Microscopic Retrograde Great Saphenous Vein Supercharge Anastomosis to Overcome Propeller Flap Congestion in Lower Limb Defect Reconstruction: A Case Report

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Abstract- Reconstruction of lower limb defects can be challenging, especially when local flaps are not feasible. While free flaps are an effective option, they are time-consuming and may not be suitable for inflamed areas. Perforator-based flaps, including propeller flaps, serve as viable alternatives to free flaps. However, venous congestion remains the most common complication associated with propeller flaps, and venous supercharging is a technique that can help mitigate this issue. This report presents a case of a 28-year-old patient with a severe knee injury who was treated using a propeller flap. The great saphenous vein was included in the flap and clipped proximally. After flap dissection, the flap was propelled to the defect, with the clipped end of the saphenous vein located at the proximal of lower limb. An anastomosis was performed between the proximally clipped end of the saphenous vein and the distal end of the saphenous vein at the proximal part of the lower limb to prevent venous congestion and ensure venous drainage in a retrograde direction (from proximal to distal). Propeller-based flaps are an excellent choice for reconstructing lower limb defects. Retrograde microscopic anastomosis of the great saphenous vein can effectively prevent venous congestion.

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Introduction

Reconstruction of lower limb defects is often challenging due to unique vascular considerations. Utilizing perforator-based flaps, such as propeller flaps, provides an effective alternative to free flaps. These flaps are advantageous as they require less surgical time and do not result in donor site morbidity (1,2). To address venous congestion, the most common complication associated with propeller flaps, venous supercharging is a viable solution. Surgeons typically include the saphenous vein (either great or less) in the flap to facilitate drainage, whether in a retrograde or antegrade manner (3). In this report, we present a more reliable method for supercharging flaps through microscopic anastomosis of the great saphenous vein to the proximal part of the saphenous vein at the defect site. This connection allows the flap to be drained in a retrograde direction without complications arising from deep venous plexus connections.

Case Report

A 28-year-old male patient was involved in a car accident and underwent open reduction and internal fixation (ORIF) of the knee. After 30 days, he was referred to the plastic surgery ward. Upon initial examination, the knee joint and distal femoral bone were exposed. The calf muscles were crushed, and there were no viable recipient vessels. Therefore, we decided to use

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a fasciocutaneous perforator flap from the thigh. The defect size measured 10 cm by 15 cm (Figure 1). The patient was planned for surgery. The preoperative vital signs were as follows: Blood Pressure: 120/80 mmHg, Heart Rate: 85 bpm, Respiratory Rate: 18 breaths/min, Temperature: 98.6° F (37° C), Oxygen Saturation: 98% on room air. Laboratory tests, including CBC, PT, PTT, INR, ESR, and CRP, were all within normal limits. Doppler ultrasound was employed to assess the vascular supply, identifying two intact perforators from the superficial femoral artery located on the medial aspect of the thigh. We chose the nearest perforator to the defect for flap elevation. The patient was placed under general anesthesia, and standard surgical protocols were followed, including careful positioning and aseptic techniques. The surgical team marked the flap design over the medial thigh, ensuring inclusion of the identified perforators. An incision was made, followed by dissection to include the great saphenous vein. The dissection was carefully carried out to maintain the integrity of the perforators and minimize damage to surrounding structures. After making the incision, the great saphenous vein was included in the flap, and dissection was performed carefully against the thigh muscles. The saphenous vein was clipped proximally. After the flap was propelled to the defect, the clipped end of the saphenous vein was located at the proximal lower limb, and an anastomosis was performed between the proximally clipped end of the saphenous vein and the distal end of the saphenous vein at the proximal part of the lower limb to prevent venous congestion. For the anastomoses, a 9-0 polypropylene suture was used (Figure 2). The anastomoses were performed using a loupe with a magnification of 2.5 times. The defect was covered with the flap, ensuring adequate tension-free closure. The donor site was closed with a split-thickness skin graft (Figure 3). After the operation, the repair site was covered with a dressing, and the patient was transferred to the ward. An antibiotic, cephazolin, was started at a dose of one gram every six hours, along with IV heparin at a dose of one thousand units per hour for five days. On the sixth day, the dressing was removed, and the flap color and capillary filling were checked again, which were completely normal. After ensuring the patient's recovery, he was discharged with an aspirin prescription of eighty milligrams daily and pantoprazole daily. The patient returned to the clinic weekly for a month, and in the one-month follow-up, the wound had completely healed.

Figure 1. Defect and donor site

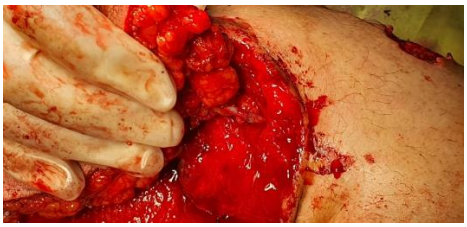

Figure 2. Anastomosis between proximally clipped end of the saphenous vein and distal end of the saphenous vein at proximal part of the leg to prevent venous congestion

Figure 3. The defect covered with flap day 20

Discussion

When managing soft tissue defects around the knee, several factors need to be considered. These include the size and depth of the defect, the condition of the surrounding tissues (especially in cases involving fractures), the status of blood vessels around the defect for free tissue transfers, and the availability of healthy muscle or fasciocutaneous tissues (1). Rao *et al*., compiled effective strategies for soft tissue reconstruction in revision arthroplasty, particularly focusing on reconstruction elevators. They provided a brief overview of all potential options and discussed their basic considerations for choosing the appropriate method (4). Lakshmi et al. treated patients, mostly involved in traffic accidents, who had soft tissue defects around the proximal lower limb near the knee. They successfully used proximally based sural flaps, which are considered a logical approach with predictable outcomes, especially with healthy vessel origins (5). Mehmet presented a case of bilateral knee injury in a child, reconstructing both knees using perforator fasciocutaneous flaps. They identified the location of perforators with a handheld Doppler, making this an acceptable method even for childhood injuries (6).

Puzzabon *et al*., reported using medial gastrocnemius muscle flaps on nine patients who had complications after total knee arthroplasty, achieving an 89% success rate except in cases of uncontrollable infections (7). Cheng *et al.*, described 28 patients with large soft tissue defects around the knee. They used perforator vastus medialis flaps to cover the defects, defining the pivot point and marking the direction of the perforator with specific anatomical lines. They successfully raised the flaps, and all of them survived (8). Papaioannou et al. reported on 16 cases of wound breakdown after total knee arthroplasty, treated with unilateral or bilateral fasciocutaneous V-Y flaps. Only one patient experienced partial flap necrosis (9). While this method is ideal for patients with healthy peripheral skin, it is less effective for those with recurrent breakdowns or traumatic injuries. In such cases, regional flaps, particularly perforator flaps, are more suitable. These flaps, well-established through detailed cadaver dissections, represent a new era in reconstruction. They have less donor site morbidity and require fewer micro-anastomoses. Although the learning curve is steep, surgeons can address challenges in severely injured limbs using these techniques.

This case report demonstrates the successful use of a fasciocutaneous perforator flap from the thigh to reconstruct a complex calf defect following a traumatic injury. The methodology highlights crucial surgical techniques and emphasizes the significance of perforator flaps in restoring function and appearance in lower extremity trauma. It also demonstrate the role of microscopic retrograde great saphenous vein supercharge anastomosis in overcoming propeller flap congestion in lower limb defect reconstruction. Further studies may expand on the versatility of this reconstructive option and its applications across varying clinical scenarios.

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