Surgical Treatment of Acute Arterial Insufficiency with Special Reference to Arteriosclerotic Obliterans

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ABSTRACTS

A total of 16 patients received 17 surgical treatments for acute arterial insufficiency during an 8-year-period. Causes were arteriosclerosis obliterans in 9, atrial fibrillation in 3, polycythemia in 2, and complication after retrograde aortography icter stupor and unknown in each 1. The initial surgical results were excellent in 7, good in 1 and poor in 9. Seven patients were operated upon within 24 hours of the onset of acute arterial insufficiency and the remainders some time later.

Because the initial surgery had failed, further surgical procedures were performed on 6 patients. The results of the repeated operation were excellent in 2 and poor in 4. The patients with arterial reconstruction for arteriosclerosis obliterans had poor result .A patient, who had an arteriovenous fistula between the posterior tibial artery and vein created during the second surgical treatment, enjoyed an excellent result. An arteriovenous fistula stimulates to develop collateral circulation. The use of an arteriovenous fistula seems justified for revascularization of an ischemic extremity resulting from arteriosclerosis obliterans.

Key words: embolism; thrombosis; acute arterial insufficiency; arteriosclerois obliterans; arteriovenous fistula

INTRODUCTION

Acute arterial insufficiency most often is the result of internal obstruction of major arteries in terms of embolism or thrombosis. However,

the differentiation between occlusion produced by emboli and that produced by spontaneous thrombosis of an atherosclerotic artery, though clinically difficult, is important. Direct removal of an embolus was first attempted by Ssabanajeff in 1895. Since that time numerous surgical advances have simplified removal of arterial emboli and thrombi. Thrombectomy at an early stage has become a safe and effective procedure after the introduction of Fogarty balloon-tipped catheters[1]. On the other hand, thrombectomy of a badly diseased artery is likely to fail, and may in some cases even extend the occlusive process, so that vascular reconstruction is often necessary even if a fresh clot is occasionally successfully extracted from a pre-existing stenotic segment.

The purposes of this paper are to present our experiences with acute arterial insufficiency with special reference to arteriosclerosis obliterans, and to present the beneficial effects of surgical creation of arteriovenous fistula for its treatment.

CLINICAL DATA

During an 8-year period from 1967 to 1974, acute arterial insufficiency was encountered in 16 patients, once in 15 patients and twice in the remaining patient. They consist of 13 males and 3 females, ranging in age from 52 to 80. The most common locations of the arterial thrombi were the iliofemoral arteries; namely, the ilio-femoral artery in 9, the femoral in 3, the brachial in 3 and the popliteal in 1 and the bifurcation of the aorta in 1, respectively (Table Ⅰ). The underlying diseases or causes were arteriosclerosis obliterans in 9, atrial fibrillation in 3, polycythemia in 2, and complication after retrograde aortography in 1 and icter stupor in 1. A source of the remainder was unknown (Table Ⅱ).

Table Ⅰ Site of Acute Arterial Insufficiency

Artery	No. of Cases
Ilio-femoral	9
Femoral	3
Brachial	3
Poplitea l	1
Aortic Bifurcation	1

Table Ⅱ Source of Acute Arterial Insufficiency

Source	No.of Cases
Arteriosclerosis obliterans	9
Atrial fibrillation	3
Polycythemia	2
Retrograde aortography	1
Icter stupor	1
Unknown	1

RESULTS

Initial surgical procedures consisted of 1 amputation, 3 arterial reconstructions using prostheses and 13 direct thrombectomies with or without a venous patch using the Fogarty balloon-tipped catheter. The prognoses of surgical treatment were rated excellent, good, fair or poor: excellent —restoration of normal circulation and return of one or more pulses; good— restoration of normal circulation, without restoration of pulses; fair— restoration of the unction in extremity, continued minor ischemic symptoms, no pulses; and poor— loss of function, amputation, rest pain and marked claudication, or death of the patient[2]. Of the 17 patients, seven (41.2%) had excellent prognoses, one (6%) had good and nine (52.8%) had poor results after the initial surgery. A primary amputation was performed on one patient because of necrosis of the right forearm shortly after admission to our clinic. Two patients died during surgery or in the ward shortly after the initial surgery. Seven patients were operated within 24 hours of the onset of acute arterial insufficiency and the remainders some time later. There were no statistically significant differences in the prognoses between the patients treated within 24 hours and those treated later. Analyzing the results of the initial surgical treatments except amputation of limb in 9 patients with arteriosclerosis obliterans, the three patients who underwent arterial reconstruction had poor results. Among the remaining patients who underwent thrombectomy with or without a venous patch, excellent results were obtained in 1, good in 1 and poor in 3. Thus, the rate of poor results was 75% in patients with arteriosclerosis obliterans. Of the seven patients without arteriosclerosis obliterans the results were excellent in 5 and poor in 2.

Because the initial surgery had failed, second operations were performed in 6 patients; arterial reconstructions, amputation and thrombectomy in each two patients. In one of the thrombectomized patients, the creation of an arteriovenous fistula between the posterior tibial artery

and vein was also carried out (Table Ⅲ and Ⅳ). The results of the second surgical treatment were excellent in two and poor in 4. Three of these 4 patients with poor results had arteriosclerosis obliterans.

Details of the patient (Case No. 8) with arteriosclerosis obliterans, treated successfully by the second surgical procedures consisted of thrombectomy and creation of arteriovenous fistula is as follows. A 52-

Table Ⅲ Synopsis of Patients with Arteriosclerosis Obliterans

Case No.	Age (Yrs.)	Sex	Source	Site of Occlusive Artery	Time Lapse of Attack (Days)	Procedures	Results
1	71	M	ASO	Left iliofemoral	5	Left aorto-femoro-popliteal artery bypass (double velour dacron graft)	Poor
						↓	
						Bilater alaorto-femoral bypass (double velour dacron graft)	Poor (operative death)
						Bilateral femoro-popliteal bypass (autogenous saphenous vein)	
2	68	M	ASO	Left iliofemoral	1	Thrombectomy	Poor
						↓	
						Femoro-popliteal bypass (double velour dacron graft)	Poor
						↓	
						A-K amputation	Poor
3	71	F	ASO	Right iliofemoral	0.5	Thrombectomy	Good
4	69	M	ASO	Left iliofemoral	3	Left ilio-femoral bypass (double velour dacron graft)	Poor (death due to cardiac failure)
5	69	M	ASO	Left iliofemoral	4	Thrombectomy	Poor
						↓	
						A-K amputation	Poor
6	83	F	ASO	Right brachial	6	Amputation of right forearm	Poor
7	52	M	ASO	Right iliofemoral	1	Thrombectomy plus Angioplasty of deep femoral artery	Poor
						↓	
						Thrombectomy plus Arterio-venous fistula of posterior tibial artery	Good
8	53	M	ASO	Right femoral	1	Thrombectomy	Excellent
9	61	F	ASO	Left iliofemoral	0.5	Left ilio-femoral bypass (Human umbilical cord vein)	Poor (death due to cardiac failure)

Table Ⅳ Synopsis of Patients without Arteriosclerisis Obliterans

Case No.	Age (Yrs.)	Sex	Source	Site of Occlusive Artery	Time Lapse of Attack (Days)	Procedures	Results
1	37	M	Unknown	Right popliteal	6	Thrombectomy	Excellent
2	54	M	Icter stupor	Bilateral brachial	3	Thrombectomy	Excellent
3	73	M	atrial fibrillation	Left femoral	0.5	Thrombectomy	Excellent
4	72	M	atrial fibrillation	Aortic bifurcation	2	Thrombectomy	Poor
						Thrombectomy	Excellent
5	56	M	atrial fibrillation	Right brachial	6	Thrombectomy	Poor
						Amputation of right forearm	Poor
6	69	M	Polycythemia	Right ilio-femoral	10	Thrombectomy	Excellent
7	70	M	Polycythemia	Left iliofemoral	1	Thrombectomy	Excellent
8	61	M	Retrograde aortography	Left femoral	3	Thrombectomy	Excellent

year-old man was referred from another hospital to the Yamaguchi University Hospital because of sudden, severe rest pain, coldness and cyanosis of the right lower leg. He had had intermittent claudication of the right lower leg since the age of 48. An aortogram revealed complete occlusion of the right common iliac artery. The femoral artery and its branching arteries were not visible. On the day of admission surgery was performed under the diagnosis of acute arterial insufficiency. A vertical incision was made in the right inguinal area and the femoral artery and its branches were exposed. A transverse arteriotomy was made over the femoral bifurcation. A proximal thrombectomy was performed using a No. 5 Frency size Fogarty balloon-tipped catheter. A forceful pulsatile flow was obtained after several passes of catheter had been made and a profusion of thrombi had been removed. Distal exploration of both the superficial and deep femoral arteries were then carried out in the same manner. Although numerous propagating thrombi were removed from the superficial femoral artery only the popliteal artery was demonstrated without visualization of its peripheral branches on an operative arteriogram (Fig. 1, A). Backbleeding from the superficial femoral artery was nearly non-existent because of severe atherosclerosis, the deep femoral arterial lumen was barely large enough to admit a catheter. This artery was opened as far as possible and then a thromboendarterectomy was performed, concomitant with a thrombectomy using a Fogarty balloon-tipped catheter. The blood efflux from this

artery was minimal. A patch angioplasty using an autogenous saphenous vein was performed on the proximal portion of the deep femoral artery (Fig. 1, B). Restoration of normal blood pressure could not be achieved in the ischemic extremity but pain, pallor and cyanosis were slightly improved after surgery. On the first postoperative day, however, his clinical symptoms became worse and a second surgical procedure was performed. A Fogarty balloon-tipped catheter was inserted into the posterior tibial artery through the previous incision in the common femoral artery and distal clots and atheromatous plaques were removed. Complete occlusion of the distal segment of the posterior tibial artery was noticed. An arteriovenous fistula was created between the posterior tibial artery above the occlusion and vein, distal valves of which were destroyed by catheter (Fig. 2).

Urokinase, 48,000 u/day, was administered intravenously for ten days after surgery. Symptoms of arterial insufficiency did not recur and the patient discharged 87 postoperative days.

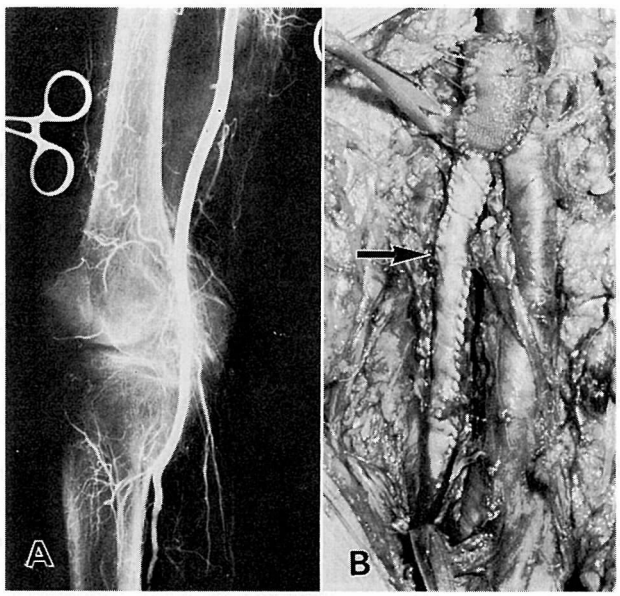

Fig. 1 Arteriogram and operative findings during the initial surgical treatments. The popliteal artery was visible but its tributaries were not completely demonstrated (A). A patch angioplasty (arrow) was performed on the proximal portion of the deep femoral artery after numerous propagating thrombi were removed (B).

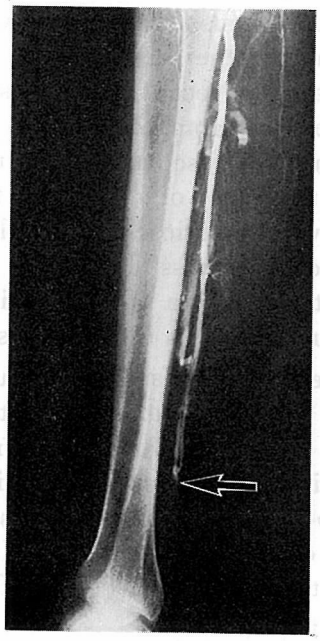

Fig. 2 Arteriogram showing an arterio- venous fistula between the posterior tibial artery and vein (arrow).

DISCUSSION

The management of the arterial occlusion due either to embolus or thrombus can be summarized in two main principles: 1) early removal of the emboli or thrombi; 2) prevention of recurrence of emboli or thrombi. While numerous methods and devices have been used for the extraction of clots, both proximal and distal to an occlusion, the Fogarty balloon-tipped catheter has been widely used[3].

The vast majority of emboli originates in the heart with rheumatic mitral stenosis, atrial fibrillation or acute myocardial infarction[1,4]. In our series of 7 patients with definite arterial occlusion without arteriosclerosis obliterans, 3 could be ascribed to cardiac diseases. The results of surgery for patients with arterial thrombosis treated more than 12 hours of the onset usually is unfavorable[2,5]. However, Spencer and Eiseman[6] reported that as long as the affected extremity is viable, regardless of elapsed time, there is still collateral circulation enough to restore pulsatile flow. The results in our series of arterial thrombosis support their view. On the other hand, the results were poor in patients with arteriosclerosis obliterans. Thrombosis may easily occur in patients with

arteriosclerosis obliterans because of the narrowing of major arteries and histochemical alterations in the endothelium. Even if fresh clots are successfully removed, vascular reconstruction is often necessary. Three out of 9 patients with acute thrombotic arterial occlusion associated with arteriosclerosis obliterans had vascular reconstruction during the initial surgical treatment and three out of 4, during the second surgical treatment. Amont patients with arteriosclerosis obliterans, who underwent arterial reconstruction, only successful surgical treatment was acheived only in a patient with the creation of an arterio-venous fistula between the posterior tibial artery and vein during the second surgical treatment.

Several groups have reported favorable results with surgical creation of arterio-venous fistula for revascularization of the ischemic extremity[7-9]. The method has been successfully used to maintain the patency of endarterectomized arteries and bypass grafts in ischemic extremities with poor run-off. An arterio-venous fistula may constitute a powerful stimulus for the development of collateral circulation[9]. It is necessary to reduce this high resistance at the terminal artery. Therefore, the use of an arterio-venous fistula seems justified.

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