Use of the short saphenous vein graft in microsurgical reconstruction

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Vein grafts are commonly used for free tissue transfer in free flap salvage surgery, in irradiated beds after extensive tumor resection, and following high-energy trauma. In these procedures, vein grafts are employed to lengthen the pedicles of flaps to provide access to distant recipient vessels, allowing for versatile flap placement.

Most studies have focused on the use of the long saphenous vein (LSV) graft for free tissue transfer. However, we prefer to use the short saphenous vein (SSV) and preserve the LSV, which is the conduit of choice for a myriad of operations, especially coronary revascularization.

Patients

We present a series of 20 cases of microsurgical reconstruction in which SSV grafts were used in 2018, and we describe the characteristics of this graft and the harvesting technique used. This study was conducted in accordance with the ethical guidelines of our institutional review board (CIRB Ref No: 2017/2444). Written consent was obtained from patients for publication of their photographs.

Harvesting technique

The SSV is harvested with the patient in the supine position with the leg flexed. A line is drawn from the midpoint of the popliteal crease to the point midway between the posterior border of the lateral malleolus and the Achilles tendon (Fig. 1). The vein graft is harvested via a longitudinal incision in the upper aspect of the calf, where the vein is easily identified in the midline, between the muscular fascia and the membranous layer of the subcutaneous tissue [1]. Once identified, the vein is traced proximally and distally, extending the incision along the course of the vessel, and all branches are ligated as they are encountered. During harvesting, the assistant should push the patient’s calf toward the surgeon for better visualization. The most common difficulties encountered when identifying the vein is dissection in the wrong plane (the vein is found beneath the deep fascia) and loss of the bearing of the midline. The harvested vein graft is flushed to check for leaking side branches and is then kept inflated with heparinized saline between two vascular clamps. One side is marked with ink to ensure that the direction of blood flow is correct and uninterrupted by valves. The vessel is prepared by removing the adventitia to prevent strictures. The vein graft is first anastomosed to the recipient vessel; after the flap pedicle is divided, the vein graft is then trimmed to the appropriate length, and the anastomosis to the flap vessel is completed.

In 20 cases, we used SSV grafts for microsurgical reconstruction (Table 1). Vein grafts were employed to lengthen the donor vessels to reach recipient vessels outside the zone of injury or the area of tumor resection. In cases of on-table flap venous congestion, SSV grafting was used as salvage for additional venous drainage. We highlight three illustrative cases.

SSV as an extension graft to the external jugular vein for scalp reconstruction in the presence of lower limb varicosities (case 3)

An 79-year-old woman underwent scalp reconstruction for cranioplasty coverage using a latissimus dorsi muscle flap and a split-thickness skin graft (Fig. 2). The patient had a history of varicose vein stripping, and the LSV was unavailable. Microvascular anastomoses of one artery (the thoracodorsal artery to the superficial temporal artery) and one vein (the thoracodorsal vein to the external jugular vein using the SSV as an extension graft) were performed. The tunnel to the neck was created using a Dilson Luz vascular dilation wand and was kept patent with a 10-mL syringe while the pedicle was...
The superior temporal artery is an excellent artery for scalp reconstruction; however, the superior temporal vein is usually too small. Additionally, the superficial temporal vein is unreliable, as it is relatively likely to have been cauterized during previous neurosurgical operations with bicoronal or question-mark incisions. The authors of the present study often do not use the superficial temporal vein, but instead use a vein graft to the external jugular vein. This case also illustrates that the SSV is more commonly spared than the LSV in cases involving lower limb varicosities.

**SSV for second venous anastomosis in clavicular reconstruction (case 5)**

A 44-year-old woman with tuberculous osteomyelitis of the right clavicle underwent en bloc resection of the right sternoclavicular joint and the surrounding soft tissue. The clavicle was reconstructed with a fibula flap, which was anastomosed to the right subclavian artery and the right axillary vein. The SSV was used for the second venous anastomosis to the external jugular vein, which was connected to the left subclavian vein. The flap healed at 3 months postoperatively, and the patient was able to ambulate with a well-functioning clavicle.
joint. The resulting 8 × 6 cm composite defect was reconstructed with a fibular osteocutaneous flap with a 10-cm bone graft. Microvascular anastomoses of one artery (the peroneal artery to the dorsal scapular artery) and two veins (one to the external jugular vein and the other to the internal jugular vein with SSV vein grafting) were performed (Fig. 3).

Whenever possible, two venous anastomoses should be performed. However, it is important that the second vein not sabotage the first vein such that the lie of the first vein is disturbed. The use of the SSV allowed tension-free anastomoses without kinking of the vessels.

**SSV as an arterial extender (case 7)**

A 48-year-old man with a Gustilo IIIB open fracture of the left humerus complicated by osteomyelitis underwent segmental resection of the lateral diseased segment of the humerus with fibula osteocutaneous flap reconstruction (Fig. 4). A 15-cm-long segment of bone was inset to the lateral humerus and revascularized using the neurovascular bundle of the brachial artery. A 6-cm segment of the SSV was harvested from the ipsilateral leg. Microvascular anastomoses of one artery (the peroneal artery to the brachial artery using an SSV interposition graft) and two veins (one to the cephalic vein and the other to the basilic vein using LSV interposition grafting) were performed.

This case emphasizes that the SSV is a good match for the arteries of common free flaps, such as fibula, radial forearm, and anterolateral thigh flaps. The LSV is often too large and is more suitable for larger-capacitance veins, such as the peroneal and latissimus dorsi veins.

**Discussion**

The SSV is our conduit of choice due to its ease of access and suitable vessel diameter. The average width of the vein over its course is 3 mm.
Long saphenous vein and short saphenous vein for vein grafting

Advantages
- Greater length of vein graft
- Easier to harvest “Y” graft configuration where there are two veins available
- Preserves long saphenous vein
- Spared during varicose vein stripping
- Better arterial match for most muscle flaps (in thickness and diameter)
- Thin-walled and easily dilated
- Yields a better hidden posterior scar

Disadvantages
- Frequently limited by previous stripping or bypass procedures
- Often traumatized by prior venepuncture
- Thick-walled, fibrotic, and prone to spasm
- Causes scarring over ankle joint
- Posterior calf access

Table 2. Comparison of the long saphenous vein with the short saphenous vein for vein grafting

Fig. 4.
Upper limb reconstruction (case 7). (A) Reconstruction of the humerus with a fibula osteocutaneous flap. Microvascular anastomoses of one artery (the peroneal artery to the brachial artery using a short saphenous vein interposition graft) and two veins (one to the cephalic vein and the other to the basilic vein using long saphenous vein interposition grafting) were performed. (B) Postoperative result. (C) Fibula flap and short saphenous vein donor site. (D) Long saphenous vein graft donor site.
SSV grafts should be considered preferable to LSV grafts due to their ready availability, ease of preparation and harvesting, and optimal handling characteristics. The SSV graft provides a reliable adjunctive technique and is a better caliber match than the LSV for most muscle flaps.

Notes

Conflict of interest
No potential conflict of interest relevant to this article was reported.

Ethical approval
The study was approved by the Institutional Review Board of Singapore General Hospital (IRB No. 2017/2444) and performed in accordance with the principles of the Declaration of Helsinki. Written informed consents were obtained.

Patient consent
The patients provided written informed consent for the publication and the use of their images.

Author contribution
Conceptualization: J Hwee, BK Tan, Y Hattori. Data curation: J Hwee, BK Tan. Formal analysis: J Hwee, BK Tan. Methodology: Y Hattori. Project administration: J Hwee, BK Tan. Visualization: BK Tan, Y Hattori. Writing - original draft: J Hwee. Writing - review & editing: J Hwee, BK Tan.

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