Thrombolysis in Arterial Graft Thrombosis


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Objective: to assess the impact of peripheral arterial thrombolysis for vascular graft occlusion.
Design: Retrospective review.
Setting: University Hospital.
Materials: Thirty-one patients presented with 33 episodes of graft thrombosis.
Chief outcome measures: Successful thrombolysis in terms of total clearance or sufficient clearance to reveal an underlying factor responsible for graft failure.
Main results: Thrombolysis was successful in seven of 10 suprainguinal grafts (4 of 5 rtPA; 3 of 5 SK). One patient had failed lysis requiring an ilio-femoral graft. Of the seven patients with successful lysis, one required revision of a proximal anastomosis, two required distal anastomotic revisions, and one rethrombosed. Twenty-three thrombosed infrainguinal grafts were managed initially with intraarterial thrombolysis (9rtPA, 14 SK). Of 27 patients surviving at 30 days, seven required major amputation despite aggressive intervention.
Conclusions: Thrombosed suprainguinal grafts are amenable to thrombolysis and adjunctive surgery when necessary, with no major haemorrhagic complications. The majority of patients with thrombosed infrainguinal grafts require surgical intervention in order to preserve, or establish long term patency. For polytetrafluoroethylene (PTFE) grafts, thrombolysis was associated with poor success, haemorrhagic complications and a high amputation rate.

Key Words: Arterial graft thrombosis; Thrombolysis; Arterial graft revision.

Introduction

Whilst peripheral arterial thrombolysis has become established as both a diagnostic and therapeutic tool in the management of arterial disease, its role in graft thrombolysis is less clear cut. Lysis within a Dacron graft has the potential hazard of haemorrhage through the graft wall. Similarly, early experience with thrombolysis of thrombosed polytetrafluoroethylene (PTFE) grafts often served only to reveal progression of distal disease, with no further benefit to the patient and was associated with early re-thrombosis on withdrawal of the intraarterial catheter. Unless lysis could be established within 24 hours of occlusion of a vein graft, it was felt that the resultant endothelial cell damage would ensure that whatever patency was achieved would only be short-lived. We therefore reviewed all patients treated with peripheral arterial thrombolysis for graft occlusion in this institution over a 6-year period from October 1987 to September 1993.

Methods

All patients presenting with graft thromboses to the Regional Vascular Unit over the period of October 1987 to September 1993 were considered for intraarterial thrombolysis. Patients with an established motor or sensory deficit were considered unsuitable for lysis and were offered reconstructive surgery whenever possible. Thirty-one patients with 33 episodes of graft thrombosis were treated. The median duration of history of occlusion was 2 days (range 1–21). Most patients presented with rest pain and critical ischaemia, but five patients presented with severe claudication. Suprainguinal grafts were lysed either directly into the graft or via a brachial artery approach. A contralateral femoral artery approach was the standard administration site for infrainguinal grafts. During the early part of the audit period, streptokinase (SK; Kabikinase, KabiVitrum, Uxbridge) was administered at 5,000 IU/h intraarterially in conjunction with heparin 250 IU/h intraarterially. Most recently the standard lytic agent was changed to recombinant tissue plasminogen activator (rt-PA; Alteplase, Boehringer Ingelheim, Bracknell) at a dose of 0.5
to 1 mg/h intraarterially, again in combination with 250 IU/h of intraarterial heparin. All patients were nursed in the Vascular High Dependency Unit with repeat arteriograms performed within the vascular radiological suite. Lysis was deemed successful if either total clearance of the occlusion was achieved, or sufficient clearance to reveal an underlying aetiological factor responsible for graft failure.

Results

Suprainguinal grafts (Fig. 1)

Ten patients (4 male, 6 female) with a mean age of 59 ± 16 years presented with suprainguinal graft thromboses (Table 1). Suprainguinal grafts (Dacron) had been implanted a median of 3 years previously (range 3 months to 22 years), one patient suffered severe claudication, the remaining nine patients presenting with rest pain. The median duration of history was 3 days with a range of 1–7 days. Six patients had had an aortobifemoral graft, three an iliofemoral graft and one patient an iliopopliteal graft. Thrombolysis was initially successful in nine (90%) of suprainguinal grafts; however, two patients underwent rethrombosis, one of whom required a below-knee amputation. No further reconstruction was attempted in the second patient as he had very poor left ventricular function and the presence of an ischaemic but viable limb.

Table 1. 30-day outcome following graft thrombolysis

<table>
<thead>
<tr>
<th>30 Day Outcome</th>
<th>Suprainguinal Dacron</th>
<th>Intrainguinal Vein</th>
<th>PTFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success lysis alone</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Success lysis + surgery</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Failure of lysis, successful reconstruction</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Amputation</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Died</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Infrainguinal grafts (Figs. 2, 3)

Infrainguinal grafts (8 vein, 15 PTFE) were performed a median of 1 year previously (8 days–11 years). The mean age of the patients was 58 ± 11 years. Four patients had claudication whereas the majority experienced rest pain on occlusion of the graft. The median duration of history was 3 days with a range of 1–21 days. Twenty-three thrombosed infrainguinal grafts were managed initially with intraarterial thrombolysis with rtPA (9) or streptokinase (14).

Supra-inguinal grafts

Infra-inguinal grafts

Infra-inguinal grafts

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Lysis was initially successful in seven of eight vein grafts, three of which required distal anastomotic revision (one vein patch angioplasty, two jump grafts), one of whom developed renal failure and died. Two re-thromboses occurred, one was re-cannalised with a further course of lytic therapy, the second requiring a femorodistal reconstruction which subsequently failed, resulting in a below knee amputation. One patient had no discernible lysis achieved.

Of 15 prosthetic grafts, seven failed lysis, one of whom required an above-knee amputation, six were reconstructed but two patients still required above-knee amputations, one of whom died. Seven patients underwent successful lysis of their grafts, four of which required distal jump grafts, and one required a repeat femoropopliteal graft. Three patients re-thrombosed, two requiring below-knee amputation (one died) and one subsequently underwent reconstruction.

**Major complications**

Despite aggressive intervention, seven patients in total required major amputation [one suprainguinal (13%), six (26%) infrainguinal grafts]. Haemorrhagic complications were few, with four major haemorrhages — all in patients with infrainguinal grafts. Four patients died within 30 days, all had prosthetic graft thromboses. Two died from myocardial infarctions, and two patients died after developing renal failure, acidosis and cardiac failure.

**Discussion**

Whilst intervention for a "failing" graft is associated with a high success rate in terms of graft patency and limb salvage, the management of a thrombosed graft presents a greater challenge with an associated higher morbidity and mortality. Initial reports of percutaneous thrombolysis and secondary reconstruction, showed promising short-term results, although long-term patency was less encouraging. Some therefore question the value of graft lysis and consider that it could be amenable to percutaneous low dose infusion. Nevertheless the potential benefits should always be 

Using high dose urokinase infusions, Arnold et al. achieved complete thrombolysis in 27 of 41 (61%) graft occlusions; of these 20 (74%) subsequently required surgical reconstruction. They found that 1 year patency following complete thrombolysis and appropriate reconstruction (54%) was better than that for complete thrombolysis alone (34%), or incomplete lysis necessitating reconstruction (38%); a similar trend was found at 1 year.

Similarly, in a retrospective comparison between surgery and thrombolysis followed by surgery, improved 30-day patency was observed in the combined therapy group. Patients with rtPA had an 86% 30-day graft patency compared to 42% of the surgically treated grafts ($p = 0.001$). Both groups required secondary revisional surgery in 90% of cases.

Thrombolysis for occluded Dacron grafts, especially retroperitoneal grafts, has the added theoretical risk of uncontrollable haemorrhage through the interstices of the graft. Experience is therefore limited. Whether this risk is altered by the type of Dacron graft, for example knitted > woven > sealed is unknown, and the influence of the maturity of the graft can only be surmised. Our own experience of ten patients, although small, has shown very encouraging results with no major haemorrhagic complications incurred.

Encouraging results for the use of thrombolysis in occluded vein grafts have also been reported by Patterson et al. Lysis was successful in 28 patients within 24 hours allowing appropriate surgical intervention to 18 underlying stenoses and seven patients with progression of distal disease. Overall secondary revascularisation was achieved in 58% of patients. These results are similar to our own experience in vein graft thromboses. Only two of eight patients (25%) were successfully lysed with no further adjuvant treatment necessary. Whilst graft thrombosis was attempted up to 21 days post-occlusion, the median duration of history of three days was considerably shorter than in the Birmingham series.

Prosthetic grafts proved more recalcitrant. Only one patient underwent successful lysis with no adjuvant treatment. Initial lysis failed in seven (47%), despite subsequent surgical reconstruction wherever possible in all patients; five above-knee amputations were eventually required, of which two patients died within the period of follow-up.

It is a fundamental pre-requisite for long term patency to correct any underlying lesion. Gardiner et al. report an 86% 1-year patency in patients with successfully lysed grafts with a correctable aetiological lesion, compared to only 37% 1-year patency in those without a correctable lesion. Newer techniques such as pulse-spray or high dose bolus administration may facilitate the application of thrombolysis for the more acute cases which would otherwise not be amenable to percutaneous low dose infusion. However, the potential benefits should always be
balanced against the danger of rapid but only partial lysis of the thrombosis, which may result in distal embolisation. The choice of agent should allow the safest surgical intervention with the minimum of systemic effect.\textsuperscript{15}

Thrombosed suprainguinal grafts proved to be amenable to thrombolysis and adjunctive surgery when necessary with no major haemorrhagic complications. At least 50\% of patients will require specialised radiological or surgical intervention in order to preserve or establish long term patency following thrombolysis for graft thrombosis. Percutaneous thrombolysis was less successful in infrainguinal PTFE graft thromboses, despite surgical reconstruction wherever possible. This series highlights the need for a team approach in patients with graft thromboses: thrombolysis has proved a useful adjunctive measure in our patients with graft occlusion, but alone is only successful in approximately a quarter of patients. With further surgical intervention a further quarter of grafts are salvaged. Despite aggressive intervention, seven major amputations (21\%) were still required, underlining the serious nature of graft occlusion in patients formerly with critical ischaemia.

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**References**


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