

Muscle and Fasciocutaneous Flaps for Lower Extremity Limb Function Preservation

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Statement of Purpose

The purpose of this case study was to showcase the utility of both the peroneus brevis muscle (PBM) and medial plantar artery (MPA) fasciocutaneous flaps for use in limb salvage of the lower extremity. We aim to show the function that these flaps provide even in the severe diabetic and neuropathic patients. This case study displays the workup, intra operative findings and management of complications to a successful outcome.

Patient History

53 year old female. PMH DM (A1c 13%), HTN, Stroke with left lower extremity weakness. Presented with right heel gangrene, calcaneal osteomyelitis and Strep Anginosus bacteremia (Fig. 1). Palpable pulses, Biphasic ABIs. Protective sensation absent. WIFI score 303; High risk for amputation³.

Procedures & Course

- 05/28 & 06/01/18 I&D with partial calcanectomy (Fig. 1). Clean margins of calcaneus obtained. PMMA Abx beads, wound VAC and IV Antibiotics. Post debridement (Fig. 1c&d).
- 07/18/18 I&D in preparation for flap, Bone Biopsy; Pseudomonas in new clearance margins → Cefepime.
- 07/21/18 Attempted reverse sural fasciocutaneous flap, compromised by patient O2 desaturation in prone. Intra-operative decision to move patient to lateral decubitus and pursue a distally based peroneus brevis muscle (PBM) flap (Fig. 2a). Intra operatively, fluorescent imaging with indocyanine green (ICG) was used to visualize perfusion of PBM which was excellent (Fig. 2b). Flap was covered with a bilayer wound matrix xenograft (Fig. 2c). Application of external fixator to provide off-loading and to prevent flap excursion (Fig. 2d). Heparin and Plavix initiated.
- 07/26/18 Elevation of medial plantar artery (MPA) fasciocutaneous flap (Fig. 3a). Perfusion noted to be poor with ICG (Fig. 3b), flap was placed back into donor site in suspicion of vasospasm (Fig. 3c). Concern for venous congestion; transferred to ICU for q1h Doppler checks and leech therapy for 5 days (Fig. 4b) to aid in reducing venous congestion. Hematoma formation on MPA (Fig. 4a).
- 08/16/18 MPA flap transposition and inset over PBM on heel (Fig. 4c). Application of bilayer wound matrix xenograft over MPA donor site with wound VAC application. Dangle protocol¹ initiated.
- 09/20/18 Removal of bilayer grafts from the lateral aspect of PBM flap and MPA donor site. Split thickness skin graft application to exposed PBM & MPA donor site (Fig. 5a). Removal of external fixator. Wound VAC application over split thickness skin grafts.
- Current; Patient healed (Fig. 5b) and fully ambulating with only the assistance of a patellar tendon weight bearing brace.

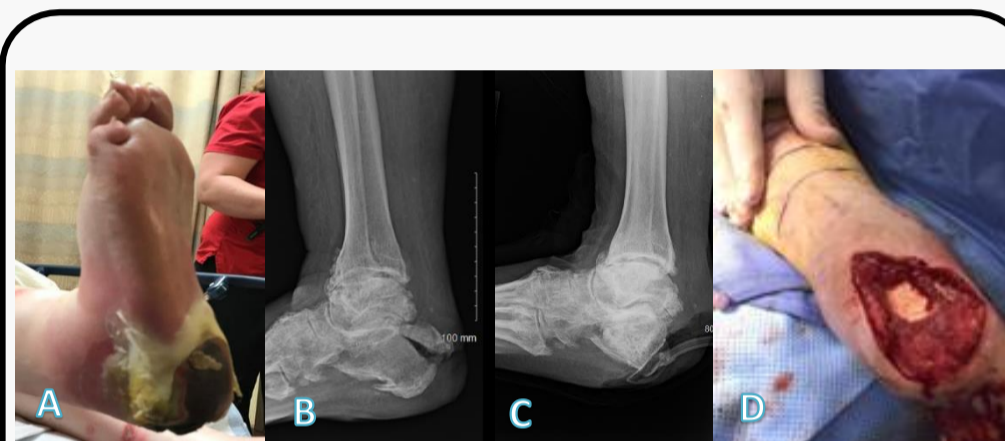


Fig. 1a Wound presentation. Gangrene of the right posterior/plantar heel.
Fig. 1b X-ray of Pathological fracture of calcaneus.
Fig. 1c Post op X-ray of partial calcanectomy with wound VAC intact.
Fig. 1d Post op posterior/plantar heel with exposed calcaneus.

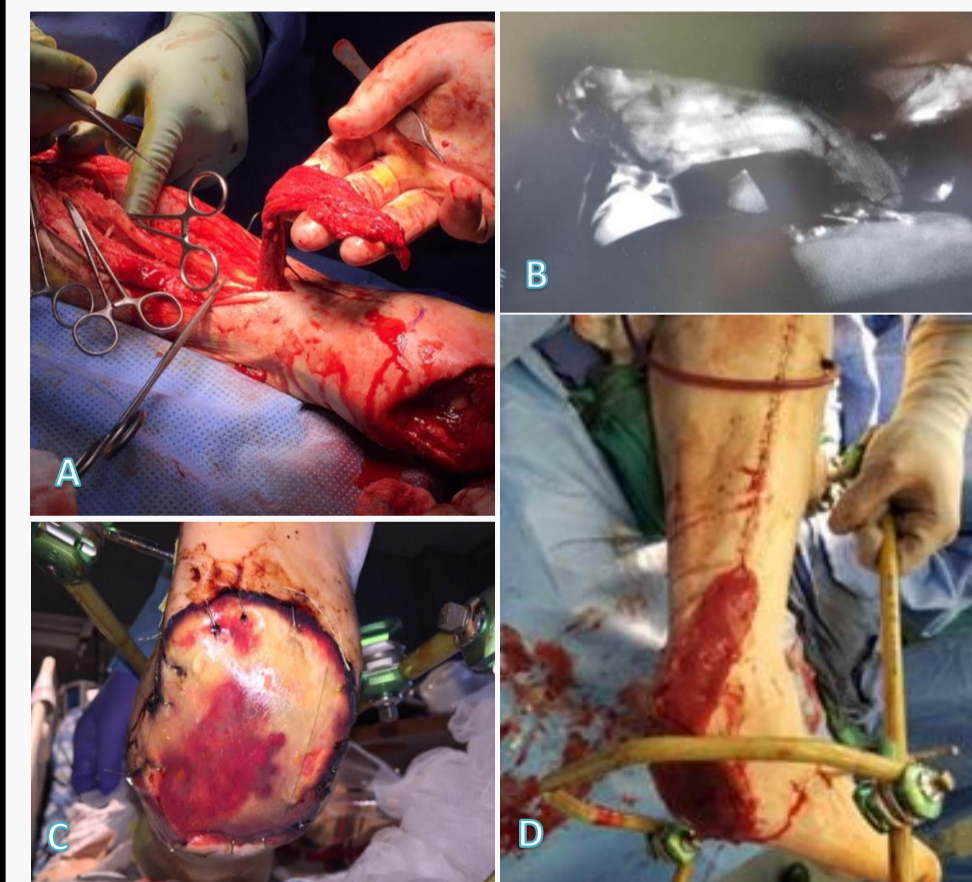


Fig. 2a Distally based peroneus brevis muscle (PBM) flap elevation.
Fig. 2b Fluorescent imaging with indocyanine green (ICG). Intra op. Perfusion visualization noted to be excellent.
Fig. 2c Inset of PBM into the posterior/plantar heel wound, covered by bilayer wound matrix xenograft
Fig. 2d Posterior-lateral view of PBM flap with application of external fixator.

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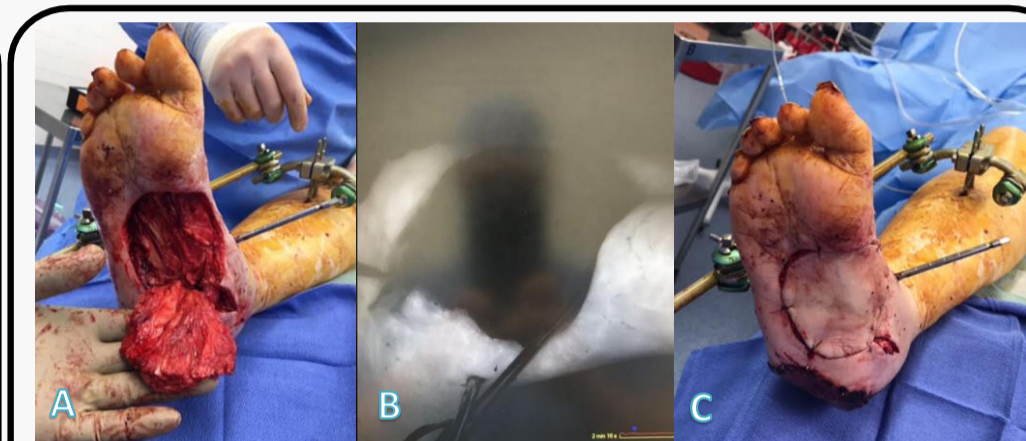


Fig. 3a Elevation of medial plantar artery (MPA) Fasciocutaneous flap.
Fig. 3b Fluorescent imaging with ICG perfusion visualization; Noted to be poor.
Fig. 3c Flap placed back into donor site.

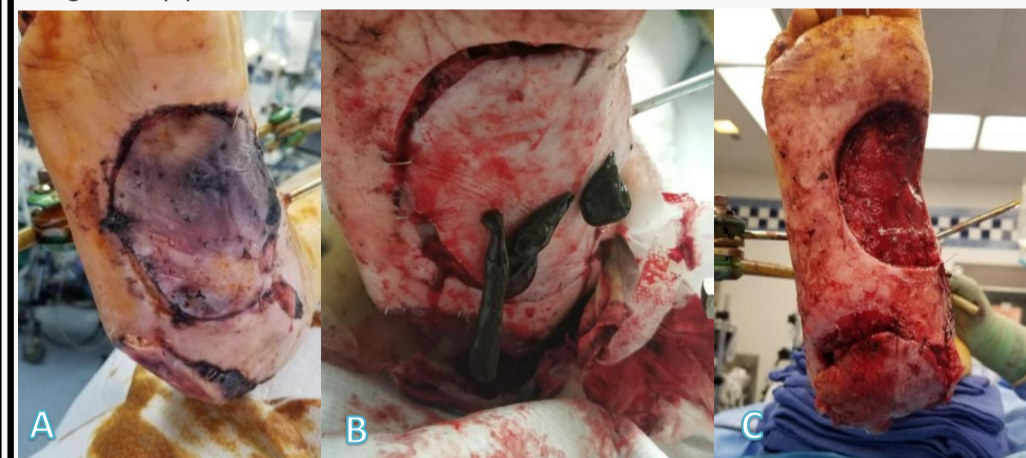


Fig. 4a Venous congestion and hematoma formation on MPA.
Fig. 4b Leech therapy to aid in reduction of venous congestion and vasospasm.
Fig. 4c Rotation and inset of MPA over PBM on heel.

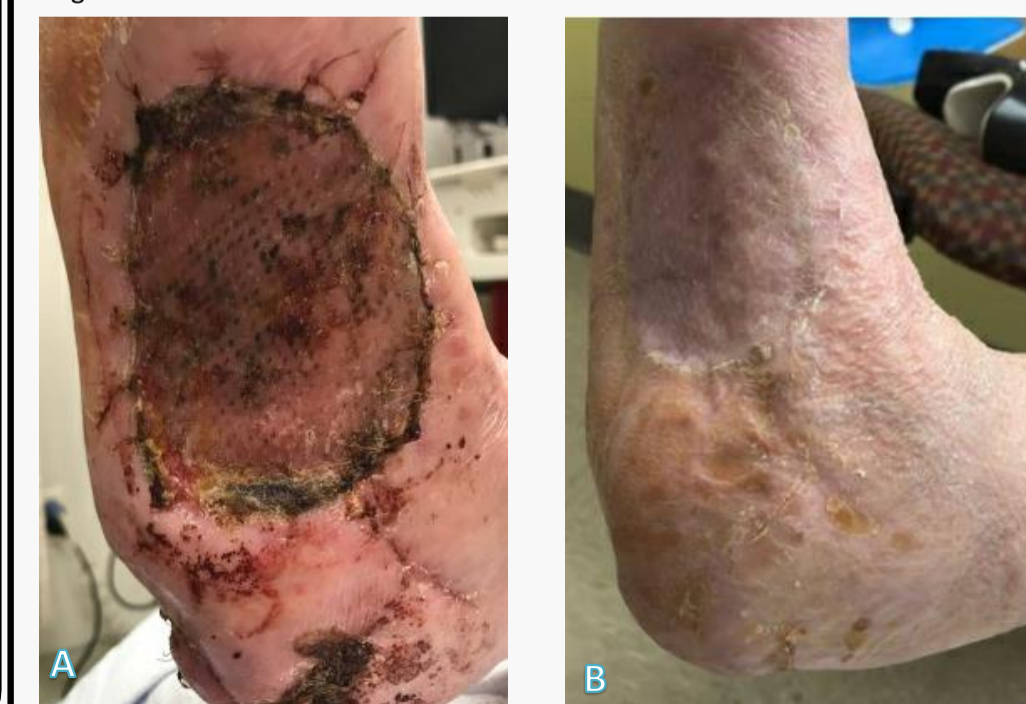


Fig. 5a Split thickness skin graft to MPA donor site.
Fig. 5b Healed STSG and plantar heel wound.

Results

1 year follow-up; No signs of infection. Successful PBM and MPA flaps and split thickness skin graft incorporation. Successful limb salvage; more importantly preservation of limb function as patient fully ambulates in a patellar tendon weight-bearing brace. This is important as the patient has contralateral lower extremity weakness from a prior stroke and a right lower extremity prosthesis would have made ambulation challenging.

Discussion

While amputation may be optimal in some patients, amputation results in reduced mobility and contributes to reduced quality of life in this population⁴. The utilization and understanding of local soft tissue transfers for preservation of limb function is a valuable technique. The early recognition and appropriate treatment of flap venous congestion is paramount for a successful outcome. Leech therapy has been shown to aid in reduction of venous congestion via their salivary excretions consisting of hirudin which acts as an anticoagulant by locally inactivating thrombin, factor-Xa and blocks platelet aggregation^{2,7}. Alternatively or in adjunct to leech therapy, one can consider venous micro anastomosis of flap vein to recipient vein to aid in reducing venous congestion⁶. We have had good outcomes when using a Dangle protocol¹ post operatively; a series of limb elevation and dependency periods that increase each day to allow the pedicle to adapt to the metabolic demands of the flap. Having an alternative flap planned is a worthwhile part of the pre-operative work up. Fortunately in this case, peroneal artery perforators were dopplerable and a change in intra-operative plans was a viable option. A CTA-lower extremity with possible vascular intervention is also something to consider in the PVD patient prior to choosing the source of flap. The PBM was chosen as a replacement for the reverse sural, fasciocutaneous flap because it offers the benefit of microsurgical dissection and harvest of vascularized tissue without the addition of anastomosis. Additionally the PBM procedure allows preservation of function, causes minimal donor site morbidity⁵. The chosen MPA flap replaced weight bearing skin with weight bearing skin; this is important as these patients are frequently neuropathic and are prone to inadvertently destroying the flap with pressure, shearing and excursion with weight bearing or range of motion. By incorporating weight bearing skin in the flap, we are able to provide a thicker and more robust flap so we can negate some of the risks associated with recurrent breakdown. In order for these limb salvage local tissue transfers to be effective, the post operative management of these patients is just as important as surgical technique used to harvest them.

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