Arterialized cephalic vein as a femoropopliteal bypass graft: A case report

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The overall therapeutic strategy in patients with diabetes mellitus and peripheral arterial disease affecting several arterial segments is problematic. Usually, the greater saphenous vein (GSV) is the gold standard for bypass. However, alternative venous grafts may be necessary when the GSV is not available. The superficial veins of the arm are not suitable for bypass operations in most cases because of anatomical variations, inadequate diameter or very thin walls. However, arterialization of the cephalic vein can dilate and strengthen the walls, thus avoiding postoperative complications.

The use of the greater saphenous vein (GSV) as an autogenous conduit for peripheral arterial reconstruction is considered to be the gold standard (1). However, in nearly 40% of patients, the ipsilateral GSV is either not suitable or not available because of former coronary artery bypass graft (CABG) surgery or peripheral arterial bypass operations (2,3). In such situations, the use of synthetic grafts or superficial veins of the upper extremities may be necessary, particularly for secondary revascularization procedures (4-7). The advantages of autologous grafts for infrainguinal reconstructions are well known, but finding an appropriate venous graft in patients with an unsuitable or missing ipsilateral GSV is a great challenge for the surgeon (6,8,9). Alternative venous conduits are the contralateral GSV, the femoral vein, the small saphenous vein and the upper-extremity veins (10). Use of allografts has no advantages to venous grafting (11). Superficial veins of the upper extremities have been used successfully as autogenous conduits since 1969, in spite of their small diameter and fragile walls (12). However, when used as conduits for bypass operations of the lower extremities, they are prone to stenotic and aneurysmal changes (13,14). That is why some authors recommend prebypass arteriovenous shunting between the cephalic vein (CV) and the radial artery to increase the diameter and strengthen the venous wall (5,7,15).

CASE PRESENTATION

A 63-year-old man with a long history of diabetes presented to the department of vascular surgery at St Marina Hospital (Varna, Bulgaria) in May 2005 with a dry necrotic lesion at the medial aspect of the left heel that had been present for 15 days. The lesion was 4 cm in diameter, affected the skin and had no

The present patient, whose case was followed for 20 months postoperatively, suffered both from diabetes and peripheral arterial disease in a setting of gangrene and a lack of the GSV. The treatment of the patient and the problems it incurred are discussed. The advantages of preoperative temporary arteriovenous shunting to improve the quality of the cephalic vein as an alternative autogenous graft are analyzed. Currently, the patient has excellent postoperative results, with healing of the ulcers and preserved peripheral pulses.

Key Words: *Alternative venous graft, Arterialized cephalic vein; Diabetes mellitus; Femoropopliteal bypass; PAD; Peripheral arterial disease*

Figure 1) Photograph of the necrotic lesion at the initial medical examination

signs of infection (Figure 1). Four years previously, he had undergone CABG surgery. Pulses of the left popliteal artery could not be detected, and scars were observed on both lower legs, which resulted from harvesting the bilateral GSVs during CABG surgery.

The x-ray angiography of the lower extremities revealed intact aortic bifurcation, insignificant stenosis of the left iliac artery, and occlusion of the middle one-third of the left superficial femoral artery and the posterior tibial artery. The popliteal artery and the proximal part of the anterior tibial artery were patent. On the right side, the iliac arteries and the common femoral artery were slightly stenotic, with high-grade stenosis in the distal part of the superficial femoral artery, while

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Figure 2) Photograph of the provisional radiocephalic shunt

Figure 4) Explantation of the arterialized cephalic vein

Figure 3) Paleography demonstrating the arterialized cephalic vein with a diameter of 3.5 cm

Figure 5) Excision of the necrotic tissue immediately after the arterial reconstruction

the popliteal artery was patent and no tibial artery could be seen.

It was decided that a left femoropopliteal bypass should be performed, using veins from the upper extremities, due to the lack of GSV. Duplex ultrasonography revealed a CV that was 2 mm in diameter. Following a detailed analysis of the clinical picture, it was decided to postpone the operation and perform a provisional arteriovenous radiocephalic shunting procedure of the left arm to arterialize the CV (Figure 2). The negative Allen's test and duplex ultrasonography of the left upper extremity revealed patent arteries and an adequate palmar arch. Unfortunately, the patient's right ulna and radius were broken in a motor vehicle accident one month later, and he underwent osteosynthesis at the trauma unit, which delayed the arterial operation. The lesion was examined very closely during his in- and out-hospital treatment, and signs of deterioration were not detected.

In September 2005, the patient was readmitted to the department of vascular surgery at St Marina Hospital for arterial reconstruction. No vessel changes were detected at control duplex sonography of the arteries of the legs. The arterialized CV had a diameter of 3.5 mm, which was confirmed by phlebography (Figure 3). A few days later, the operation was performed under general anesthesia. A 30 cm-long segment of the CV was harvested (Figure 4) and used for reverse femoropopliteal bypass. The postoperative period was uneventful and pulses on the left popliteal artery were palpable. Excision of the necrotic tissues of the heel was performed simultaneously with the arterial intervention (Figure 5). The patient was discharged on the sixth postoperative day. Thirty days after the operation, good patency of the graft was documented (Figures 6 and 7). Moreover, on follow-up examination 20 months later, the left popliteal artery had an easily detectable pulse and the heel wound was almost entirely healed.

DISCUSSION

The anatomical variations of the superficial venous system of the upper extremities dramatically reduce the chance of providing a sufficiently long and strong vein. In the present case, the patient had an arteriovenous shunt for a period of four months.

The use of allograft in a patient with unavailable GSV and gangrene of the foot is risky in terms of graft infection.

Figure 6) Duplex ultrasound of the graft one month after the operation

The preference of a venous graft in patients with diabetes mellitus and infection is a reason to search for an alternative autogenous graft. The small diameter of the CV of our patient, documented preoperatively by duplex ultrasonography, increased the risk for bypass failure. To increase the diameter and strengthen the venous wall, a provisional arteriovenous shunting procedure was performed, resulting in arterialization of the CV.

According to the literature, infrainguinal bypasses with veins from the upper extremities are prone to stenosis and aneurysmal dilations, and therefore have a lower patency rate

Figure 7) Ultrasonographic image of the graft one month after the operation

(13,14). Therefore, the patients should be under strict follow-up that includes regular duplex ultrasonographic control and proper endovascular and surgical procedures (13,16).

Twenty months after the operation, the CV's arterialized graft was functioning adequately without any signs of stenotic or aneurysmal changes. We believe that provisional arterialization of upper extremity veins, in a limited number of patients, when the GSV is unavailable and the revascularization is not urgent, may be recommended because this technique can provide adequate graft material for arterial reconstructions.

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