Autologous Vein Reconstruction in Prosthetic Graft Infections


Section of Vascular Surgery, Department of Surgery, Washington University School of Medicine, Barnes Hospital, St. Louis, MO, U.S.A.

Introduction

Aortofemoral prosthetic graft infection remains one of the most complex challenges that a vascular surgeon faces. Although the reported incidence of this serious complication is approximately 2%, the current published associated mortality and amputation rates range from 5 to 25%.1-5 Multiple approaches to the resolution of this dreaded complication have been reported with each having advantages and disadvantages, as well as variable results among different investigators. The most accepted approach has been complete excision of the infected prosthesis with extra-anatomic revascularisation, either in a simultaneous or staged fashion.1-3,6,7 Recently, other innovative revascularisation techniques such as retroperitoneal in-line prosthetic grafts,9 antibiotic-bonded prosthetic graft in situ replacement,9 and in situ replacement with cryopreserved homografts have been published with good early and mid-term results.10 Although for infrainguinal prosthetic graft infections some authors have proposed a conservative (no total excision) approach,10-12 most authors concur that in the presence of sepsis and total graft involvement, complete excision and autogenous revascularisation provides the lowest morbidity and mortality.15-17

Extra-anatomic revascularisation with axillofemoral, femorofemoral prosthetic bypass has been the frequently used approach, either staged or simultaneous to replace an excised infected aortic graft. However, when the septic process involves the femoral vessels then the approach used to restore lower extremity flow becomes more complex. The usual approach has been the use of bilateral axillo-deep femoral artery or bilateral axillopopliteal bypass. Unfortunately, these two approaches are associated with early failure due to recurrent thrombosis of the extra-anatomic graft.15,19 The use of autogenous tissue, such as saphenous vein, can be an attractive alternative for the crossover bypass graft in such cases, as it can be used in a contaminated bed as long as appropriate debridement, drainage and coverage of the anastomosis is performed.16 Autogenous superficial femoral vein, with or without saphenous vein, can also be used to create a new aortoiliac system (NAIS) at the time the aortic graft is excised. This approach has two distinct advantages in that it avoids extra-anatomic revascularisation and uses autogenous vein with its attendant bacterial resistance. This interesting approach has been reported to have excellent early results.21-22 Based on these encouraging results by other investigators, we report our experience with autogenous vein revascularisation of the lower extremities in 16 patients with Staphylococcus aureus graft infections.

Materials and Methods

We reviewed the records of patients with S. aureus prosthetic graft infections from January 1990 through November 1995. The study group consisted of 14 men and two women with a mean age of 63 years (range 26–89 years). All patients had the diagnosis of S. aureus graft infection made prior to their reoperation. Two of the bacterial isolates were oxacillin-resistant S. aureus. In the aortic graft infection, aspiration of groin infection site for bacteriological evaluation was performed in five patients after computed tomography (CT) confirmation of perigraft fluid. Two patients had aspiration of aortic perigraft fluid to confirm the septic
process (Fig. 1). In the infrainguinal graft infection group, cultures of wound drainage provided the diagnosis of *S. aureus* graft infection. Two patients with aortic graft infections had a second bacterial isolate of *Staphylococcus epidermidis* (n=1) and *Enterobacter cloacae* (n=1), respectively. Seven patients (43.7%) had an aortobifemoral Dacron graft infection with a mean time of presentation of 18 months (range 1-48 months) (Table 1). Six (37.5%) patients had an infected femoropopliteal/distal PTFE graft with a mean time of presentation of 2.8 months (range 0.5-6 months). Two of the bacterial isolates were oxacillin-resistant *S. aureus*. Two patients presented with a crossover axillofemoral (PTFE) graft infection and an infected axillofemorofemoral (PTFE), respectively, with a mean time of presentation of 1.5 weeks. One patient was transferred to our hospital with an oxacillin-resistant *S. aureus* infection of an ipsilateral femorofemoral Dacron graft used to repair a blunt trauma femoral artery injury 3 day earlier.

In the aortic group, five of the seven patients (71%) had staged axillofemoral (superficial femoral [n=3], deep femoral [n=2]) bypass with 9 mm ringed PTFE graft, using the lateral to the sartorius surgical approach, and crossover reversed saphenous vein femorofemoral grafts with excision of the aortic grafts 24-48 h later (Fig. 2). In all patients with aortic graft infections, the aortic stump was closed in two layers with polypropylene sutures and reinforced with an omental tongue. The retroperitoneum was widely debrided of all necrotic tissue and widely drained with closed suction drainage until the cultures of the fluid drained remained negative for longer than 5-7 days. Two patients had synchronous aortobifemoral graft excision and revascularisation with a neo-axillofemoral system using all superficial femoral vein in one patient and combining superficial femoral vein and contralateral saphenous vein graft in the other patient (Fig. 3). The other nine patients with infrainguinal graft infections required simultaneous excision of the prosthetic graft and saphenous vein revascularisation (Table 2). All patients required extensive debridement of necrotic tissue and closed suction drainage. In two patients, rotational coverage with the sartorius muscle was needed. All patients were

![Fig. 1. Computerised tomography of patient with *S. aureus* sepsis 48 months after aortobifemoral graft. Note the perigraft fluid whose percutaneous CT-guided aspiration grew *S. aureus*.](image)

**Table 1. Clinical characteristics and outcome of patients with *Staphylococcus aureus* infection of aortobifemoral grafts.**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age (years)</th>
<th>Time of presentation</th>
<th>Procedure</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68</td>
<td>48 months</td>
<td>Staged Ax-fem (PTFE) Fem-fem (SV) Excision infected ABF</td>
<td>Alive and well (20 months)</td>
</tr>
<tr>
<td>2</td>
<td>73</td>
<td>5 months</td>
<td>Staged Ax-fem (PTFE) Fem-fem (SV) Exc inf ABF</td>
<td>Expired (13 months)</td>
</tr>
<tr>
<td>3</td>
<td>51</td>
<td>6 months</td>
<td>Staged Ax-fem (PTFE) Fem-fem (SV) Exc inf ABF</td>
<td>Alive and well (31 months)</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>1 month</td>
<td>Staged Ax-fem (PTFE) Fem-fem (SV) Exc inf ABF</td>
<td>Expired (3 months)</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>36 months</td>
<td>Simultaneous exc ABF N AIS (SVF)</td>
<td>Alive and well (13 months)</td>
</tr>
<tr>
<td>6</td>
<td>49</td>
<td>8 months</td>
<td>Simultaneous exc ABF N AIS (SVF)</td>
<td>Alive and well (37 months)</td>
</tr>
<tr>
<td>7</td>
<td>66</td>
<td>24 months</td>
<td>Staged Ax-fem (PTFE) Fem-fem (SV) Exc inf ABF</td>
<td>Expired (19 months)</td>
</tr>
</tbody>
</table>

Ax-fem = Axillofemoral; ABF = Aortobifemoral; SV = saphenous vein; N AIS = Neo-aortoiliac system; SFV = superficial femoral vein.

Eur J Vasc Endovasc Surg Vol 14 Supplement A, December 1997
treated with intravenous vancomycin for 6 weeks using a basilic or subclavian line for home antibiotic therapy.

Because of the small number of patients, as well as the heterogeneity of the groups, no statistical analysis between the groups was performed. Actual survival, primary patency and limb salvage were calculated with standard methods.

Results

Recent follow-up data was obtained in 15 patients (94%), with one patient lost to follow-up 23 months after surgery. The mean follow-up for the 16 patients was 24.4 months (range 3–81 months). There were no in-hospital mortalities in this series. There were four late deaths (25%) in the 16 patients. Three (43%) of the patients with aortic graft infections died during the follow-up period. Two died at 3 and 13 months of cardiac causes and the third patient of an unknown cause at 19 months. In the infrainguinal graft infection group of nine patients, one patient (11%) died at 16 months of follow-up from metastatic bladder carcinoma. None of the 16 patients required amputation during the follow-up period. Three (25%) of the 12 alive patients have moderate lower extremity claudication due to superficial femoral artery disease. Two
Table 2. Clinical characteristics and outcome of patients with Staphylococcus aureus infrainguinal graft infections.

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age (years)</th>
<th>Initial procedure</th>
<th>Time of presentation</th>
<th>Procedure</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>58</td>
<td>Crossover fem-fem (PTFE)</td>
<td>2 weeks</td>
<td>Simultaneous excision of graft, fem-fem (SV)</td>
<td>Alive and well (11 months)</td>
</tr>
<tr>
<td>9</td>
<td>26</td>
<td>Ipsilateral fem-fem (Dacron)</td>
<td>3 days</td>
<td>Simultaneous exc. of graft, fem-fem (SV)</td>
<td>Alive and well (5 months)</td>
</tr>
<tr>
<td>10</td>
<td>56</td>
<td>Ax-fem, fem-fem (PTFE)</td>
<td>1 week</td>
<td>Simultaneous exc. of graft, fem-fem (SV)</td>
<td>Expired (6 months)</td>
</tr>
<tr>
<td>11</td>
<td>67</td>
<td>Fem-BK-pop (PTFE)</td>
<td>4 weeks</td>
<td>Simultaneous exc. of graft, fem-AT (SV)</td>
<td>Alive and well (22 months)</td>
</tr>
<tr>
<td>12</td>
<td>79</td>
<td>Fem-BK-pop (PTFE)</td>
<td>10 weeks</td>
<td>Simultaneous exc. of graft, fem-PT (SV)</td>
<td>Alive and well (67 months)</td>
</tr>
<tr>
<td>13</td>
<td>79</td>
<td>Fem-AK-pop (PTFE)</td>
<td>4 weeks</td>
<td>Simultaneous exc. of graft, fem-at (SV)</td>
<td>Alive and well (7 months)</td>
</tr>
<tr>
<td>14</td>
<td>89</td>
<td>Fem-PT (PTFE-Miller cuff)</td>
<td>2 weeks</td>
<td>Simultaneous exc. of graft, fem-AT (SV)</td>
<td>Alive and well (81 months)</td>
</tr>
<tr>
<td>15</td>
<td>57</td>
<td>Fem-BK-pop (PTFE)</td>
<td>25 weeks</td>
<td>Simultaneous exc. of graft, fem-PT (SV)</td>
<td>Alive and well (11 months)</td>
</tr>
<tr>
<td>16</td>
<td>66</td>
<td>Fem-PT (PTFE-Miller cuff)</td>
<td>6 weeks</td>
<td>Simultaneous exc. of graft, fem-AT (SV)</td>
<td>Alive and well (38 months)</td>
</tr>
</tbody>
</table>

Ax-fem = axillofemoral; BK pop = below-knee popliteal; AK pop = above-knee popliteal; SV = saphenous vein; PT = posterior tibial artery; AT = anterior tibial artery.

Discussion

The challenge that a vascular surgeon has in the presence of a vascular graft infection can be overwhelming. The diagnosis can be difficult in some cases of sepsis in a patient with an aortic graft. Similarly, the strategy to eradicate the infection and provide adequate lower extremity revascularisation has been controversial. Even though most series agree that complete graft excision and alternate route revascularisation is optimal, some authors have proposed prosthetic graft preservation in selected cases of graft infection. Other authors have reported good results with either in-line autologous vein reconstruction or autogenous femorofemoral graft combined with prosthetic axillo-deep femoral or superficial femoral grafts. We have adopted this approach in selected cases of graft infections in which we felt the bacteriology of the infection was amenable to graft excision with autogenous vein reconstruction and antibiotic therapy. Although S. aureus has been considered a moderately virulent organism in animal and in vitro models, various clinical series have demonstrated that autogenous vein can resist infection and heal in a contaminated field if wide debridement, closed suction drainage and long-term antibiotic therapy is instituted. The lack of in-hospital mortality in our 16 patients can be attributed to a strict adherence to the basic techniques.
principles of patient stabilization, complete infected graft excision with wide debridement and either staged or simultaneous revascularisation with autogenous vein and long-term intravenous antibiotic therapy. The small cohort of patients, as well as the heterogeneity of the therapeutic strategies described in this study, makes it difficult to propose a specific strategy of the best configuration of autogenous vein revascularisation, but it definitely suggests the advantage of the policy of autogenous vein reconstruction.

The disadvantage of the prosthetic axillo-deep femoral (or superficial femoral) and combined saphenous vein femorofemoral bypass graft is recurrent thrombosis either because of the length of the prosthetic graft, the possible compression of the axillo-deep femoral graft, or inadequate size of the saphenous vein for the femorofemoral bypass grafts. We encountered this complication in two (28%) of seven patients with aortic graft infections. The failures of the saphenous vein crossover bypass grafts were due to inadequate size in one patient and the development of intimal hyperplasia (5 months later), probably induced by a previous thrombectomy. We currently recommend preoperative duplex assessment of the size of the
saphenous and superficial femoral vein prior to selecting the operative strategy. Postoperative duplex scan surveillance of the saphenous vein is mandatory because the long-term failure rate from intimal hyperplasia can be significant and early detection can retrieve a failing graft. 27

Two (28.5%) of patients with aortic graft infections had simultaneous graft excision and lower extremity revascularisation with a neo-aortoiliac system using superficial femoral vein alone or in combination with saphenous vein. This technique has shown excellent results in two large recent series reported. 5 22 We feel that in selected patients this technique offers multiple advantages that avoid extra-anatomic prosthetic graft revascularisation with its attendant risk for infection and recurrent thrombosis. Longer-term follow-up will be needed to establish the role of this innovative technique in the management of these very sick and challenging patients.

References


