

Factors Influencing Patency of Femoropopliteal Arterial Reconstructions

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ABSTRACTS

Twenty-nine limbs (26 patients) that had undergone arterial reconstruction of the femoro-popliteal region from January, 1969 to October, 1978 were studied.

The overall early patency rate one month after surgery was 76%. Early occlusion was present in 7 limbs (24%): 2 limbs with endarterectomies, 2 with Dacron grafts, 2 with vein grafts and 1 with profundaplasty. The early occlusion seemed to be inversely related to the degree of distal run-off.

Two-year patency rate for autogenous vein grafts exceeded that of Dacron grafts at each interval of follow up. Re-operations for late occlusion cases were performed on 7 limbs. Two with vein graft remained patent because of excellent run-off, and another 2 limbs were saved from major amputation. Three limbs with amputation had poor run-off. The results of cases with the repeated surgical procedures were not very satisfactory in cases with poor run-off. With regard to the correlation of the number of distal run-off vessels with graft patency, the average duration of patency was 36 months for limbs with three run-off vessels, 18.5 months with 2 vessels and 6.4 months with one or zero vessel.

Autogenous veins seem to be the best bypass graft material at present. The patency rates are directly correlated with the status of the distal run-off vessels in the femoropopliteal bypass.

Key words: early and late occlusion; femoropopliteal bypass; autogenous saphenous vein; dacron graft

INTRODUCTION

The operations of choice in chronic arterial occlusive diseases of the femoropopliteal region are reconstructions using autogenous vein grafts or endoarterectomies, the use of prosthetic grafts having largely been abandoned because of mediocre long-term results. The blood vessels in the femoropopliteal region are considerably smaller and the rate of blood flow significantly lower than in the aorto-iliac area. For this reason, the outcomes of operations are often dependent on technical and pathological factors to a degree not encountered in large vessel surgery

DeWeese reported a 5-year patency rate of 63% with vein grafts and 54% with endoarterectomies in the femoropopliteal arterial reconstruction¹⁾. Our 2-year patency rate has been 47% (7/15) with vein grafts over the past 10 years. This figure is lower than other reports. Some recent reports have suggested that long-term patency of femoropopliteal arterial bypass grafts is not dependent on the degree of distal run-off^{2,3)}. Since this seemed to differ from our findings, we attempted to analyze the factors influencing patency of femoropopliteal arterial reconstructions and the results of the surgical procedures for patients with late occlusion after the first reconstruction of the femoropopliteal artery.

CLINICAL MATERIALS

Twenty-nine limbs (26 limbs) that had undergone arterial reconstruction surgery for chronic arterial occlusive disease of femoropopliteal region from January, 1969 to October, 1978 were studied. The operative procedures included femoropopliteal bypass (21 limbs), thromboendoarterectomy (6 limbs) and profundoplasty (2 limbs).

Three patients underwent reconstruction on both limbs. The ages of the patients at operation are summarized in Table I. More than half of them were 60 years or older. Their presenting symptoms were intermittent claudication (5 limbs), rest pain (18 limbs) and necrosis or other trophic changes (6 limbs) (Table II). In addition, more than half of the limbs (18 limbs) were diabetic, 12 limbs had hypertension and 16 limbs showed myocardial ischemic findings or other abnormalities on electrocardiogram.

Preoperative arteriography by the Seldinger or translumbar technique was carried out on all patients to detect the condition of the distal run-off vessels. In addition, an operative-table femoral arteriography was performed in some instances. The degrees of distal run-off are designa-

Table I Age Distribution

Age (Yrs.)	Numbers of Limbs
40 - 49	1
50 - 59	6
60 - 69	10
70 - 79	12
Total	29

Table II Preoperative Symptoms

Symptoms	Numbers of Limbs
Intermittent Claudication	5
Rest Pain	18
Necrosis	6

Table III Operative Procedures

Procedures	No. of Limbs	No. of Patientt	Early Patency No. (%)	Late Patency (After 2 Years) No. (%)
Thromboendarterectomy Bypass Graft	6	5	4/6 (67)	2/6 (33)
Dacron	6	5	4/6 (67)	1/6 (17)
Autogenous Vein	15	14	13/15(87)	7/15(47)
Profundaplasty	2	2	1/2 (87)	0/2 (0)
Total	29	26	22/29(76)	10/29(34)

ted as zero, one, two or three, depending on the number of patent branches of the popliteal artery.

The operative modes of arterial reconstruction summarized in Table III include thromboendarterectomies (6 limbs), femoropopliteal bypass using Dacron grafts (6 limbs), femoropopliteal bypass using autogenous vein grafts (15 limbs) and profundaplasty (2 limbs).

RESULTS

The operative mortality in our series was 10.3% (3/29). A patient died of acute renal failure, one died of postoperative bleeding and other died after a cerebral vascular accident. The overall early patency rate of the arterial reconstructions was 76% (22/29) one month after surgery.

Early occlusion was present in 7 limbs: 2 with endoarterectomies, 2 with Dacron grafts, 2 with vein grafts and 1 with profundaplasty (Table III, IV). All the early occlusion cases except one had poor run-off. Therefore, it seems that early occlusion of reconstructed arteries is closely related to the paucity of distal run-off.

Inexperience may have been a factor contributing to early occlusion in the initial stage of the 10-year studies. However, in the later stage, our early patency rate exceeded 90% with improving techniques and surgical skill.

Table IV Early Occlusion Cases after Revascularization

Case No.	Procedures	Age (Yrs.)	Sex	Symptom	Run-off Vessels
1	TEA + Sympathectomy	57	Male	Rest Pain	0
2	F-P bypass (vein graft)	75	Male	Claudication	2
3	F-P bypass (vein graft)	68	Male	Rest Pain	0
4	TEA + Sympathectomy	53	Female	Rest Pain	0
5	F-P bypass (Dacron graft)	73	Male	Rest Pain	1
6	F-P bypass (Dacron graft)	69	Male	Rest Pain	0
7	Profundaplasty	62	Male	Rest Pain	0

TEA: Thromboendoarterectomy F-P bypass: Femoropopliteal bypass
I-F: Iliofemoral bypass

Long-term patency of the 2-year intervals of follow-up are shown in Figure 1. The patency rate for autogenous vein grafts exceeded that of Dacron grafts at each interval of follow-up. This seems to confirm that the autogenous vein is the better available reconstructive material for femoropopliteal bypass.

Late occlusion cases included 8 patients (9 limbs). Their initial reconstructive procedures vein grafts (3 limbs) and thromboendoarterectomy (one limb).

Re-operations for late occlusion cases were performed on 7 limbs (Table V). One of challenges of vascular surgery today lies in the salvage of limbs in which previous reconstructive procedures have failed. Among the 7 reoperated limbs, only 2 with vein grafts remained patent and another 2 limbs were saved from major amputation. Our results were not very satisfactory, but 4 limbs (57%) were ultimately salvaged. Three

Table V Revascularization for Late Occlusion Cases

Case No.	Procedures	Graft	Age (Yrs.)	Sex	Symptom	Run-off Vessels	Patency Periods (Months)	Reoperation	Graft	Results
1	TEA + Sympathectomy		69	Male	Claudication	3	9	F-P bypass	Vein	Patent
2	F-P bypass	Dacron	74	Male	Rest Pain	2	8	F-P bypass	Vein	Patent
3	F-P bypass	Dacron	73	Male	Rest Pain	2	4	F-P bypass	Vein	Limb Salvage
4	F-P bypass	Vein	69	Male	Rest Pain	2	7	F-P bypass	Dacron	Limb Salvage
5	F-P bypass	Dacron	71	Male	Claudication	2	12	Profundaplasty + I-F bypass	Dacron	Amputation
6	F-P bypass	Vein	75	Male	Rest Pain	1	6	F-P bypass	Dacron	Amputation
7	F-P bypass	Vein	51	Male	Rest Pain	1	4	F-P bypass + I-F bypass	Composite	Amputation

TEA: Thromboendoarterectomy F-P bypass: Femoropopliteal bypass

I-F: Iliofemoral bypass

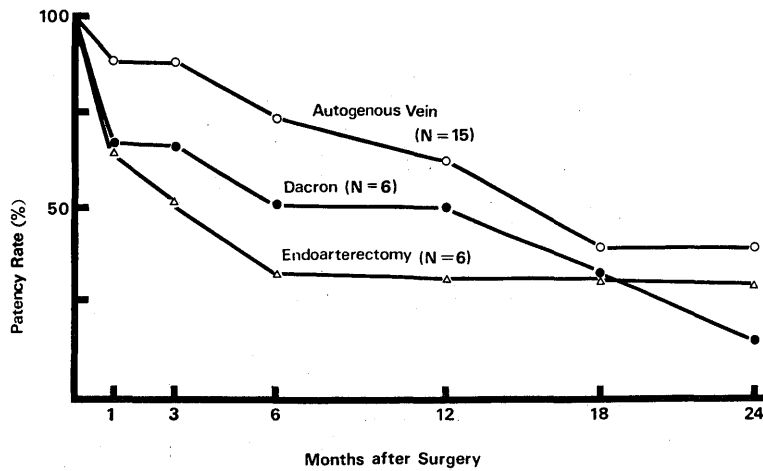


Fig. 1. Late Patency Rate with Autogenous Vein Graft, Dacron Graft and Endoarterectomy

amputated limbs had poor run-off, and 2 successful cases with vein grafts had excellent run-off. The prognosis of re-operation also seems closely related to the degree of distal run-off.

In addition, the correlation of distal run-off with graft patency in 18 cases of autogenous vein grafts was studied (Table V). The average time of patency was 36 months for limbs with three run-off vessels, 18.5 months for limbs with two vessels and 6.4 months for those with one or zero vessel.

Table V. Correlation of Preoperative Angiograms with Patency Period (VeinGrafts)

Run-off (Patent Vessels)	No. of Limbs	Patency Periods (Months)
Good (3)	3	36
Fair (2)	4	18.5
Poor (1 or zero)	8	6.4
Total	15	

DISCUSSION

Late occlusion after bypass grafts may be due to the failure of the reconstructed segment itself (examples of which are synthetic prosthesis and homograft), error in surgical technique or progression of the basic

occlusive disease⁴). It is now well accepted that the autogenous saphenous vein graft offers better long-term results than synthetic Dacron graft for arterial reconstruction of femoropopliteal region^{2,4,5}). Therefore, prosthetic grafts are not advisable and are actually contraindicated in arterial reconstructive procedures for chronic occlusive disease of the femoropopliteal arteries. A prosthetic graft should be used only in the case where no autogenous vein can be used as a bypass graft due to their small caliber or obstruction in their lumen. However, most patients have a saphenous vein of sufficient length and caliber for use as a suitable bypass graft.

Koontz²) suggested that, assuming adequate inflow and an adequate run-off bed, the most critical factor in determining the success of this operation is the size of the saphenous vein available, both in terms of length and diameter. The importance of a good run-off status has been emphasized in his report. Koontz²) also reported that in some cases arteriogram of the outflow tract does not reveal the actual condition of the distal vessels, because the collateral circulation feeds into the run-off vessels so far distally that reflux of radiopaque dye into the distal popliteal artery does not occur. Another report revealed that blood flow measurements of the outflow tract — intraoperative hemodynamics of the grafts — are of little value in predicting early or late graft patency³). On the contrary, in our cases, early and late graft patency rates seemed to be directly related to the degree of outflow distal to the grafts. The patency rate in patients with two or three run-off vessels was superior to that in patients with zero or one vessel. Koontz²) further suggested that changing indications for surgery and better selection of patients are also important factors in improvement of patency rate. Patients with claudication alone are more likely to undergo successful procedures than those in whom the surgery is performed for rest pain or gangrene.

In recent years, more patients with claudication alone have undergone surgery in our clinic which is one of the factors related to our improved long-term patency rates. Technical improvement and the increased experience of the surgeons may have played a role in the improved results, especially in early patency.

We have maintained a positive attitude toward attempting bypass grafts for limb salvage in patients with advanced femoropopliteal occlusive disease. This approach seems warranted by the reports of several investigators who have found that initially vein grafts will remain patent with low flow rates and later flow rates may improve as increased arterial pressure dilates collateral vessels⁶⁻⁸). We speculate that the mere

presence of a temporarily functioning graft may stimulate an increase in collateral circulation.

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