Successful Endophlebectomy of Autogenous Venous Bypass Graft *

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THE FEASIBILITY of removing solid obstructing tissue from the lumen of the superior vena cava by endophlebectomy, with long term relief of the superior vena caval syndrome, has been described previously.[1, 2, 5] Endophlebectomy of lesser veins, however, has not been reported. We have recently encountered a localized area of almost complete obstruction in an autogenous saphenous vein functioning as a bypass graft in the arterial system. The severity of the patient's symptoms prompted reoperation, and in this unique situation, endophlebectomy with autogenous venous patch-graft angioplasty has provided restoration of normal blood flow and complete relief of symptoms.

Case Report

A 56-year-old man, a tool and die maker, was admitted to the University of Rochester Medical Center on August 21, 1962 with a 12-month history of intermittent claudication in the left foot and calf upon walking further than one block. Some mild numbness, tingling and coldness of the left foot was noted at night, but this did not interfere with sleep. There was some initial improvement with the use of vasodilating drugs, but discomfort recurred and was disabling in his employment. A left femoral arteriogram revealed a long area of atherosclerotic irregularity of the distal superficial femoral and popliteal arteries, with a 6-cm. long segmental block of the upper popliteal artery, and delayed run-off into the calf vessels.

On August 24, 1962, under continuous epidural anesthesia, an autogenous venous bypass graft was inserted from the left superficial femoral artery to the popliteal artery below the knee, utilizing a reversed greater saphenous vein. The patient had an uneventful early postoperative course, with restoration of bounding dorsalis pedis and posterior tibial pulses, and oscillometric readings of 2.5 to 3.0 units in the left calf compared to 0.5 unit preoperatively.

Previous symptoms of arterial insufficiency in the left leg were all relieved postoperatively, and the patient was able to walk unlimited distances without claudication. Excellent femoral, popliteal and pedal pulses were observed 1 year following operation, with an oscillometric reading of 3.0 units in the left calf. However 16 months after the original operation the patient noted recurrence of claudication in the left calf occurring after one block of walking, with severity comparable to his original preoperative symptoms. The popliteal pulse was no longer palpable at this time, although weak dorsalis pedis and posterior tibial pulsations were noted. Oscillometric readings were observed to have declined to 1.0 unit in the calf.

A left femoral arteriogram, obtained 18 months postoperatively, demonstrated a very marked constriction, 2 mm. in length, in the lumen of the autogenous vein about 10 cm. above the joint line (Fig. 1). The proximal and distal anastomoses were well formed and widely patent, and there was prompt flow into the three branches of the popliteal artery.

The patient was readmitted to the Medical Center on April 1, 1964. Results of general physical examination were normal. Serum cholesterol was 330 mg./100 cc. The left lower extremity exhibited well-healed, nontender groin, medial adductor and medial calf scars. Grade 4/4 pulsations were felt along the course of the bypass graft in the left thigh to a point 5 inches above the knee

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joint where they suddenly diminished. Popliteal, posterior tibial and dorsalis pedis pulses were not detected on the left. Oscillometric readings revealed 1.25 units in both thighs, 1.25 units at the left knee level and 0.75 unit in the left calf, compared with 3.75 units in the right calf. Upon return to recumbency after 2 minutes of elevation, venous filling on the dorsum of the left foot was delayed to more than 1 minute on the left, compared to 35 seconds on the right.

FIG. 1. Left femoral arteriogram, showing circumferential intraluminal obstruction of autogenous venous bypass graft.

On April 2, 1964, under general anesthesia, the autogenous venous bypass graft was re-explored in the lower thigh. The vein was readily mobilized from about 20 cm. above the knee joint to the level of the femoral condyles. There was virtually no inflammatory reaction surrounding the vein, which exhibited excellent pulsations to a level about 6 cm. above the joint line. At this point the pulsations became dampened and a circumferential intraluminal nodule could be palpated. There was no extraluminal constriction. The point of occlusion could be positively identified as that seen on the arteriogram—1 cm. proximal to a small ligated branch.

A longitudinal phlebotomy was made over the obstructed area, exposing a firm intramural nodule of white, fibrous tissue which appeared to be covered by smooth, tan endothelium. The vein wall at this level appeared thickened to 2 to 3 mm. in diameter. The obstructing tissue was sharply excised by endophlebectomy, and a short segment of greater saphenous vein at the level of the ankle was removed and utilized as a patch-graft to widen the phlebotomy. Upon removal of the clamps there was excellent pulsation transmitted through the endophlebectomized segment, and an operative arteriogram showed restoration of normal patency with good flow into the three calf vessels (Fig. 2). The removed nodule measured $4 \times 4 \times 2$ mm. and histologically was seen to be composed of mature collagenous tissue showing some basophilic degeneration. No hemosiderin deposits or inflammatory cells were seen.

Postoperatively, the patient had an uneventful recovery, and demonstrated strong pedal pulsations and three oscillometric units in the left calf up to the time of his discharge. When last seen as an out-patient 13 months postoperatively, the patient continued to have excellent dorsalis pedis and posterior tibial pulses, and was free of symptoms of claudication.

Discussion

Endophlebectomy, for relief of venous obstruction, has been an infrequently reported procedure. This method involves direct excision of solid obstructing tissue from the lumen of a vein with primary reconstruction, but is to be distinguished from acute venous thrombectomy. The only

published reports of successful endophlebectomy refer to measures for relief of the superior vena caval syndrome. O'Neill [2] described a patient with severe "woody" mediastinitis and superior caval obstruction, in which the cava was opened and the dense fibrotic obstructing tissue was rongeured from the lumen of the vein. The vein was primarily reconstructed, with subsequent disappearance of symptoms in the ensuing year. In one of two cases reported by Blondeau *et al.*,[2] the superior vena cava was opened and the obstructing tissue, which proved to be sarcoma, was excised. The symptoms of obstruction were relieved but the patient died 1 year later of recurrent tumor.

More recently, Templeton [5] reported restoration of blood flow in the superior vena cava by "endvenectomy" in two patients. One patient with a nonspecific granulomatous mediastinitis involving the S.V.C. remained free of symptoms 3 years after operation. The second patient underwent successful excision of a mass of invasive neoplastic tissue in the superior vena cava, arising from bronchogenic carcinoma. The posterior wall of the cava, after resection of the obstructing mass, consisted entirely of neoplastic tissue. The patient remained free of symptoms for 1 year after operation, but then had a recurrence of superior caval obstruction. A second thoracotomy was performed, at which time it was observed that the residual tumor tissue within the cava, which had been left raw at the time of the previous operation, was now covered with a smooth endothelial-like surface. No thrombus was present. Endophlebectomy again afforded restoration of normal blood flow and pressures for 6 weeks, at which time the patient succumbed to widespread carcinoma.

There has been little indication for endophlebectomy of veins smaller than the cavae in terms of the functional improvement to be anticipated, since obstruction of these smaller conduits usually can be managed more effectively by indirect measures. In the unique situation described here, however, the saphenous vein was serving functionally as a conduit for arterial blood, and its partial obstruction was therefore incapacitating and justified a direct attack. Endophlebectomy of this obstructed but nonthrombosed vein appears to have been completely successful thus far.

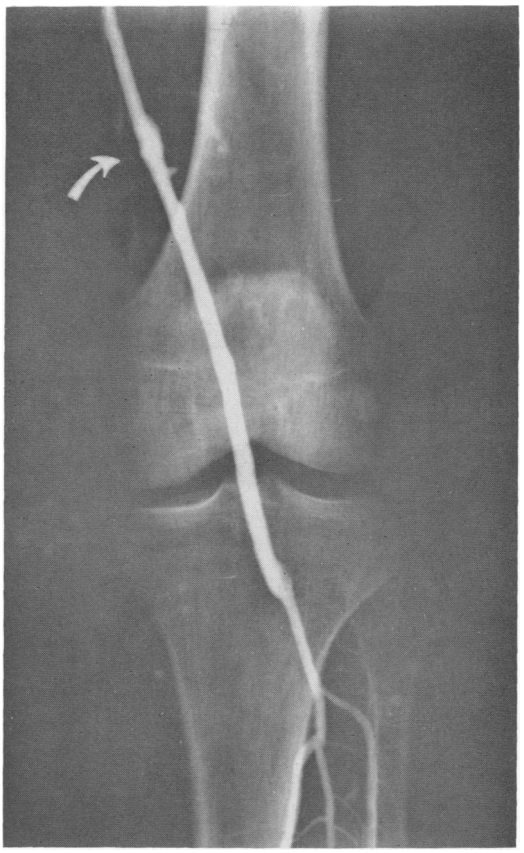

FIG. 2. Operative arteriogram, showing restoration of patency of bypass graft following endophlebectomy and venous patch-graft angioplasty.

The etiology of the obstruction in this case is not clear. There is no histologic evidence to suggest that an atheromatous process was involved. Sako and Varco [4] observed that vein grafts placed in the thoracic aorta of dogs with normal cholesterol levels develop no atheromatous lesions even after 10 years. Sako [3] further showed that even in dogs rendered hypercholesterolemic

by thyroid ablation and high cholesterol feedings, a minimum of 12 months at average cholesterol blood levels of 1,000 mg./100 cc. was required for atheromatous lesions to appear in autogenous vein grafts in the abdominal aorta and iliac arteries.

We have speculated that the obstructing fibrous nodule in the case reported here may have arisen from organization of a small thrombus at the site of one of the valve cusps in the reversed venous segment. The absence of hemosiderin granules in the excised tissue, however, casts some doubt upon this theory. It remains to be seen whether this occurrence will be duplicated more frequently with the utilization of nonreversed autogenous veins for bypass grafts.

Summary

A case is reported in which endophlebectomy and autogenous venous patch-grafting provided complete restoration of blood flow in an obstructed but nonthrombosed autogenous venous bypass graft functioning in the arterial system.

Addendum

We have recently encountered a second case requiring endophlebectomy and venous patch-graft angioplasty of a functioning autogenous venous bypass graft.

On October 13, 1964, a 54-year-old man, a dentist, was readmitted to the University of Rochester Medical Center with sudden symptomatic occlusion of a short distal femoral-to-popliteal venous bypass graft. The latter had been implanted 7 months earlier (3/5/64) in conjunction with a long thromboendarterectomy of the common femoral and proximal superficial femoral arteries down to the level of the adductor hiatus. At reoperation, after extraction of fresh thrombus from the graft through a common femoral arteriotomy by means of Fogarty catheters, a longitudinal incision was made through what appeared to be a stenotic proximal arteriovenous anastomosis. Marked hypertrophy of the posterior wall of the vein was observed, producing a longitudinal intramural ridge which severely reduced the diameter of the inflow lumen into the vein graft. The distal anastomosis appeared normal and was not opened. The hypertrophied posterior wall of the proximal portion of the vein was sharply endophlebectomized, and the phlebotomy was widened by means of an autogenous vein patch obtained from the forearm. Postoperative arteriography demonstrated patency of the graft, the popliteal artery and its three major calf branches. The patient was discharged on the twelfth postoperative day without symptoms and with strong dorsalis pedis and posterior tibial pulses. He remains symptom free with a patent graft 7 months after reoperation.

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