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Case report

Composite venous allograft for femoro-pedal bypass grafting in critical limb ischaemia

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ABSTRACT

Background: We report a series of four patients with critical limb ischaemia and lack of autologous conduits, treated with composite (end-to-end anastomosis) allogenic fresh/or cryopreserved saphenous vein bypass grafting. This technique may be necessary in case of femoro-pedal artery bypass grafting, which is an extreme situation if there is shortage in length or inadequate quality of the venous allograft. Such a long reconstruction requires two donor saphenous veins.

Case report: Four patients were indicated for ''I-composite'' fresh venous allograft for femoro-pedal bypass grafting. One composite graft occluded 4 months postoperatively, one 21 months postoperatively, two other remained patent with median follow-up 23 months. No amputation was required in any of the patients during the follow-up.

Conclusion: Midterm patency of the reconstruction may be satisfactory provided that the ABO compatibility, short cold ischaemia time of the graft, adequate immunosuppressive therapy and proper follow-up protocol of the patient after vascular allograft transplantation are observed. Surgeons should keep in mind possibility of this technique mainly in diabetic patients with critical limb ischaemia and occluded crural vessels.

Introduction

Long bypass to the dorsal pedal or posterior tibial artery is an option to salvage an ischaemic limb in the absence of a more proximal target vessel. Allogenic transplantation of the saphenous vein graft in critical limb ischaemia represents the last resort in patients with extensive limb-threatening arterial disease where autologous conduits had been exhausted or are of insufficient quality or length [1,2]. This technique was introduced in 1948 by Jean Kunlin. Fresh or cryopreserved venous allografts may represent a solution for patients with lack of autologous conduits [3]. If there is shortage in length or inadequate quality of the venous

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allograft we recommend to use two donor veins as ''I composite'' end-to-end bypass.

Methods

There were only four patients indicated for femoro-pedal allogenic bypass grafting out of 47 arterial allogenic reconstructions (47/4 – so 8.5%) performed at our institution since the program of vascular transplantations was established in 2010 (8/2010–8/2016).

In four patients (age 67, 71, 73 and 78 years, men) an ''I-composite'' allograft venous transplantation was indicated as a last resort before amputation due to critical limb ischaemia and lack of autologous saphenous veins. Three patients suffered from foot ischaemic ulcerations and one severe rest pain. All these patients had only one suitable site of proximal anastomosis in the common femoral artery and only pedal arteries suitable for the distal anastomosis. ''I'' composite (end-to-end anastomosis) of two donor grafts may enhance the population of patients undergoing surgical revascularization both in group of critical limb ischaemia patients and group of patients undergoing surgical revascularization of myocardium, where this technique is used [4,5]. Angle of the anastomosis performed may improve the long-term patency of composite graft [6].

The patients were entered into a waiting list similar to that used for potential recipients of solid organ transplants. The ABO compatibility (but no HLA compatibility and no cross-match was performed) between donors and recipient of venous allografts was requested. Average time that patients were on waiting list of solid organ transplantations was 17 days.

Between October 2010 to June 2015, six cold-stored venous allografts that were obtained during multiorgan harvest were implanted into 3 critically ischaemic limbs of 3 patients, and two cryopreserved venous allograft were implanted into last fourth patient. The fresh allografts were cold stored (Custodiol®, Köhler Chemie GmbH, Germany) and implanted with cold ischaemia time of 6, 17, and 22 h (Figs. 1 and 2). Remaining two cryopreserved allografts were used 7 months after cryopreservation. Two saphenous veins from one donor were used for each patient. Before 2014, when program of cryopreservation for vascular allografts has started in Czech Republic, there was the only option to use fresh vascular allografts, so only in one last case were used cryopreserved grafts.

Compared to autologous and prosthetic grafts, there are minor technical differences in the surgical procedure with allogenic venous grafts – short cold ischaemia time, appropriate length and tension-free anastomosis, proper ligature of allograft side branches (through and through polypropylene suture) and avoidance of exudate collection around graft by sufficient drainage [7]. Meticulous surgical technique ''no touch the graft'' includes also avoidance of clamping allogenic tissue.

Results

An immediate postoperative immunosuppressive protocol consisting of orally administered tacrolimus with the drug blood level maintained between 4 and 7 μg/L was started. Tacrolimus was administered throughout the entire period of allograft patency and blood levels were determined periodically. Dual antiplatelet therapy was used in all cases [8].

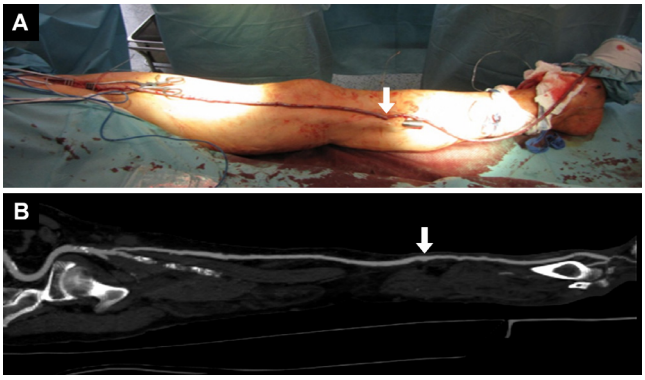

Fig. 1 – (A) Photograph of construction of a femoro-pedal bypass using an I-composite saphenous vein allograft (ABO compatibility) after completion of the proximal anastomosis. Arrow shows location of the end-to-end anastomosis between the allografts. (B) Curved planar reformation of CT angiography of a femoro-pedal bypass (I-composite venous allograft) two years postoperatively demonstrates its preserved patency. Arrow shows location of the end-to-end anastomosis between the allografts.

A follow-up visit with the vascular surgeon was scheduled during the first month after discharge and 3–6 months thereafter. Duplex ultrasound examination was performed each 6 months to detect possible significant stenosis or graft dilatation. Angiography was ordered at the discretion of the vascular surgeon.

One composite graft occluded 4 months postoperatively, one 21 months postoperatively, two other remained patent with follow-up 18 resp. 28 months. During the follow-up period leg ulcers healed in three patients. No amputation was required in any of the patients during the follow-up.

Discussion

Limb salvage and patency rates in patients with long distal allogenic bypass warrant consideration of this procedure as a last resort before limb amputation. Duplex ultrasonography is a reliable modality for detection of target pedal arteries not visualized by preoperative arteriography and it helps to reduce the number of patients with non-operable arterial occlusion disease by about 25% [9].

Clinical experience showed that venous allografts exhibit slow degenerative changes, ultimate aneurysmal dilatation, and failure as a result of slow chronic rejection [3]. The understanding of pathophysiological processes after vascular allografts transplantation is important to minimize their deterioration and to ensure good long-term patency rates.

Since 1960s led the poor clinical results of venous allografts led to experimental and subsequently to clinical use of immunosuppression in patients after allovenous graft implantation [10]. The best results were achieved with a

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