

Distally pedicled peroneus brevis muscle flap: a versatile lower leg and foot flap

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ABSTRACT

Introduction: The purpose of this study was to evaluate the outcome of our early experience with the distally pedicled peroneus brevis flap in the management of soft tissue defects of the lower leg, ankle and foot.

Methods: This was a non-randomised, retrospective study involving five patients who were treated with the peroneus brevis muscle flap for soft tissue defects over the lower leg.

Results: In all five patients, the flaps were viable and successful in providing satisfactory soft tissue coverage for the defects. In one diabetic patient, distal flap necrosis was observed, which was treated successfully with a local rotational skin flap.

Conclusion: The distally pedicled peroneus brevis muscle flap is an economical, reliable and relatively easy procedure for treating defects of the distal third of the leg, ankle and foot.

Keywords: flap, lower limb reconstruction, peroneus brevis

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INTRODUCTION

Skin and soft tissue coverage for defects in the distal third of the leg, ankle and foot has always posed a challenge, as this area is more susceptible to skin and soft tissue loss. Tendons and bones are commonly exposed, which predisposes them to delayed healing and infection. Free flaps have been used to manage these defects, with good results, but they require microsurgical expertise and have a higher complication rate than loco-regional flaps.⁽¹⁾ On the other hand, pedicled flaps, such as the sural neurocutaneous flap, soleus and gastrocnemius flaps,^(2,3) have been widely employed since the 1980s. However, these flaps are more useful for defects in the mid and upper leg. The lower leg and foot continue to be a source of concern for surgeons, especially in cases of acute trauma with significant soft tissue defects. An ideal flap



Fig. 1 Photograph shows the defect over the Achilles tendon.

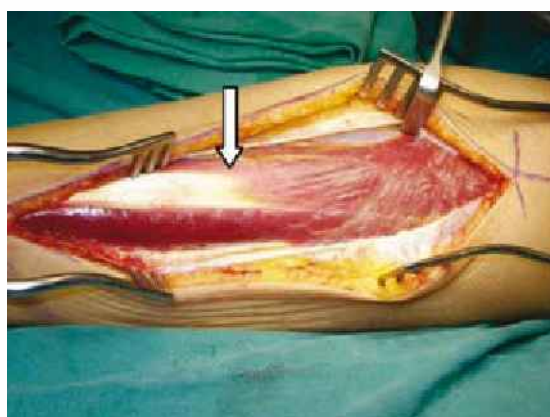


Fig. 2 Photograph shows the peroneus brevis muscle (arrow) being identified.



Fig. 3 Photograph shows the dissection and elevation of the flap.

should be technically easy to harvest, reliable and have a high success rate with minimal donor site morbidity. The distally pedicled peroneus brevis muscle flap is a

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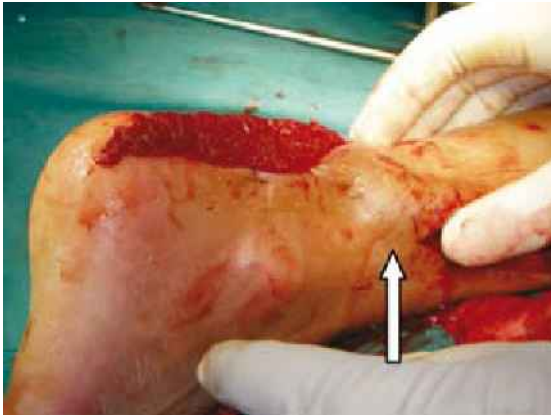


Fig. 4 Photograph shows the flap tunneled through the bridge of skin to cover the defect.



Fig. 5 Photograph shows the flap anchored to the wound edges.



Fig. 6 Photograph shows the results after delayed split skin grafting.



Fig. 7 Photograph shows the donor site scar at three months postoperation.

simple and quick procedure that has shown good results in covering defects in the distal leg region.⁽⁴⁾ The purpose of this study was to evaluate the outcome of our early experience with this novel flap in the management of soft tissue defects of the lower leg and foot.

METHODS

This was a non-randomised retrospective study involving the first five consecutive patients who were operated on from November 2006 to March 2009. All the patients had soft tissue defects over the lower leg and were managed with a distally based peroneus brevis muscle flap. The inclusion criteria were the presence of a soft tissue defect over the lower leg or foot which required a flap, the presence of palpable distal pulses, a clean wound bed and the absence of infection.

All the patients underwent wound debridement and subatmospheric wound dressing with a vacuum-assisted closure device (VAC) prior to peroneus brevis flap surgery. The harvesting of the peroneus brevis muscle flap was performed using the technique described by

Eren et al.⁽⁴⁾ The incision was made 1 cm dorsal to the fibula axis (head of fibula to fibular tip), from the turning point of the flap to the upper third of the fibula. The distal pedicles were preserved within 6 cm of the distal fibular tip to preserve the most distal pedicles.⁽⁵⁾ Following the elevation of the flap, the proximal muscle belly was then rotated to cover the distal defect. It may even be tunneled under an intact bridge of skin, if necessary. The flap was then anchored to the wound edges with absorbable sutures, and the tourniquet was released to assess the viability of the flap. A VAC dressing was applied at 125 mmHg in continuous mode. The flap was inspected after three days and continued on three-day cycles of VAC dressing. A split skin graft was then performed on the granulating wound 7–9 days after the flap surgery. Two patients (Cases 1 and 5) underwent primary split skin grafting and did not receive VAC treatment. The lower limb was immobilised with a plaster slab for a minimum of two weeks and the duration of immobilisation was prolonged based on the associated pathologies. The patients were followed up regularly after two weeks, six

Table I. Patient summary.

Patient no.	Age (years), gender	Diagnosis	Size of defect (cm)	Additional diseases	Procedure	Complications	Final outcome
1	32, M	Open fracture of the right tibia, fibula and medial malleolus with skin defect over the medial aspect of distal leg.	3 × 3	None	Open reduction and internal fixation of the right tibia, medial malleolus and distally pedicled peroneus flap.	SSG failure treated by re-grafting.	Successful
2	57, F	Chronic posterior heel wound after right Achilles tendon repair.	2 × 2	Diabetes mellitus; Hypertension	Distally pedicled peroneus brevis flap.	Distal flap necrosis treated by local rotational skin flap closure.	Successful
3	60, F	Failed calcaneal avulsion fixation with skin necrosis at the posterior heel.	5 × 5	Hypertension	Calcaneoplasty, reconstruction of bone tendon junction and distally pedicled peroneus brevis flap.	None	Successful
4	36, F	Open posterior heel wound with Achilles tendon defect.	5 × 3	None	Right flexor hallucis longus tendon reconstruction of Achilles tendon defect and distally pedicled peroneus brevis flap.	None	Successful
5	42, F	Lateral malleolus ulcer extending to the lateral edge of Achilles tendon.	6 × 4	Diabetes mellitus	Distally pedicled peroneus brevis flap.	SSG partial failure; healing by granulation tissue.	Successful

M: male; F: female; SSG: split skin graft

weeks, three months, six months and one year. They were examined for the viability of the flaps, the presence of residual defects and ankle eversion weakness.

RESULTS

The mean age of the patients was 45.4 (range 32–60) years. One patient was male and four were female. The location of the defect was over the Achilles tendon ($n = 3$), medial malleolus ($n = 1$) or lateral malleolus ($n = 1$). The size of the defects ranged from 4–25 cm². Two patients (Cases 1 and 5) underwent primary split skin grafting after the flap was applied. The split skin graft took poorly, and a repeat skin grafting was required for Case 1, which was subsequently successful. In Case 5, partial split skin graft failure (40% take) was observed, and wound healing was achieved by granulation. For all the other cases, split skin grafting was performed as a secondary procedure after a period of VAC dressing so as to promote granulation tissue regeneration at the wound bed. Another patient (Case 2), who was a diabetic, had a residual 5 mm × 5 mm skin defect due to distal necrosis of the peroneus brevis flap. This patient was successfully treated with a local rotational skin flap. In all five cases, the flaps were viable and successful at providing satisfactory soft

tissue coverage for the defects (Table I). All the patients recovered well with no significant disability. The donor site surgical incision was closed primarily in all the cases, with no morbidity.

DISCUSSION

The challenge of soft tissue coverage for defects in the lower leg and foot is an ongoing one. The use of local muscle flaps is an anatomical impossibility in this region, as this region is devoid of large mobile muscle bellies. Free muscle flaps have consistently provided good results in the coverage of defects in the distal third of the leg. However, this technique demands microsurgical expertise, longer operating hours, the need to sacrifice a major vessel in the tibial region and higher costs.^(6,7) There are also specific complications associated with free flaps.

Pedicled fasciocutaneous flaps, such as the sural flap, have been a popular choice due to their wide rotation arc and the ease of dissection. The complications associated with this technique include venous congestion, a loss of sensation in the area of sural nerve function and aesthetic impairment.^(8,9) The soleus muscle flap has been useful in treating small to moderate sized defects but is limited by

its small distal rotation arc.⁽²⁾

The distally based peroneus brevis muscle flap is a fast, economical and simple alternative. Several studies have examined the clinical application of this muscle flap and have shown good, reliable and reproducible results.^(5,10,11) Nonetheless, distal flap necrosis requiring further reconstruction has been reported.⁽¹²⁾ The peroneus brevis flap is classified as a Type IV flap because of its segmented vascular pedicles,^(5,13) which may limit mobility. It receives a retrograde perfusion from the posterior tibial artery, besides receiving blood supply from the peroneal artery. Yang et al have recommended the preservation of the attachment of the muscle to the distal 6 cm of the fibula.⁽⁵⁾ This ensures the preservation of its blood supply. As the average length of the peroneus muscle is 25 cm, as much as 19 cm of muscle can be mobilised to cover defects that are distal to the fibular tip. However, the dissection should stop when the muscle is sufficient to cover the defect in order to preserve as many distal pedicles as possible.

Bach et al have demonstrated that the peroneus brevis flap is viable in patients with severe vascular risk factors and those who are of older age, and that it is able to cover skin defects of up to 60 cm². The same study also suggested several negative predictors of the outcome of the flap, such as vascular risk factors, the age of the patient, the arc of rotation and kinking of the pedicle area, tissue trauma secondary to accidents or irradiation.⁽¹¹⁾ In this series, we had two diabetic patients with a viable flap. Although distal flap necrosis occurred in one of them, this was resolved with minimal morbidity.

In our experience, we found that by avoiding primary split skin grafting, applying a VAC dressing and split skin grafting on granulation tissue produced superior results. This is likely due to better wound bed conditioning and the proliferation of granulation tissue after VAC therapy.^(14,15)

In conclusion, the distally based peroneus brevis muscle flap is an economical, reliable and relatively easy procedure for treating defects of the distal third of the leg, ankle and foot. The ease of raising the muscle flap and the elimination of the need for microsurgical expertise are the major advantages of this technique. This technique

enables adequate and predictable soft tissue coverage for small to moderate sized defects in the lower leg and foot.

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