

# Implementation of a graft surveillance programme for infrainguinal vascular bypass surgery

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## Abstract

**Aim:** Patients undergoing bypass graft placement in the lower limb are often entered into a graft surveillance programme using duplex scanning. The aim of this programme is to identify stenoses in vein grafts before they become symptomatic and treat these by angioplasty or surgery, thus prolonging the patency of the graft. This paper aims at reporting on the progress and viability of this programme at Mater Dei Hospital, Malta.

**Method:** Infrainguinal bypass grafts carried out between July 2007 and May 2009 were enrolled. Scanning starts during the patient's in-hospital stay at one week post-operation. It is then scheduled at 6 weeks, 3 months, 6 months, 12 months, 18 months, 24 months, and yearly afterwards. When a significant stenosis is encountered, the patient is referred for angioplasty. Surgery would be considered in cases when angioplasty is not an option.

**Results:** During this period 56 patients were recruited. At one week post-op the patency rate was 100%. At 6 months the primary unassisted patency was 77.5% while the primary assisted patency was 87.5%. At 12 months the primary unassisted patency was 50% while the primary assisted patency was 77%. Secondary patency rates at 6 and 12 months were 95% and 82% respectively.

**Conclusion:** The graft surveillance programme ensures that any problem detected in the post-operative period is dealt with as soon as possible. The study shows that this programme is being effective in that assisted rates (i.e. after angioplasty or surgery) are better than unassisted rates.

## Keywords

peripheral vascular disease, ischaemia, angioplasty, duplex Doppler ultrasonography

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## Introduction

For patients with severe peripheral vascular disease, especially those with long occlusions of the superficial femoral and popliteal arteries, infrainguinal vascular bypass surgery may be the only option for revascularization of the limb.<sup>1-4</sup> There are three main types of infrainguinal bypass surgery – femoro to above knee popliteal bypass, femoro to below knee popliteal bypass and femoro to distal bypass. The latter can be femoro to anterior tibial, femoro to posterior tibial or femoro to peroneal bypass. Once patients have been scheduled for a bypass procedure they are assessed medically to check whether they are fit for the operation and they are scanned by the vascular surgeon in charge to look for any suitable vein graft which can be used as a new conduit. Vein grafts are preferred over PTFE grafts as they have longer patency than the latter. Patients who undergo such operations are not simply discharged once they have recovered from their operation, but are followed up on a regular basis to check the progress of their graft and therefore of their clinical condition.

This is in accordance with the recommendations of The Trans-Atlantic Inter-Society Consensus on the Management of Peripheral Arterial Disease (TASC), which states that patients “who undergo bypass graft placement in the lower extremity for the treatment of claudication or limb-threatening ischaemia should be entered into a clinical surveillance program.”<sup>1</sup> This consists of asking the patients how they are doing in regards to their previous symptoms and whether any new symptoms have developed since the operation. Vascular examination of the lower limb should take place as well with palpation of inflow, graft and outflow vessel pulses. Resting and post-exercise Ankle brachial pressure indices (ABPI) should be measured as well.

Although strictly not a TASC recommendation, as ongoing trials are still needed to determine its efficacy, many surgeons also enter their patients into a graft surveillance programme whereby the graft is scanned by duplex ultrasound at regular intervals. The aim of this scanning is to check that the graft is working and to detect and treat any stenosis in the graft. This article reports on the setting up of such a graft surveillance programme in Malta.

## Methods

Once a patient undergoes a vascular bypass operation he or she spends a day in an ITU/HDU setting and is then transferred to a normal surgical ward. The patient is seen daily to monitor his or her progress and at one week post-op the first graft scanning takes place. The scanning needs to answer two main questions:

- Is the graft working?
- Is there any stenosis?

Duplex ultrasound Doppler is used to answer these questions, by means of waveform analysis and peak systolic velocities measurement. Colour Doppler is used to detect blood flow (Figures 1 and 2).<sup>5-6</sup>

In terms of waveform analysis, triphasic waveforms represent better blood flow than biphasic which are in turn better than monophasic waveforms.

Blood flow is assessed in the artery proximal to the graft, the graft itself and the outflow artery. An increase in Peak Systolic Velocity of more than 3 times along the vessel is considered significant and is suggestive of a stenosis (Figure 3).<sup>5-6</sup> Peak systolic velocities of less than 20cm/sec indicate that the flow through that segment of graft is poor and may require intervention.<sup>7</sup>

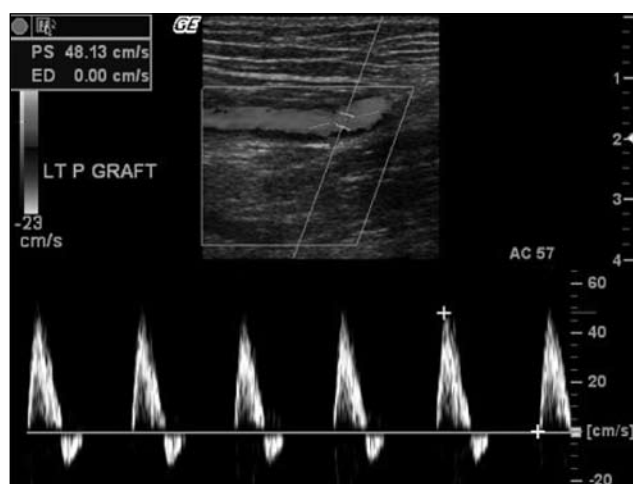
Stenosis may occur at any site along the graft including the proximal and distal anastomosis.

If during this process any stenosis is identified the patient can then be sent for angioplasty of the stenosis. This ideally should happen before such a stenosis becomes clinically significant. Sometimes graft scanning will reveal long occlusions which are not amenable to angioplasties. In such cases, if possible, the patient will be offered redo bypass surgery.

Scanning takes place at one week post-op, then continues at 6 weeks, 3 months, 6 months, 12 months, 18 months, 24 months and yearly afterwards. Only patients who underwent bypasses using vein grafts are scanned. PTFE grafts are not routinely scanned as they cannot be angioplastied should the need arise.

This report covers graft scanning done for those infrainguinal bypasses carried out between August 2007 and May 2009 at St Luke's Hospital and Mater Dei Hospital by the firm of one of the authors (KC).

Records for primary unassisted patency, primary assisted patency, and secondary patency were kept. Primary unassisted patency refers to patency of the graft without any intervention. Primary assisted patency refers to patency of the graft with the help of angioplasties when stenosis occurs, whilst secondary patency refers to those cases where the graft is occluded and needs surgical intervention (redo bypass) to revascularise the limb.



**Figure 1:** Good blood flow on Colour Doppler of a Saphenous Vein graft and biphasic waves on duplex ultrasound

## Results

Our study period was over 22 months (from August 2007 to May 2009). During this period sixty infrainguinal vascular bypasses were done. These patients entered the study at different times; therefore not all of them had the same number of scans post-op. Those patients who were operated near the end of the study period, had only a few number of scans.

Post-operatively at 1 week all the grafts were patent. Out of the 60 patients, 56 made it to the first scan at one week post op and these were all patent.

At 6 weeks, 49 patients were scanned and 46 grafts were patent (94%). One of the other patients had successful redo vascular bypass surgery bringing the secondary patency rate to 96%.

At 3 months, 44 patients had their grafts scanned and 40 patients had patent grafts (90%). Another patient needed redo surgery and this brings the secondary patency rate up to 95%.

At 6 months 31 out of the 40 patients scanned had their grafts patent (77.5%). Four other patients had successful angioplasty bringing the primary assisted patency to 87.5%. Secondary patency was 95% (38 out of 40 patients).

At 12 months 22 patients were scanned. At this point primary unassisted patency was 50%, i.e. only 11 patients had their graft patent. Primary assisted patency was much better at 77%, with another 6 patients having angioplasties. Secondary patency was slightly better at 82% (18 patients out of 22).

At 18 months only nine patients were scanned. Four of these grafts were patent – 44% primary unassisted patency, while another patient had an angioplasty, thus putting the primary assisted patency at 56%. Another patient had redo-surgery with the secondary patency rate thus being 67%.

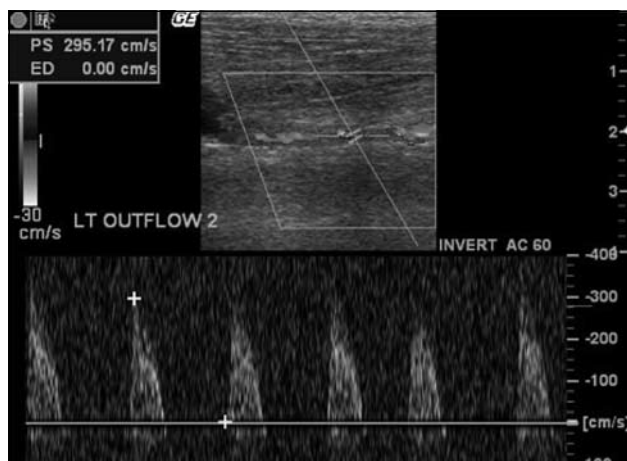
The above information is shown in Table 1 and in the Kaplan-Meier curves (Figure 4) for the various patencies described above. The primary end-point is sonographically detected graft stenosis.

## Discussion

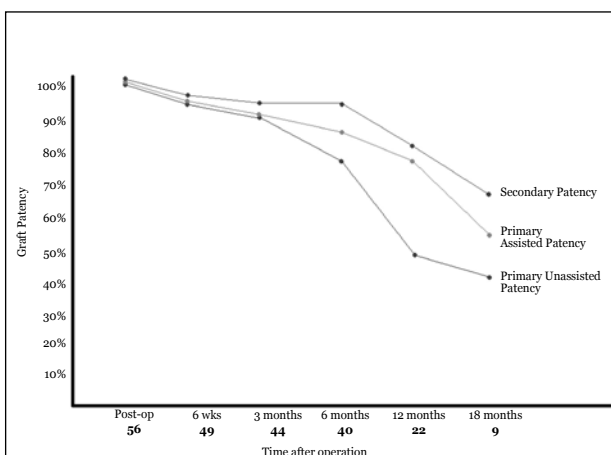
As we can see from the figures in the table below, primary assisted patency and secondary patency were significantly better



**Figure 2:** Distal anastomosis of an in-situ bypass graft. The size of the graft (arrow) matches the diameter of the tibial artery (arrowhead)



**Figure 3:** Peak systolic velocities are elevated (295 cm/sec) at the point of abnormal color Doppler signals. This indicates a focal stenosis of 50 to 75% in the native artery distal to the graft.



**Figure 4:** Kaplan-Meier Curves for primary unassisted, primary assisted, and secondary patency rates. Figures below “time after operation” denote the number of patients at that stage

**Table 1:** Primary unassisted patency, primary assisted patency and secondary patency for infrainguinal bypass grafts at different post-operative duplex scanning

Time post-op	Number of patients	Primary Unassisted Patency	Primary Assisted Patency	Secondary Patency
One week	56	56 (100%)		
6 weeks	49	46 (94%)	46 (94%)	47 (96%)
3 months	44	40 (91%)	40 (91%)	42 (95%)
6 months	40	31 (77.5%)	35 (87.5%)	38 (95%)
12 months	22	11 (50%)	17 (77%)	18 (82%)
18 months	9	4 (44%)	5 (56%)	6 (67%)

than primary unassisted patency from the sixth month onwards. This indicates that the graft surveillance programme, which aims at treating significant stenoses or occlusions as soon as possible by sending them to angioplasty or surgery if necessary, is being efficient at detecting those patients who need further treatment. Were it not for the surveillance programme these patient might present at a later stage where treatment would be more complex, if at all possible. This is in keeping with several other studies which also mentioned the importance of graft surveillance by duplex ultrasound.<sup>8-10</sup>

## Conclusion

This study shows that a graft surveillance programme makes a lot of sense in the setting of infrainguinal bypass surgery and we look forward to official recommendations by TASC on this matter.

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