

# Distally Based Peroneus Brevis Muscle Flap for Reconstruction of Defects around the Ankle – A Retrospective Study

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## Abstract

**Background:** Soft-tissue defects in the lower leg and ankle are a major problem for the reconstructive surgeon. Muscle flaps bring in vascularity to the region of the defect and peroneus brevis muscle flap is a well-vascularized muscle that is used to cover defects around the ankle as a distally based flap. Peroneus brevis is a muscle in the lateral compartment of the leg which is muscular throughout its length and is expendable without any functional deficit.

**Materials and Methods:** This was a retrospective study of 10 cases of distally based pedicled peroneus brevis muscle flaps used for coverage of defects of the lower leg and ankle between July 2018 and June 2021. There were nine males and one female with an average defect size of 5 × 5 cm.

**Results:** The average flap length was 11 cm. The flap with split-thickness skin graft was well settled in eight patients but two patients had partial skin graft loss which settled by conservative management.

**Conclusion:** The flap is simple to harvest and safe for the reconstruction of small-to-moderate-sized skin defects of the distal third of the tibia and all parts of the ankle as it has a reliable vascular supply. It provides a good cosmetic with a linear scar over the lateral aspect of the leg.

**Key words:** Distal third leg defects, Muscle flap, Peroneus brevis

## INTRODUCTION

Defects in the lower leg and ankle are challenging for a plastic surgeon. A number of methods for lower leg reconstruction are available including local cutaneous flaps, fascial or fasciocutaneous flaps, muscle flaps, the reverse sural artery island flap, lateral supramalleolar flap, reverse adipofascial flap, and free

tissue transfer.<sup>[1-4]</sup> Reconstruction of the distal third of the leg is associated with high complication rates due to the paucity of reliable local flaps. Local flaps are not always suitable for covering defects in the lower leg because of the limited radius and hence arc of rotation.<sup>[5]</sup> Microvascular surgery is of long duration and requires microsurgical expertise.<sup>[6]</sup> The peroneus brevis muscle flap has been proven to be a good local flap for small defects of the lower leg and ankle.<sup>[7,8]</sup> This muscle was first described by Pers and Medgyesi and this flap has become an established workhorse in reconstructive procedures of the lower leg.<sup>[9]</sup> Barr and Saydam have mentioned the reliability of distally based peroneus brevis muscle flaps.<sup>[10-12]</sup>

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www.surgeryijss.com

Month of Submission : 01-2021  
Month of Peer Review: 02-2021  
Month of Acceptance : 03-2021  
Month of Publishing : 04-2021

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## MATERIALS AND METHODS

This is a retrospective study of 10 cases who underwent peroneus brevis muscle flaps between July 2018 and June 2021. There were six cases of post-traumatic defects, three were post-infective, and one post-surgical raw area exposing the underlying tendons or the ankle joint. The flap was based on the distal perforators of the peroneal artery. The donor sites in all the cases were closed primarily over suction drains. All cases were followed up postoperatively from a minimum of 8 months to a maximum of 14 months.

## RESULTS

Ten cases underwent peroneus brevis muscle flap with split-thickness skin graft between July 2018 and June 2021 of which nine were males and one was a female. The age group varied from 24 to 53 years with a mean age of 36 years. The flap length was usually about 10–11 cm. The mean harvesting time was 50 min (range 40–65 min). There was complete flap survival in all patients with two patients having partial graft necrosis which settled conservatively. The donor areas of all the patients healed well with a vertical linear scar. The average hospital stay ranged from 5 to 9 days. Representative cases are shown below [Cases 1 and 2].

## DISCUSSION

A variety of local fasciocutaneous flaps of the leg are available for reconstruction of the ankle but mostly leave a bulky ankle with a significant donor defect immediately adjacent.<sup>[13,14]</sup> Most of these flaps are perforator based, particularly on the lateral side which is not constant. They may also have been damaged in the primary injury. This muscle flap is easily raised, whether pedicled proximally or distally. The proximally based peroneus brevis as a pedicled muscle flap was first described by Pers and Medgyesi in 1973.<sup>[9]</sup> Eren *et al.* in 2001 described the use of the distally based peroneus brevis flap for reconstruction around the ankle.<sup>[15]</sup> Schmidt and Giessler in 2001 provided the main contribution to the literature on this flap of about 109 reported cases.<sup>[16]</sup> Many studies have shown that the removal of the peroneus brevis, with the peroneus longus still functional and intact, does not cause ankle instability.<sup>[13,17]</sup> All patients have a linear scar on the lateral aspect of the leg which is cosmetically acceptable, especially in a male with a hairy leg. There is also no indentation from loss of the muscle bulk. The advantages of the peroneus brevis muscle is that the donor site can always be closed primarily with a thin inconspicuous scar over the lateral aspect of the leg, which is cosmetically acceptable, the flap is very malleable and can fill a defect; and the flap is reliable especially in high-

risk patients.<sup>[15,16-24]</sup> In addition, it can be harvested as a composite flap with a segment of fibula as a vascularized bone segment for use as a free flap with very low donor-site morbidity.<sup>[16]</sup> Lyle and Colborn have reported the use of the transposed peroneus brevis muscle flap to cover a limited defect of 3 cm at the distal third of the leg.<sup>[25]</sup> Hughes and Mahoney demonstrated that the flap could cover 4 cm above the lateral malleolus and 2 cm above the tip of the fibula.<sup>[26]</sup> El-Khatib has mentioned that a longitudinal vertical split of the peroneus brevis muscle allows for the coverage of medium-sized defects of up to 7 cm.<sup>[27]</sup>

The peroneus brevis muscle is deep to the peroneus longus muscle originating from the junction of the upper and middle third junction of the lateral surface of the fibula. It is muscular up to, and sometimes beyond, the lateral malleolus and is inserted into the base of the fifth metatarsal. In the literature, it is described as both type II and type IV muscle based on its vasculature. Proximally, the neurovascular bundle enters the muscle within 2–4 cm of the upper end of the muscle. Several branches from peroneal vessels pierce the posterior septum and supply the muscle. It receives a few branches from the anterior tibial artery also. The superficial peroneal nerve traverses the compartment on the anterior surface of the muscle, which is easily identified and separated from the muscle up to the point of the middle of the leg where it pierces the anterior septum to become subcutaneous. All the procedures were performed under tourniquet control and regional anesthesia. All patients were put in a lateral decubitus position throughout the surgery. The incision is made just posterior to the line of the fibula and deepened through the deep fascia to expose the peroneal compartment. It is easy to identify the peroneus longus tendon overlying the brevis tendon distally and separate the longus from the brevis from distal to proximal. The axial vessel system vital to the viability of the peroneus brevis flap is on the posterior surface of the peroneus brevis muscle close to the posterior septum and has to be identified and protected. Small branches of this vessel system to the longus muscle are cauterized to leave the axial vessel system supplying the peroneus brevis intact. Immediately anterior to this axial vessel is the attachment of the brevis muscle to the lateral surface of the fibula. It is important that the fibular periosteum is not raised with the muscle as this may give rise to heterotrophic ossification. Three of 14 muscular branches from the peroneal artery in the posterior compartment perforate the posterior septum to enter the posterior surface of the peroneus brevis muscle. A constant perforator to the muscle lies 6–8 cm from the lateral malleolus which is the main pedicle of the distally based flap in all of our cases. Between these constant perforators and beyond the distal constant perforator are a variable number of perforators, also arising from the peroneal artery.<sup>[15]</sup> During dissection,



**Case 1:** Post-infective raw area – left foot. (a) Post debridement. (b) Peroneus brevis muscle flap elevated and covered over the exposed tendons (c) Flap and residual raw area covered with SSG. (d) Late post OP



**Case 2:** Post-infective – exposed tendoachilles. (a) Exposed tendoachilles - post infective. (b) Post Debridement. (c) Peroneus brevis muscle flap elevated and covered over the exposed tendons. (d) Late post OP - managed conservatively

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. Finally, the muscle is moved to the defect either by incising the skin bridge or by tunneling subcutaneously. The muscle is inset with delayed absorbable sutures and a split skin graft is applied to the superficial surface of the muscle.

## CONCLUSION

The distally based peroneus brevis muscle flap is a safe and reliable for small-to-medium-sized defects around the ankle. It brings in more vascularity to the region and is used to fill in defects. There is no secondary functional

deformity following removal of this muscle and the donor site scar is esthetically acceptable.

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**How to cite this article:** Jayachandiran AP, Mahipathy SRRV, Durairaj AR, Sundaramurthy N, Rajendran S. Distally Based Peroneus Brevis Muscle Flap for Reconstruction of Defects around the Ankle – A Retrospective Study. *IJSS Journal of Surgery* 2021;7(2):24-27.

**Source of Support:** Nil, **Conflict of Interest:** None declared.