

# Versatility of Intrinsic Muscle Flaps for the Diabetic Charcot Foot

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## KEYWORDS

- Charcot foot • Wounds • External fixation • Muscle flaps
- Surgery • Diabetes

For diabetic foot and ankle wounds, the abductor hallucis, flexor digitorum brevis (FDB), abductor digiti minimi, and the extensor digitorum brevis muscles have most commonly been reported.<sup>1</sup> These flaps allow for low donor site morbidity and decreased functional sacrifice when appropriately used. Intrinsic muscle flaps provide well-vascularized tissue with adequate composition capable of not only filling the defect but also having the ability to withstand high impact forces of ambulation. A case report is presented illustrating successful use of the FDB muscle flap for coverage of a plantar wound resulting from infection in a diabetic Charcot foot.

## CASE REPORT

A 55-year-old man presented to the emergency department with a history of a right foot plantar wound infection. Wound duration was approximately 4 weeks with recent onset of increased drainage, foot pain, and subjective fevers. The patient's past medical history was significant for uncontrolled diabetes, peripheral neuropathy, hypertension, and nonobstructive coronary artery disease. He had history of cardiac catheterization without anesthesia complications and admitted recent cessation of smoking and alcohol after a 30-year history of prior use.

Clinical examination revealed an alert and oriented but febrile patient. The foot demonstrated palpable pedal pulses and significant loss of protective sensation. A 3 cm × 5 cm full-thickness wound was visualized at the plantar central midfoot/hind-foot region with exposed tendon and fibrinous base. There was direct probing to bone, purulence at the central aspect of the wound, and peri-wound nonblanching erythema. Radiographic examination confirmed midfoot collapse with osseous disorganization but without a rocker bottom deformity, subluxation, and cystic changes

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indicating Charcot neuroarthropathy without definite signs of osteomyelitis. Leukocytosis and hyperglycemia were found on laboratory analysis. Following hospital admission, medical optimization with initiation of empiric broad-spectrum parenteral antibiotic therapy, and vascular work-up demonstrating no arterial occlusive disease in the right lower extremity, the patient underwent staged surgical debridements. Once the acute infection had been addressed, the patient was discharged with an 8-week course of culture-specific intravenous antibiotics.

He was followed in the outpatient clinical setting for local wound care and off-loading. Further studies including computed tomography and magnetic resonance imaging confirmed the clinical evidence of prominent plantar cuboid exostosis. Based on the nonhealing wound and imaging findings, he was admitted to the hospital for further staged reconstruction. Ultimately, the patient underwent partial cuboid excision, FDB muscle flap with a biologic matrix dressing, and off-loading with stabilization of the foot and lower extremity with circular external fixation. Biweekly clinic visits thereafter included wire and flap site care with serial radiographs. Six weeks later, the circular external fixation system was removed, and the residual wound was surgically addressed with the use of an autogenous split-thickness skin graft. Further immobilization via posterior splint and continued clinic visits followed until complete healing was observed. The patient was then transitioned to a surgical boot for progressive ambulation and subsequently fitted for extradePTH shoes with customized multidensity inlays (**Fig. 1**).

## DISCUSSION

One of the first muscle flaps documented in history was in 1906 describing the use of the pectoralis minor muscle for breast reconstruction; however, the first record of pedicled muscle flaps in the lower extremity was introduced in post-traumatic wounds and stasis ulcerations in the 1960s by Ger.<sup>2</sup> Historically speaking, advances in anesthesia, antibiotics, and wound healing gradually popularized the use of these flaps with increasing postoperative success.

Muscle flaps offer unique advantages over other closure techniques when addressing weight bearing soft tissue deficits with bone and joint exposure. They provide durable tissue consistency and longevity for plantar wounds that skin grafts and local skin flaps generally lack. Intrinsic muscle foot flaps for diabetic foot wounds have entertained increasing popularity versus free flaps in diabetic patients based on their relative ease of surgical technique, low donor site morbidity, and quicker operating times.<sup>1</sup> Muscle flaps have also been reported useful in wounds with low-grade infection based on their enhanced vascular perfusion and bacterial clearance.<sup>3</sup> Furthermore, in wounds with significant soft tissue and bone loss, muscle flaps in combination with antibiotic-loaded cement beads or spacers can allow for further staged reconstruction using bone graft.

Much of the existing literature regarding the FDB muscle flap involves soft tissue defects left following resection of tumors, yet its use in the treatment of diabetic foot wounds has gained more attention in recent years based on the increasing prevalence of diabetic foot complications.<sup>4-7</sup> The FDB muscle flap is specifically optimal for foot wounds located plantar centrally or at the heel. The reach of this flap may also allow for coverage of distal lateral defects.<sup>5</sup> The bulk of this muscle varies yet is surprisingly adequate for filling defects extending to bone or joint and provides a durable surface for weight bearing. Dissection of the FDB flap also allows easy access and visualization of associated osseous deformities that may require concomitant correction as seen in midfoot Charcot neuroarthropathy.<sup>7</sup>

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