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A review of 155 extra-anatomic bypass grafts

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Summary

Extra-anatomic bypass grafting has been used as treatment for patients with aorto-iliac disease who were considered unfit for aortic surgery. Eighty five percent of the patients had ischaemic pain at rest or skin necrosis. One hundred and three femorofemoral (FF) grafts, 40 axillounifemoral and 12 axillobifemoral grafts were performed. Femoropopliteal extension grafts were performed in 39 cases. The three year cumulative graft patency rate was 69% for FF grafts and 48% for both types of axillofemoral (AF) graft, falling to 61% for FF grafts and 32% for AF grafts at five years. The long term patient survival rate was poor, particularly for AF grafts, 27% at five years, reflecting the poor general condition of these patients. In addition almost a quarter of AF grafts required declotting at some stage. However, worthwhile limb salvage rates were obtained with both types of grafts, 69% for FF and 72% for AF at three years and 61% for FF and 65% for AF at five years, suggesting that these grafts should be employed as a means of avoiding amputation in poor risk patients.

Introduction

Extra-anatomic vascular bypass grafting is a well recognised method of treatment for patients with aorto-iliac disease who are not considered fit enough to withstand an aortofemoral or aortobifemoral graft. The grafts usually employed are the femorofemoral (FF) crossover graft and the axillofemoral (AF) graft. The first series of FF grafts was described in 1962 by Vetto (*1*) although an account of a single crossover graft was published in 1952 by Freeman and Leeds (*2*). In 1961 Lewis reported a graft from the subclavian artery to the external iliac artery (*3*) but it was not until 1963 that Blaisdell and Hall (*4*) and Louw (*5*) described what we know today as the axillofemoral graft. In American practice both operations have been widely used in patients with rest pain and skin necrosis, and to improve systems of claudication. Results comparable with those of aortofemoral grafting have been reported, with five year graft patency rates of 76% for AF grafts (*6*) and 73% for FF grafts (*7*). Some have even considered FF grafts to be the operation of choice for unilateral iliac disease, irrespective of the general condition of the patient (*7,8*).

In the United Kingdom extra-anatomic procedures have been reserved for restoring the femoral pulse in those patients with severe claudication, rest pain and skin necrosis who are considered unfit for operative exposure of the abdominal aorta. Results have not always been encouraging, particularly those of AF grafting. In 1972 Pollock (*9*) reported a series of 17 AF grafts performed in poor risk patients of which only four remained patent for over one year. Corbett *et al.* (*10*) reported the results of 30 AF grafts, all performed for rest pain and skin necrosis, with a two year graft patency rate of 38%, but a limb salvage rate of 92%. Graham's results (*11*) of a series of 22 FF and 42 AF grafts were better with a 57% cumulative graft patency rate at three years, but the series included a larger percentage of claudicants. We have regularly been performing extra-anatomic grafts since 1973 in poor risk patients and have recently reviewed our results.

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Patients and methods

Between 1973 and March 1985, 155 extra-anatomic grafts have been performed on 143 patients. There were 103 FF grafts and 52 AF grafts of which 40 were axillo-unifemoral and 12 were axillobifemoral. Of the 143 patients 111 were male and 32 female, with a mean age of 65 years (range 44-86). One hundred and twenty-two (85%) patients suffered ischaemic pain at rest, 53 (37%) with skin necrosis and 21 (15%) patients had disabling claudication. Nine patients had had previous aortofemoral surgery, in seven cases the graft had thrombosed and in two it had become infected. All but eight patients smoked preoperatively. Twenty patients were diabetic, 30 had controlled hypertension, 59 had severe bronchitis. Selection for extra-anatomic grafting rather than aortofemoral grafting was on clinical grounds, taking into account the general condition of the patient. In the early part of the series preoperative arteriography was not performed routinely for local historical reasons, with considerable emphasis being placed on the clinical assessment of the femoral pulse as judged by two experienced vascular surgeons (BRH and GSM). Isotope angiography was of some use in assessing the severity of iliac disease, particularly if the femoral pulse was considered to be palpable but diminished (*12*). If the femoral flow on the donor side was judged to be capable of supporting a graft then FF grafting was preferred to AF grafting. Axillo bifemoral grafts, as opposed to axillo-unifemoral grafts, were reserved for patients with severe symptoms in both legs and were only required in 12 cases.

Operations were performed using the techniques described by Vetto *(1)* and by Blaisdell and Hall *(4)*. Subcutaneous tunnels for the grafts were made using a blunt rod and care was taken to keep the subcutaneous tunnels of AF grafts well lateral. Dacron® 10 mm was used in all cases except three FF grafts where reversed saphenous vein was used. The anastomoses were fashioned using continuous Prolene® sutures. Heparin was used locally to flush the distal vessels at the recipient site. Systemic anticoagulants were not used routinely, neither were antiplatelet drugs. As prophylaxis against infection all patients received a course of antibiotics, usually Magnapen®. Femoropopliteal extension grafts were inserted in 39 cases. They were mainly either reversed saphenous vein or polytetrafluorethylene (PTFE) grafts although latterly *in-situ* vein grafts have been performed. Xeroangiography was useful in assessing the patency of the popliteal artery in the absence of arteriography (*13*). Seventeen extension grafts were performed at the time of the original operation and 22 at a later date.

Patients have been followed for between three months and 12 years. Graft patency was assessed by palpation or with the aid of Doppler ultrasonography. Data were stored on a TRS-80 microcomputer. Patient survival, cumulative graft patency and cumulative salvage rates were calculated using an actuarial procedure (*14*) and are presented graphically in Figs. 1 and 2.

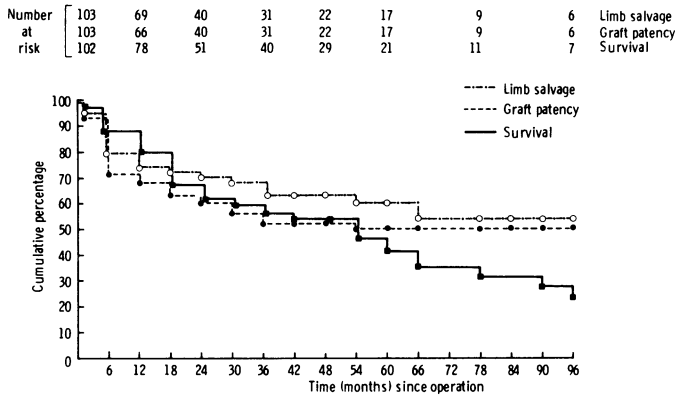

FIG. 1. Cumulative graft patency, limb salvage and patient survival for FF grafts.

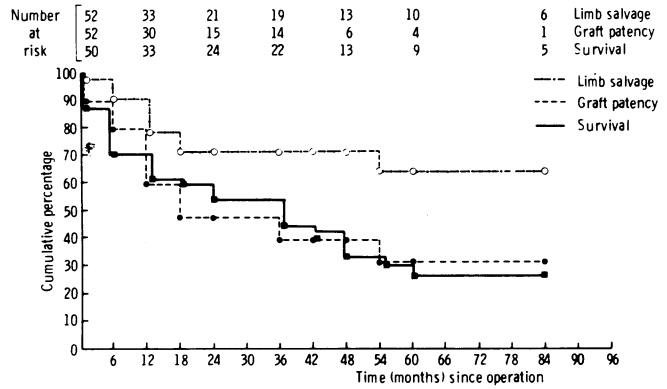

FIG. 2. Cumulative graft patency, limb salvage and patient survival for AF grafts.

Results

The operative mortality, deaths within 28 days of surgery, was 2% in patients having FF grafts and 12% in those having AF grafts.

One hundred and two patients had 103 FF grafts. Fig. 1 shows the cumulative graft patency rates, the limb salvage rate and the patient survival plotted against time since operation. After five years 40 grafts had occluded, 30 of these occlusions occurring in the first year. There were no further FF graft occlusions. The cumulative graft patency rate was 57% (S.E.M. 6%) at three years and 51% (S.E.M. 9%) at five years. Twenty nine patients required a major amputation during the first five years and one further amputation was performed six years after grafting. The cumulative limb salvage rate was 69% (S.E.M. 7%) at three years and 61% (S.E.M. 10%) at five years. A total of 47 patients died during the first ten years following surgery, the cumulative survival being 60% (S.E.M. 4%) at three years, 42% (S.E.M. 7%) at five years and 24% (S.E.M. 15%) after ten years.

Fifty patients had 52 AF grafts and their results are shown in Fig. 2. After five years 23 of the grafts had occluded, 11 patients had required a major amputation, and 30 patients had died. The cumulative graft patency rate was 48% (S.E.M. 8%) at three years and 32% (S.E.M. 19%) at five years, the limb salvage rate was 72% (S.E.M. 8%) at three years and 65% (S.E.M. 14%) at five years and the survival rate 53% (S.E.M. 4%) at three years and 27% (S.E.M. 9%) at five years.

Declotting of occluded AF grafts was attempted in 11 (21%) cases. Six grafts occluded within 24 hours of insertion All were declotted successfully. In 4 cases a PTFE femoropopliteal extension graft was inserted at the same time as the declotting procedure. Two of these 6 patients died postoperatively. In the remaining 4 the grafts were patent for 3, 8, 17 and 57 months. Declotting was attempted in 5 AF grafts, which occluded at a later date (median 3 months after insertion). In 2 patients it was unsuccessful and both required a major amputation. Graft patency was restored in the other 3 although one patient died postoperatively. In the remaining two patients patency was maintained for 4 and 11 months.

Declotting was attempted in 6 (6%) FF grafts which occluded. Three grafts occluded within 24 hours of insertion. One was declotted successfully and remained patent for 10 months. The other 2 could not be declotted, one patient died and the other required an amputation. There were 3 late attempts at declotting, 2 of which failed. The third was successful and the graft remained patent for a further 34 months. When it clotted again an amputation was performed.

The results of the 39 femoropopliteal extension grafts are shown in Table I. The median interval between the original operation and extension grafting in the delayed group was 8 weeks (interquartile range 1–35 weeks). Five delayed extension grafts were peformed one year or more after the original operation. The median graft patency in the early and the delayed group was the same, 16 weeks.

Discussion

Our cumulative graft patency rates of 51% for FF grafts and 32% for AF grafts at 5 years are comparable to those reported in other British series (*10,11*), but are lower than those in many American series, which contain larger numbers of patients operated on for claudication (*6,7*). All our patients were a poor risk for major abdominal surgery.

TABLE I *Femoropopliteal extension grafts, n=39*

Number performed	*Deaths*	*Major amputations*	*Median graft patency in weeks (inter quartile range)*
Early $n=17$			
At time of initial procedure	2	5	16 (8–34)
Delayed $n=22$			
At a later date	3	12	16 (1–65)

Wherever possible FF grafts were preferred to AF grafts because they are shorter, less likely to be compressed externally and less likely to episodes of graft thrombosis (*6*). As a result patients receiving AF grafts had more extensive arterial disease at the outset than patients receiving FF grafts. This is reflected in the low survival rates in the years following grafting in the AF group (Fig. 2). Poor long term survival following AF grafting has previously been described (*10,15*).

A comparison of Figs. 1 and 2 shows that although patient survival and cumulative graft patency rates are higher for FF grafts than AF grafts, the limb salvage rates are similar. This is because many patients receiving AF grafts have a short life expectancy and only require a short period of palliation of symptoms to avoid amputation. These patients die of co-existing disease before an amputation is necessary. The limb salvage rates obtained from both types of graft, 61% for FF grafts and 65% for AF grafts at five years, reinforce our view that these grafts are a worthwhile undertaking, bearing in mind the significant medical and social problems associated with amputation in this group of patients.

Fourteen per cent of our patients were diabetic. In a concurrent series of patients with superficial femoral occlusion undergoing femoropopliteal bypass the incidence of diabetes was 33% (*16*). This is in agreement with previous reports that diabetes is less commonly associated with aorto-iliac disease than with superficial femoral disease (*17,18*). Graft patency, limb salvage and survival were assessed for patients with and without diabetes, but no significant difference between the two groups could be found.

Graft thrombosis is a well recognised problem with AF grafts and 21% of AF grafts in our series were declotted at some stage. Some authors consider that axillobifemoral grafts, which have a greater run off than axillo-unifemoral grafts, hence a higher flow in the verticle limb of the graft, are less likely to thrombose, thereby improving long term patency (*11,19*). We have limited experience of this procedure, which we reserve for patients with absent femoral pulses and severe bilateral symptoms. Twelve axillobifemoral grafts have been inserted. Four patients died in the immediate postoperative period. The other 8 grafts remained patent for a median of 8 months (range 1-24 months).

Declotting AF grafts was rewarding, 6 of 11 grafts declotted were subsequently patent for a median 17 months (range 3–57 months). Femorofemoral grafts were less likely to thrombose, but when they did, simple declotting was usually inadequate. An episode of graft thrombosis was often taken as an indication to insert a femoropopliteal extension graft to improve the run off. The decision to insert an extension graft was not always easy. Superficial femoral artery occlusion, demonstrated either arteriographically or at operation is only a relative indication to extension grafting because restoring the blood flow to the profunda femoris artery is often sufficient to alleviate the symptoms of rest pain and save a severely ischaemic leg. Large areas of ulceration, however, will not heal unless the popliteal pulse is restored. The patency of these grafts was extremely variable (Table I). The interval between the original procedure and extension grafting was in many cases short. Probably some of the delayed grafts should have been inserted during the initial operation because the median patency was the same for the early grafts and the delayed grafts. An accurate method of assessing the need for an extension graft is obviously required.

In conclusion we feel that extra-anatomic grafting is of benefit to patients with aorto-iliac disease who are not fit for major surgery. The procedures are well tolerated and can be performed with a minimum of preoperative investigations. The late mortality of these patients is high, particularly of those undergoing AF grafting, but the limb salvage rates obtained makes them worthwhile procedures.

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