

Venous Crossover Bypass Grafts for Arterial Insufficiency

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SUBCUTANEOUSLY implanted crossover grafts have proved to restore effectively peripheral arterial flow in patients in whom more conventional technics involving laparotomy would be hazardous.¹⁻⁴ In previously reported operations, synthetic grafts were used. The present report describes our experience with three patients in whom the long saphenous vein was used as a crossover graft. In one patient with cerebrovascular insufficiency this was done to avoid the risk of thoracotomy, and in two patients with lower extremity ischemia this technic was used to avoid laparotomy. The saphenous vein was chosen for the graft because of its proven long term suitability as an arterial substitute and its relative freedom from the complications inherent in synthetic grafts.

Case Reports

Case 1. A 59-year-old man was studied in February, 1965 because of occupational disability resulting from dizziness, diplopia, ataxia, and reduced mental acuity. Transmediastinal endarterectomy for innominate artery stenosis had been performed 18 months previously. The history and the electrocardiographic findings indicated advanced

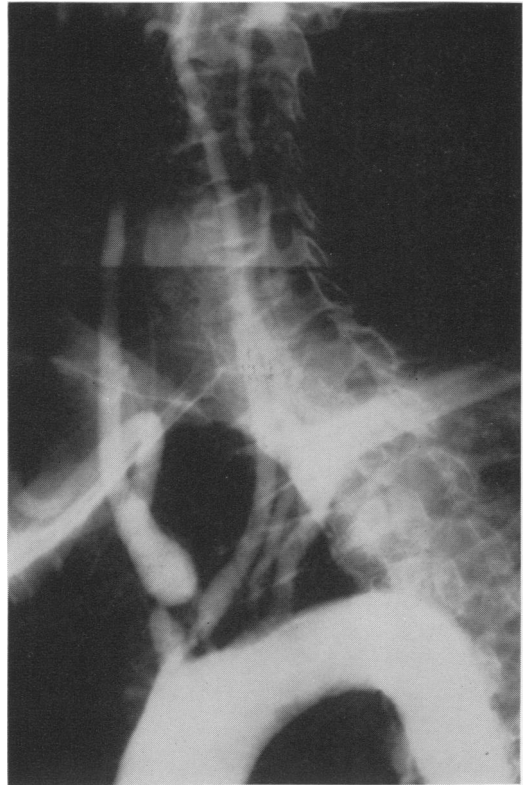


FIG. 1. Preoperative arch aortogram showing stenosis of the innominate, left common carotid and vertebral arteries. The lumen of the left subclavian artery is normal.

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coronary arteriosclerosis. On examination there were bilateral carotid, and subclavian bruits, absence of pulsations in the right arm and barely palpable pulsations in the cervical common caro-

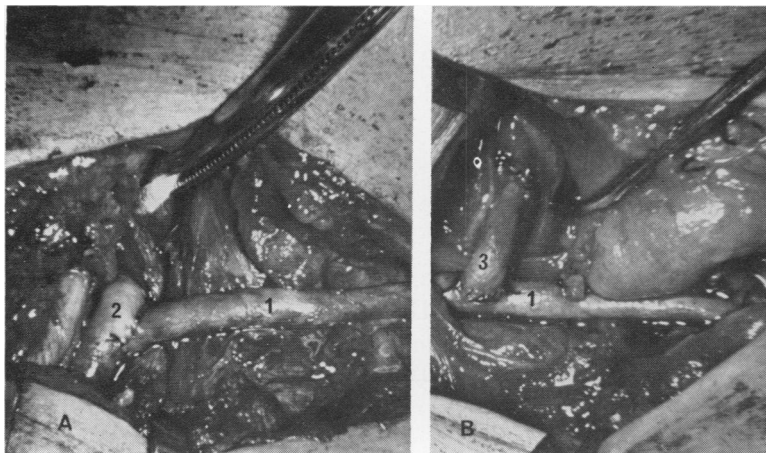


FIG. 2. (Case 1.) Composite operative photograph of left (A) and right (B) cervical incisions showing vein graft (1) anastomosed to the right subclavian artery (2) and the venous sidearm to the left common carotid artery (3).

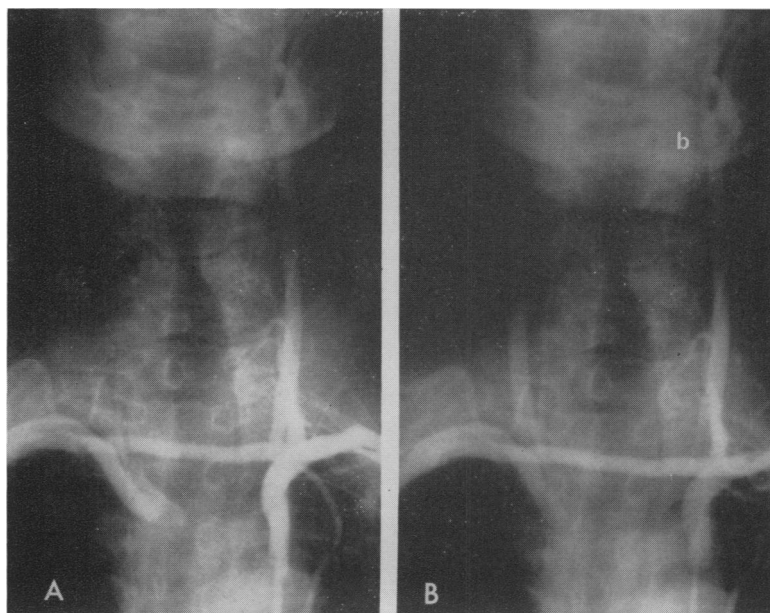


FIG. 3. Serial postoperative left subclavian arteriograms showing the subclavian to subclavian venous bypass graft and the venous sidearm to the left common carotid artery. In film B, taken 1 second after film A, note the rapid retrograde opacification of the right common carotid and vertebral arteries. Severe stenosis of the left internal carotid artery is now visible (b).

tid arteries. Arteriography of the aortic arch and its branches disclosed residual stenosis of the innominate artery and almost complete occlusion of the orifice of the left common carotid artery (Fig. 1). The right vertebral artery could not be visualized and the left vertebral artery was severely stenotic at its origin from the aortic arch.

It was concluded that cerebral symptoms were caused by marked reduction of cerebral blood flow,

resulting from occlusive lesions at the aortic arch of all the extracranial cerebral arteries. The left subclavian artery, which did not contribute to cerebral blood flow, was the only undiseased branch of the aortic arch. Because of the cardiac disease and previous mediastinal operation it was considered unwise to attempt revascularization by any of the customary transthoracic operations. Accordingly a transcervical crossover graft, using the saphenous

vein was implanted anterior to the trachea taking origin from the left subclavian artery. The graft was anastomosed distally to the right subclavian artery and, by means of a venous sidearm, to the left common carotid artery distal to the level of stenosis (Fig. 2). Postoperative arteriograms demonstrated excellent blood flow through the graft and rapid filling of the left common carotid, right subclavian, common carotid and vertebral arteries (Fig. 3). Stenosis of the left internal carotid artery, now clearly demonstrated, was corrected by a subsequent operation. Postoperatively, symptoms of cerebrovascular insufficiency disappeared. Psychometric testing has shown marked improvement of mental acuity. The patient has no discomfort or inconvenience from the visible and palpable pulsation of the cervical venous graft.

Case 2. A 73-year-old man was admitted to the hospital in January, 1967 because of claudication of the left leg and ischemic rest pain in the left foot. Similar symptoms had been present bilaterally during a previous admission. At that time the skin of both feet was cold and ruborous, and there were necrotic ulcers on the dorsum of the left foot. Aortography demonstrated multiple occlusive lesions involving the terminal aorta and the iliac and superficial femoral arteries bilaterally. Bilateral sympathectomy and an aortabilateral iliofemoral endarterectomy was performed to provide increased inflow to the profunda femoris arteries. This operation was complicated by postoperative reocclusion of the left iliac-common femoral arterial segment. Because of concurrent coronary and pulmonary complications further operation was deferred. The ulcers of the left foot healed slowly over a 1-year period and the rest pain disappeared, presumably as a result of the sympathectomy. Severe limiting claudication persisted and in January, 1967 rest pain of the left foot recurred. A translumbar aortogram showed occlusion of the left common and external iliac arteries and the common and superficial femoral arteries (Fig. 4). The left profunda femoris and popliteal arteries were patent. Although it was recognized that increased profunda inflow would provide adequate improvement, the cardiopulmonary status made transabdominal aortic grafting hazardous. The right iliac and femoral arteries were widely patent. Accordingly, a reversed saphenous vein bypass graft was placed subcutaneously from the right common femoral to the left profunda femoris artery (Fig. 5). In addition, endarterectomy of the proximal profunda femoris artery was performed to improve

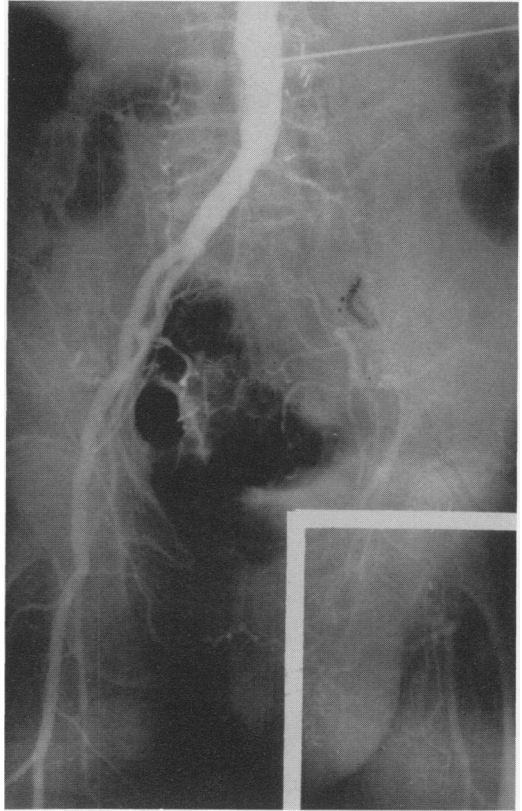


FIG. 4. Translumbar aortogram taken after aortofemoral endarterectomy. Note wide patency of the right common, external iliac, and common femoral arteries and occlusion of these vessels on the left. Inset shows collateral filling of the patent left profunda femoris artery.

the proximal outflow. All ischemic symptoms including claudication disappeared after operation.

Case 3. A 59-year-old man was admitted to the hospital in February, 1967 because of increasing ischemic rest pain of the right foot, sufficiently severe to prevent sleep. Severe coldness and numbness were also present. These symptoms had been preceded by increasing right calf claudication for six years. Mild rest pain first appeared in 1965. At that time occlusions of the right external iliac, common, profunda, and superficial femoral arteries were demonstrated by aortography (Fig. 6). The popliteal segment was patent but the distal trifurcation outflow vessels were severely diseased and the anterior tibial artery was occluded. Operation in the right groin confirmed the presence of extensive inoperable arteriosclerotic lesions in



FIG. 5. Operative arteriogram showing the saphenous vein bypass from the right common femoral to the left profunda femoris artery.

the profunda femoris artery. A sympathectomy provided temporary relief of rest pain which recurred 3 months prior to the present entry.

Examination now showed obesity, moderate hypertension, advanced pulmonary emphysema, and electrocardiographic evidence of an old myocardial infarction. All pulsations in the right leg were absent. The right foot showed elevational pallor and extreme rubor on dependency. A large and prominent saphenous vein was visible throughout the full length of the right leg and thigh. A strong common femoral pulse was present on the left side. Although there were no pulsations distal to that level there appeared to be adequate vascularity in the left foot. Aortography showed no significant change from the findings present in the previous study.

On March 3, 1967 the right saphenous vein was removed from ankle to thigh, reversed, and placed subcutaneously from the left external iliac artery to the right distal tibial-peroneal trunk (Fig. 7). To improve the outflow into the posterior tibial and peroneal arteries local endarterectomy was performed into the orifices of these vessels. Postoperatively a strong posterior tibial pulse was palpable in the foot. Since that time, pain has ceased and the patient has virtually unlimited walking tolerance.

Discussion

The use of the saphenous vein placed subcutaneously for crossover arterial grafting permits an autogenous vascular reconstruction in patients unable to safely undergo laparotomy or thoracotomy. The advantages of autogenous grafting procedures include: technical ease, diminished risk of infection, lessened likelihood of false aneurysm formation, and tolerance to angulation in areas of increased mobility and flexion. Physical examination, preoperative venography, and operative inspection determine saphenous vein size and suitability. The vein may be fashioned for extended use both transabdominally and transcervically.

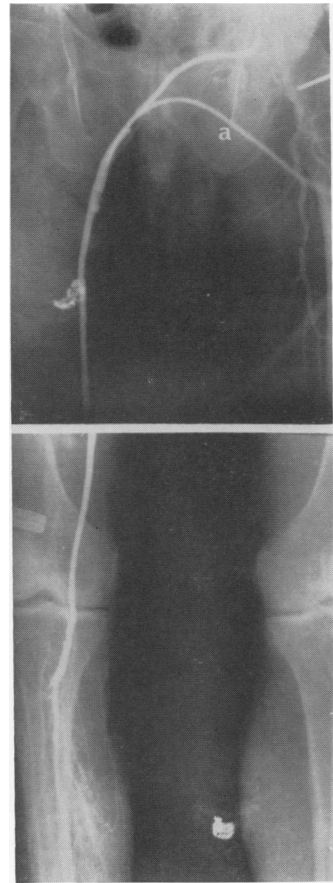
Summary

The long saphenous vein placed subcutaneously has been used for bypass grafting in three patients with cerebrovascular and peripheral vascular arterial insuffi-

FIG. 6. Pre-operative trans-lumbar aortogram showing occlusion of the right external iliac, common, profunda, and superficial femoral arteries. The right popliteal segment is patent but the trifurcation vessels are diseased.



FIG. 7. Operative arteriogram showing the reversed saphenous vein placed from the left external iliac artery to end-arterectomized distal right popliteal artery. The column labeled (a) represents the arteriogram tubing.



ciency. The main advantage of subcutaneous grafting is avoidance of the increased hazard of thoracotomy and laparotomy in debilitated and poor-risk patients. Use of the saphenous vein in preference to synthetic material allows greater technical ease, diminished risk of infection, lessened likelihood of false aneurysm formation and increased tolerance to angulation in areas of increased mobility and flexion.

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