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Case Report

Reconstruction of a complex lower leg defect following oncologic resection with a combination of inferiorly based peroneus brevis muscle flap and fasciocutaneous flaps: a case report

Sumanjit S. Boro[1]*, Ashutosh Sahewalla[2], Abhijit Talukdar[1]

[1]Department of Burns and Plastic Surgery, All India Institute of Medical Science, Guwahati, Assam, India
[2]Department of Surgical Oncology, Dr B. Barooah Cancer Institute, Guwahati, Assam, India

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***Correspondence:**
Dr. Sumanjit S. Boro,
E-mail: sumanjit.boro@yahoo.in

ABSTRACT

Wounds and soft tissue defects in the distal third of the leg and ankle remain a challenge. Defects at this site will often require a flap cover. A free flap is an ideal choice for these defects but it has its limitations. The distal peroneus brevis muscle flap is a well-described flap for such defects. Peroneus brevis is an expendable muscle in the leg without much functional deficit. A 38-year-old male patient presented with a chronic ulcer in the right leg for 1year of which biopsy was positive for squamous cell carcinoma that underwent wide local excision with peroneus brevis flap reconstruction and also two local fasciocutaneous flaps. The distally based pedicled peroneus brevis muscle flap is an economical, reliable, and relatively easy procedure for treating defects of the heel, Achilles tendon, and medial and lateral malleolus, extending deep into the ankle.

Keywords: Flap, Lower limb reconstruction, Peroneus brevis

INTRODUCTION

Lower extremity, ankle and foot soft tissue defects with or without bone defects often require vascularized flap coverage. Due to less soft tissue anatomically and limited blood supply, the amount of locally available skin is very limited.

Free flaps have become a routine procedure, especially when large and complex defects have to be addressed.[1] Local flaps may be a good option when local conditions or systemic diseases limit an extended operation time or when microsurgical expertise is absent. Proximally based pedicled local flaps have a limited arc of rotation and are not good candidates for the reconstruction of defects in the lower third of the leg, ankle, or foot.

Here we describe the use of a distally based peroneus brevis flap where a free flap was not suitable due to logistic issues.

This flap can be quickly and reliably harvested as the anatomy is relatively constant and the donor site poses no clinical or functional problem.[2-5] The muscle has been successfully applied for coverage of small and moderate-sized defects of the heel, Achilles tendon, medial and lateral malleolus, extending deep into the ankle, covering exposed osteosynthesis material, bone and tendons.[6] Although free flaps avoid the adjacent cosmetic donor defects, commonly used free flaps often produce a bulky ankle when subcutaneous fat is included except in very thin patients.[7]

CASE REPORT

A 38-years-old male who is an electrician by profession came with a history of ulcers in his right leg for 1 year. The patient gives a history of earlier surgery in 2019 of which details were not available. The patient had no comorbidities. On examination, there was an ulcer of size 7×7 cm over the anteromedial aspect of the right leg. There

was a scar from previous surgery (Figure 1). A biopsy of the ulcer showed squamous cell carcinoma. Local imaging had doubtful infiltration of bone. So image-guided bone biopsy was done which was found negative for malignancy. The rest of the systemic examination was normal and there was no metastasis.

Figure 1: Ulcer over the right leg.

Three options were available including free flap, cross leg flap, and local peroneus brevis flap. The patient did not agree to a free flap. Cross-leg flap has its comorbidities with the patient being restricted to bed for at least 4 weeks. So, patient was planned for peroneus brevis flap reconstruction.

The patient was taken up for surgery where he underwent wide local excision (resulting defect was 11×8 cm) (Figure 2) followed by peroneus brevis flap reconstruction plus two small inferiorly based fasciocutaneous flaps as the defect size was big enough to be covered with peroneus brevis flap alone (Figure 3). The postoperative period was uneventful and the patient had a smooth recovery.

Figure 2: Defect following wide local excision.

Surgical procedure

The patient is kept in a supine position throughout the operation. The foot rests on a small sandbag with the knee in 60-70° of flexion to prevent the foot from sliding down and allow the ankle to rest in plantar flexion and to relax the peroneus muscles and allow easy access to the peroneus brevis, lying deep to the peroneus longus.

When the distally based flap is planned, initially 6-8 cm is kept from the lateral malleolus to ensure inclusion of the distal constant peroneal artery perforator. While raising the distal flap from proximal to distal, it is customary to keep any perforators of significant size in the distal half of the muscle. After the release of the tourniquet, the muscle is moved to its eventual site in stages while clamping these branches sequentially from proximal to distal and repeatedly checking muscle perfusion, then ligating or cauterizing them, until the muscle is in position. During dissection, between the brevis muscle and the anterior septum, it is also necessary to identify and preserve any significant branches of the anterior tibial vessels perforating the anterior septum distally and leave these intact to enhance the vascularity of the distally based flaps. During this part of the dissection, care must be taken to protect the superficial peroneal nerve, which lies between the muscle and the anterior septum before passing through the fascia in the middle of the leg to enter the subcutaneous fat.

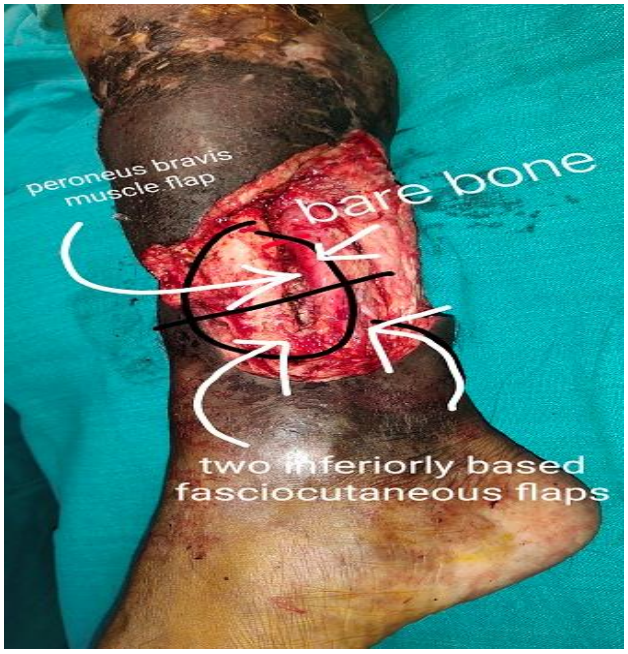

Figure 3: Planning of flap.

Figure 4 (a and b): Post-flap reconstruction.

Finally, the muscle is moved to the defect either by incising the skin bridge, which is done mostly for lateral malleolar defects, or by tunneling subcutaneously, which, is done mostly for defects over the tibia and anterior ankle. We have done tunneling of the peroneus brevis flap. While setting the muscle, care is taken to anchor the deep surface of the muscle to the wound while protecting the axial vessel on this surface. A split skin graft is then applied to the superficial surface of the muscle (Figure 4a and b). Immediately after surgery, all of these reconstructions are protected in a plaster of Paris ankle slab.

DISCUSSION

Fasciocutaneous or neurofasciocutaneous flaps from the leg are useful and versatile reconstructive options for patients with moderate-sized soft tissue defects of the leg, ankle, and foot. Although a considerable number of local or free flaps have been successfully described to surgically reconstruct these defects each case needs the optimal indication for the most suitable flap procedure.[8-14] The plethora of local fasciocutaneous flaps of the leg, adjacent to the ankle may provide the cover, but mostly leave a bulky ankle with significant donor defect.[15] Most of these flaps are perforator based and the position of the perforators is not constant.

Peroneus brevis muscle flap has a unique pattern of vascularity. Several authors have considered it to be either a type II or type IV muscle in respect of its vascularity.[16-20] However, its survival as either a proximally based or distally based flap, often on a single (but different) perforator makes it, by definition, neither type II nor type IV. Cadaveric angiography studies have shown that as long as one pedicle is maintained complete filling of the muscle can be accomplished.[21] This may be due to the very unusual axial vessel system on the posterior aspect of the muscle, linking the perforators. Most previous publications make no mention of this axial vessel or mention it only in passing.[22]

This muscle flap is raised easily either proximally or distally based pedicle. Proximally based peroneus brevis flap is used to cover small defects of the distal third of the tibia to the ankle. The distally based flap can be raised with a segment of the vascularized fibula if needed which is used to cover defects of the lateral malleolus and tendoachilles, even in older patients. When used for defects of the leg or ankle the muscle is initially bulky and undergoes auto-thinning with time. As the muscle atrophies, it provides better aesthetic results than local fasciocutaneous flaps. This has particular value around the ankle as the reconstruction is less likely to interfere with footwear. Several studies have shown that the loss of peroneus brevis, with peroneus longus being still functional, does not cause instability of the ankle.[15,23]

The peroneus brevis flap receives blood supply from peroneal artery and retrograde perfusion from posterior tibial artery. Yang et al recommend preservation of attachment of the muscle to the distal 6 cm of the fibula which ensures the preservation of its blood supply.[24]

The average length of peroneus muscle is 25 cm and as much as 19 cm of this muscle can be mobilized to cover defects that are distal to the fibular tip. However, the dissection should stop when the muscle is sufficient to cover the defect to preserve as many distal pedicles as possible. Bach et al have demonstrated that peroneus brevis flap is viable in patients with severe vascular risk factors and those who are older and that it can cover skin defects of up to 60 cm^2.

All patients have the cosmetic problem of the linear scar on the lateral aspect of the leg. However, this scar narrows with time and becomes difficult to see in a hairy male leg. There is no indentation from loss of muscle bulk. Although this feature has been commented upon often, the combined cosmetic advantage of very little donor defect of the distal third of the leg and little swelling at the ankle needs particular emphasis when the local alternatives currently being used are almost all fasciocutaneous flaps, which leave very conspicuous grafted donor sites with significant contouring defects, immediately proximal to the ankle, as well as a swollen ankle.

Sahu et al concluded that a distally based peroneus brevis muscle flap is a safe option with reliable anatomy for small to moderate-sized defects following low-velocity injury around the ankle.[25] Thammannagowda et al in their study found that distally based peroneus brevis flap (DPBF) is reliable for lower third leg defects of moderate size.[26] It gives a good functional outcome, and DPBFs have a good aesthetic appearance at the donor site and recipient site. DPBFs have the advantage of the ease of surgery, speedy recovery, less hospital stays, and no donor site morbidity. DPBFs appear to be the preferred choice for Lower third leg defects. Horch et al concluded that the peroneus brevis muscle flap can be a valuable tool to reconstruct small to medium-sized defects at the ankle, distal tibia, and heel with acceptable donor site morbidity.[27] Despite the easily available variety of free flaps to achieve this purpose, still proper indications remain where a local flap can be a viable option in the hand of experienced plastic surgeons.

CONCLUSION

Distally based peroneus brevis flap remains a valuable option for reconstruction of full-thickness defects in the distal lower leg when routine use of free flaps is not indicated. Peroneus brevis muscle flap is an economical, reliable, and relatively easy procedure. The ease of raising the muscle flap and the elimination of the need for microsurgical expertise are the major advantages of this technique. Vascular integrity of the affected leg is a prerequisite, and if local perfusion is compromised by peripheral vascular disease, failure rates are higher. In such cases the use of free flaps with vascular reconstructions and optimization of blood flow is advocated.

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