 months (1–93 months). Cumulative graft patency and limb salvage were analysed using Life Table analysis.

### Operative Technique

After exposure of the long saphenous vein over a sufficient length to reach the recipient artery, a Hall's valvulotome was used to destroy the valves in the earlier series. A recent change to this is the introduction of a LeMaitre valvulotome to replace the more traditional Hall's device. The anterior tibial artery is then exposed in the anterior compartment and prepared for anastomosis. After systemic heparinisation, the proximal anastomosis was at the common femoral artery in all our cases. The distal portion of the long saphenous vein is mobilised below the knee to the required length. A tunnel is then created in the subcutaneous tissue across the front of the tibia at an angle of 45° from the medial to the anterior compartment. A Spencer Wells artery forceps is used for dissection in the subcutaneous tissue. The vein is routed gently through the tunnel and orientation facilitated by allowing pulsatile blood flow down into the vein prior to the distal anastomosis. In five patients the distal anastomosis was at the level of the

**Table 1. Secondary procedures.**

Site of revision	Procedure	No.
Proximal stenosis	Vein patch angioplasty	2
Distal stenosis	Distal anastomosis revision	3
External iliac	Angioplasty	1

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Table 2. Cumulative primary patency Life Table.

Interval (months)	No. at risk at start of interval	No. failed during interval	Withdrawals during interval	No. at risk in interval	Interval failure rate	Cumulative patency (%)
0–1	25	2	3	23.5	0.085	91
1–3	20	1	1	19.5	0.051	87
3–6	18	0	3	16.5	0.000	87
6–12	15	0	1	14.5	0.000	87
12–18	14	0	0	14	0.000	87
18–24	14	1	2	13	0.077	80
24–30	11	0	1	10.5	0.000	80
30–36	10	0	0	10	0.000	80

ankle, and in the remaining patients at the level of the middle portion of the artery in the anterior compartment. Completion angiography was not routinely done, but the graft was palpated over its subcutaneous route to confirm patency. A Doppler signal was obtained from the dorsalis pedis artery at the ankle on completion in all cases.

### Results

Five grafts occluded during the period of study, three within three months of surgery. All patients with occluded grafts went on to have an amputation. All amputations were at the below-knee level except for one patient who required conversion to an above knee amputation. Three patients were lost to follow-up and eight patients died during the study; all of these had a patent graft up until the time of death. The cumulative patency was 87% at 12 months and 80% at 3 years. At the end of the study, six patients had undergone secondary procedures (Table 1). There were no local complications related to the subcutaneous position of the graft in this study.

### Discussion

Improved medical and surgical treatment of coronary heart disease has increased life expectancy in patients with peripheral vascular disease. Many studies have shown that vascular reconstruction leads to less morbidity and mortality than primary amputation in patients with distal vascular occlusion.<sup>2</sup> In some patients with critical ischaemia the anterior tibial artery is the only patent artery in the distal leg available for bypass. Many ways of routing the long saphenous vein grafts from the medial to the anterior compartment have been described, the most common of which is through the interosseous membrane.<sup>3</sup> This involves blunt and blind dissection that may predispose an already vulnerable limb to further traumatic insult. Grafts tunnelled in this way may also be

compromised by extrinsic compression from oedema, haematoma or may be kinked by the rigid interosseous membrane. Routing of the grafts through the tibia itself or via a gutter has been described and offers a protected route.<sup>3,4</sup> The potential for compression by callus formation is a matter of concern (Table 2).

We have opted for the less traumatic and simple approach of routing our in situ vein bypass graft onto the anterior tibial artery bypass via a subcutaneous pre-tibial course. To prevent kinking of the graft, the tunnel is created at a 45° angle. The whole procedure involves less tissue dissection and palpation of the pulsating graft over its subcutaneous surface can be reassuring. In theory, routing of a graft in this position could cause potential problems, namely the vulnerable position of the artery to trauma and compression. We have not encountered any such problems in our experience. The long saphenous vein can be routed to any part of the ATA using this technique. The cumulative patency rate of 80% at 3 years in this study compares favourably with other reports of distal in situ bypass for critical ischaemia.<sup>2,5</sup>

We recommend this technique of routing the long saphenous vein onto the ATA during in situ vein graft bypass which in our experience has been associated with minimal problems.

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