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Research Article

# Can a Fast Track Referral System Improve the Effectiveness of a Graft Surveillance Programme?

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## ABSTRACT

**Purpose:** To assess the effectiveness of a fast track referral system from Vascular Laboratory to Interventional Radiology on threatened vein bypass grafts in the lower limbs.

**Methods:** A Fast Track System (FTS) was set up in February 2011 to minimise the delay from duplex scan to intervention for bypass grafts with identified significant stenoses. 111 scans were performed pre - FTS over one year and compared with 190 scans which were performed post-FTS introduction over two years.

**Results:** Significant stenoses were identified in 24 scans (22%) before FTS, of which, 6 (25%) had no intervention, 15 (62.5%) had interventions and 3 (12.5%) were occluded by the time of intervention. The median delays from duplex to referral to radiology and from duplex to intervention were 32 and 56 days respectively. After the introduction of FTS, 35 scans were noted to have significant stenoses. Only 23 (66%) of them had interventions. The median delays from duplex scan to referral to radiology and from duplex to intervention were 0 and 20 days respectively. There was one graft (3%) occlusion after the introduction of FTS by the time of the angiogram compared with 3 (12.5%) in the pre-FTS group ($p$ = 0.35).

**Conclusions:** Approximately 20% of the scans performed over one year for infra-inguinal bypass are at risk of failure. The FTS has reduced the time - delay from Duplex scan to referral to radiology and the number of occluded grafts. Further improvement is needed to reduce the delay between the referral and intervention.


**Keywords:** Vein graft; Infra - inguinal bypass; Surveillance scan

## INTRODUCTION

The vein graft is considered to be the conduit of choice for infra-inguinal bypass surgery [1]. The graft failure rate maybe as high as 30% at 1 year [2]. The failure rate is higher for distal bypasses and patients with chronic critical limb ischemia due to the increased atherosclerotic burden [1]. Graft failure can be divided into early, mid and late. Early failure, up to 30 days, is caused predominantly by technical factors including patient selection [3]. Midterm failure, between 1 to 24 months, is mainly related to Neo-Intimal Hyperplasia (NIH) [4]. Late failure, at more than 24 months, is mostly due to the progression of atherosclerotic disease in the native arteries [1,5]. Midterm patency rates can be improved by early identification of at risk grafts by a surveillance programme and timely intervention [6].

Duplex ultrasound scanning is currently the method of choice for detecting anastomotic and graft stenosis that may threaten graft patency [7]. Although some small trials have shown benefit from a surveillance programme [6,8], a larger multi-center randomized controlled trial data and literature review have shown no overall benefit [9,10]. The role of delay from the diagnosis of a failing graft to intervention has not been taken into account in the studies, but it is clearly desirable to minimise this. The aim of this study was to assess whether the introduction of FTS on surveillance programme has an impact on graft salvage on patients after a small number of grafts with significant stenoses at scanning were found to have occluded at angiography.

## METHODS

All duplex scans carried out between March 2010 and February 2013 were included in this study. Patients who had infra-inguinal bypass using vein routinely underwent duplex surveillance by an accredited vascular technologist in the Vascular Laboratory at 3, 6, 9, 12 and 18 months. This surveillance programme was restarted again if an intervention was performed (angioplasty or revision of a failing graft). A graft at risk of failure, was defined as having an Ankle Brachial Pressure Index (ABPI) fall more than 0.15 [11], a peak systolic velocity (PSV) greater than 300 cm/s, a slow peak systolic flow velocity of less than 45 cm/s [12] or peak systolic Velocity Ratio (VR) more than 2.5 [13]. The presence of inflow, outflow disease, graft dilatation or arteriovenous fistula was noted. After comparison with the previously recorded scan results, at risk grafts were referred urgently by the vascular sonographer to vascular surgery and interventional radiology.

Previously, there was a time-delay between detecting a failing graft and an intervention to correct the underlying cause. A Fast Track System (FTS) for referring patients from vascular laboratory to radiology directly was introduced in February 2011. Instead of waiting until the scan is seen by the treating surgeon, patients with grafts at risk were referred on the same day to interventional radiology by the vascular laboratory. The request was processed on the same day and a date and time were given for the planned intervention with conventional angiography in view for angioplasty.

Data on all scans between the periods March 2010 to Feb 2013 were collected prospectively and entered onto a database. This includes the number of scans, the number of at risk grafts, the number of interventions, the number of occluded grafts and the time-delay between scans, referrals and interventions. Data were categorised into two groups, pre and post - FTS. The main outcomes were the time-delay and the graft occlusion rate by the time of the angiogram.

## DATA ANALYSIS

The database was created using SPSS software, version 15.0. Median days between the two groups were compared using Mann - Whitney U test. The numbers of occluded and non-occluded grafts between the groups were compared using Yates continuity corrected Chi-squared test. A $P$-value less than 0.05 were considered to be significant. Kaplan-Meier analysis was used to show the one-year patency rate curve of both groups with censoring the occluded grafts on the duplex scan.

## RESULTS

One hundred and eleven duplex scans on 65 patients which were carried out between March 2010 and February 2011 (pre - FTS) were compared to 190 scans on 112 patients from the period between March 2011 and February 2013 (post - FTS). These grafts were either to below or above the knee popliteal arteries. No spliced graft was used in both groups. Grafts at risk were identified in 22% and 18% of duplex scans before and after FTS respectively. There was an improvement in the median delay from duplex scan to referral

to radiology and from duplex to intervention which was statistically significant (Table 1).

Graft occlusion rate between surveillance and attempted intervention was 12.5% of at-risk grafts in the pre-FTS group compared with 3% in the post - FTS group, *P*-value = 0.35 (Table 2; Figure 1). Two of the four patients who had occluded graft on the scan have lost their limbs after one year.

The intervention rates were 62.5% in the pre-FTS group and 66% in the post - FTS group. There were no reported complications after the angioplasty procedures. The remaining group with no intervention were monitored closely at three monthly intervals. Two scanned grafts in the pre - FTS which were under close observation have been treated after a follow up scan the year after. Another two grafts had angioplasty two and three years later. One graft was scanned twice in the pre - FTS group and findings were stable. One case in the post-FTS group which thought to have significant findings on the scan was found to have a normal arteriogram and no intervention was needed. Four scans were performed on the same patient in the post - FTS group who was deemed to have significant duplex findings and there was no change in the results and graft continued to be patent proving stable lesion. Another scan result was referred to radiology and a date was set for angioplasty but the patient didn't attend and had died three months later. In terms of limb loss; one patient lost his limb in the no intervention pre - FTS subgroup, while no limb loss was noted in the no intervention post-FTS subgroup.

## DISCUSSION

The fast track system of referring patients with grafts at risk directly to Radiology has shown a trend of decreasing the number of grafts found to be occluded by the time of angiogram in this study. The main aim of a graft surveillance programme is to prevent graft occlusion and thus prevent limb loss. It is known that intervention on a diseased but patent graft has a better patency rate compared with occluded grafts [14]. Reducing the period between the scan and the intervention by a fast track system can improve the value of graft surveillance.

There was a delay between the duplex scan and decision to list the patient in the pre - FTS group (median 32 days). This was due to the previous practice of scanning the grafts and sending the report to surgeons or waiting until the patients are reviewed in the clinic.

**Table 1:** Median number of days from scan to referral and to intervention.

| Median number of days | From duplex to referral | From duplex to intervention |
|---|---|---|
| **Pre - FTS** | 32 | 56 |
| **Post - FTS** | 0 | 20 |
| ***P*-value*** | < 0.001 | 0.002 |

*Yates continuity corrected Chi-squared test.

**Table 2:** The number of the failing grafts and the outcome.

| Number of failing grafts | Pre - FTS (%) n = 24/111 | Post - FTS (%) n = 35/190 | *P*-value* |
|---|---|---|---|
| **No intervention** | 6 (25) | 11 (31) | |
| **Intervention** | 15 (62.5) | 23 (66) | |
| **Occluded** | 3 (12.5) | 1 (3) | 0.35 |

*Mann-Whitney U tests. Values are given as n (%) of failing grafts

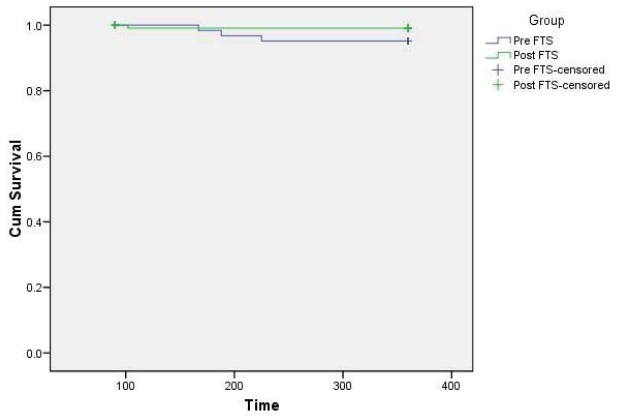


**Figure 1:** Kaplan-Meier curve showing the one year patency rate in both groups (pre and post-FTS).

Despite the improvement in the time-delay from scan to referral after introducing the FTS, there is still a room for an improvement from referral to the intervention. A delay can be due to the availability of elective day case beds. Reduction in this delay would require the use of emergency facilities or an increase in day case capacity. Afurther factor may be the limited capacity in the interventional radiology department. This could be addressed by role extension. Vascular surgeons and other allied professionals can be trained to carry out interventions and capacity can be further increased by making use of the increasing number of hybrid theatres. Priority should be given to at risk grafts when planning lists [15].

The decision to intervene or to observe a stenosis depends on the previous angiogram, surgical findings and whether the stenosis will progress, stabilise or regress over the follow-up period. A study by Mattos, et al. [16], concluded that a high number of stenotic grafts stay patent whether treated or not . Various studies have aimed to identify criteria which can be used to predict the risk of failure according to early manifestation of flow disturbance. Grafts can be categorised into high, medium or low risk for failure based on predefined duplex criteria. The high-risk category was defined as critical stenosis with PSV > 300 cm/s or Vr > 4. This group merits intervention with arteriography and angioplasty while medium and low-risk categories can be closely observed [17]. Selective surveillance can be adopted in grafts performed distal to the knee or when using poor quality veins. This would minimise the work load but still can miss critical stenosis in other grafts. In the current study, there were 25% and 31% of the risk of failure scans that did not undergo intervention in the pre and post-FTS groups respectively. Only two of the observed grafts progressed on subsequent follow-up scans suggesting the criteria used in the current study was effective in identifying high-risk grafts. However, predicting the progression of a lesion detected on the early duplex scan has proved to be difficult [8]. In some patients, conservative management was recommended based on the surgical findings or a recent angioplasty. These have shown small graft caliber, anatomical bands or disease in distal native arteries which can give findings of failing graft on the scan. In other cases, the decision whether to intervene or to observe was made on the basis of the radiologist's interpretation of the previous angiogram and intervention or documented letters from the surgeon and the Multidisciplinary Team (MDT) discussion. However, FTS was introduced not to bypass the MDT but to reduce the delay waiting for the decision which will be mostly supporting an intervention.

There was no information from the published RCT about the time gap from detecting a failing graft to the time of intervention. This could have a major impact on the results of limb salvage which was shown to be the same in the clinical and duplex surveillance arms [9]. The current study provides some insight into how a graft surveillance programme can be effective when reducing the time-delay from the scan to intervention. It is retrospective study analysing prospectively collected data. It has a small number of graft occlusions but it is encouraging that the number of occluded grafts appears to have decreased following the introduction of the fast-track protocol. Although no significant difference could be shown, this would be due to the small numbers of the scans included. RCT with more details about the time frame is needed to draw a conclusion on the efficacy of a surveillane programme.

## CONCLUSION

The current surveillance programme has identified approximately 20% of infra-inguinal bypass vein grafts to be at risk of failure. FTS has reduced the total time-delay for intervention thus contributed to graft salvage. Improvement is needed to decrease the waiting before the intervention. The benefit of FTS on long-term limb salvage is unknown. If a surveillance programme is to be successful, it is essential to be linked to a prompt re-intervention service.

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