Peroneus Brevis Musculocutaneous Rotational Flap for Treatment in a Diabetic Charcot Neuroarthopathic Patient: A Case Study

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Introduction

Charcot neuroarthropathy (CN) is one of the many comorbidities that may develop secondary to neuropathy. The detrimental effects span from rapidly progressive bone deformity and joint instability to subsequent chronic ulcerations. The prevalence and incidence of CN secondary to diabetic neuropathy ranges 0.8% - 13% and 0.1% - 29%, respectively.[1] One of the biggest challenges are non-healing ulcerations due to underlying bony deformity coupled with impaired healing. The peroneus brevis muscle flap has previously shown sufficient results for treating large and small wound defects of the foot and ankle.[2] Although it has been widely described, there is little research on its efficacy with diabetic CN patients. The purpose of this paper is to present a case study using a rotational peroneus brevis flap for a chronic lateral ankle wound resulting from charcot neuroarthropathy.

Literature Review

Charcot neuroarthropathy is a progressively destructive, severely debilitating disorder leading to structural damage, bone resorption and hypertrophic repair. The exact mechanism of neuroarthropathy remains uncertain, but the common conception remains that lack of proprioception and sensation leads to joint instability, ligamentous laxity and minor trauma resulting in major deformity.[3,4] Any disorder resulting in peripheral neuropathy including alcoholism, IV drug use, syphilis, vitamin B12 or folic acid deficiency, HIV, leprosy, spina bifida, and multiple sclerosis can cause charcot neuroarthropathy; however diabetes is the most common cause.[1,5,6] A paper by Bernstein et al. identified the most common trigger events as acute trauma, surgical procedures, infections, and overuse injuries.[1] The joints most commonly affected are tarsal and tarsometatarsal joints which usually correlate to an increase in plantar pressures from an equinus contracture.[3,7] Other common foot and ankle deformities subsequent to charcot neuroarthropathy include midfoot collapse leading to a “rocker bottom foot,” ulcerations, significant dislocations of the midfoot and hindfoot, and instability of the ankle joint.[8]

Literature has shown muscle flaps are an excellent procedure for coverage of non-healing wounds. Muscle flaps have even been shown to effectively treat soft tissue defects with underlying osteomyelitis due to it’s vascularity and ability to deliver systemic antibiotics.[9] The peroneus brevis muscle flap has been described for coverage of foot and ankle wounds with a variety of sizes.[2] However, there is little research documenting their use for wound defects caused by the structural changes from charcot neuroarthropathy. Reports have shown that the peroneus brevis muscle flap provides reliability for soft tissue coverage as well as limited donor site morbidity and limited functional deficit. The peroneus brevis muscle can be transposed in either the proximal or distal fashion due to vascular supply. Perforators from the anterior tibial artery supply the proximally based flap while perforators from the peroneal artery supply the distally based flap.[2,10,11]

Ceran and colleagues documented successful results utilizing a proximally based peroneus brevis muscle flap for coverage of exposed hardware on lateral malleoli.[10] Moreover, Bach et al demonstrated the versatility of a distally based peroneus brevis muscle flap for coverage of heel, achilles, medial and lateral ankle wounds with successful and reliable results.[2]

There is currently no gold standard of treatment for CN; however, the ultimate goals are to avoid amputations and produce a stable, brace-able, weight bearing plantargrade lower extremity that is free of infection with intact soft tissues.[7,12] The consensus on treating the acute stage remains early and strict off loading.[13] Alternative surgical treatment options include exostectomies, realignment arthrodesis with internal fixation, external fixation arthrodesis, or a combination.[6,7,13] External fixation is the treatment of choice in patients with active infections, poor soft tissue coverage, history of DVT, and those noncompliant with non-weight bearing status.[12]

Case Study

A 68 year old diabetic female with HTN, venous stasis and chronic pain was referred with a 2 month history of a right lateral ankle wound. Patient stated the wound was caused from chronic rubbing of her ankle brace. Patient had a history of poorly controlled diabetes with associated charcot neuroarthropathy. Patient presented with a large lateral ankle wound with 3mm undermining, positive probe to bone, and serous drainage. Patient underwent an MRI which confirmed osteomyelitis of right lateral malleolus with an infected sinus tract, extensive subluxation, irregularity, and fracture/dislocation of the mid and hindfoot. Patient underwent an I&D with bone biopsy and joint aspiration.

Figure 1

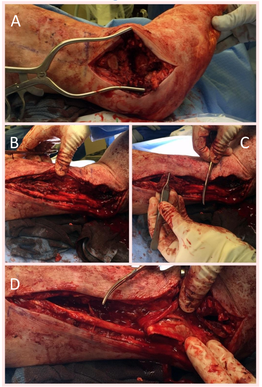

Figure 2

The patient was receiving IV antibiotics with routine hyperbaric oxygen therapy. Due to patient’s severe charcot deformity resulting in ankle varus and exposed fibula, further surgery was warranted. Patient received serial xrays, noninvasive vascular studies and CT angiography. Patient underwent surgery including excision of right distal fibula, achilles tenotomy, ankle fusion with application of multiplanar external fixator, peroneus brevis rotational muscle flap, application of bilayer wound matrix/wound graft, and application of wound VAC. The patient continued with wound vac and HBO therapy while in the postoperative period.

Figure 3

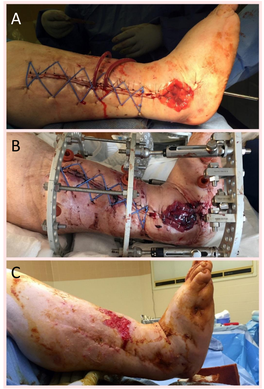

Figure 4

Figure 1

A. Intraoperative examination of ankle joint. B. Incision extending to identify peroneus brevis. C. Creating rotational flap. D. Demonstrating flap closure.

Figure 2

A, B. Mortise and lateral view of preoperative ankle C, D. 2 week post operative X-rays

Figure 3

A. Timeline demonstrating initial surgery
B. Poster operative dressing change
C. External fixator removed at 12 weeks

Figure 4

A. Poster operative dressing change
B. External fixator removed at 12 weeks

The external fixator was removed after ankle fusion was achieved at approximately 12 weeks. A crow boot prescription was then provided for the patient. All wounds were clinically healed at approximately 16 weeks and free of infection and pain.

During the postoperative course, the patient progressed to full weight bearing in the CROW boot with prescription for physical therapy. During her follow up visit, patient endorsed little time ambulating in the boot without limiting activities. Patient was then seen every 3 months for follow up for palliative care with no complaints, maintained fusion and no ulcerations or skin breakdown.

Analysis and Discussion

Wound closure while providing stability for complicated diabetic neuropathic patients remains a challenge. The balance lies between providing adequate reduction in the deformity along with sustainable wound coverage. To our knowledge, no other case studies have been presented utilizing a peroneus brevis muscle flap for closure in conjunction with an ankle fusion utilizing external fixation treating diabetic charcot neuropathy. It should be noted that Capobianco et al. demonstrated positive results for a abductor hallucis muscle flap in conjunction with a staged medial column arthrodesis in a chronically ulcerated charcot foot with concomitant osteomyelitis.[14]

There are many different modalities and products that may be utilized for wound closure including, skin grafts, flaps, and wound vacs, etc. Despite the high complication rate of infection in diabetics, the peroneus brevis rotational flap, in this case provided excellent soft tissue coverage and wound closure to the lateral ankle defect.

Stability along with reduction of the deformity are crucial for the wound closure to be sustainable. There are numerous options that provide a more plantargrade foot including, exostectomy and arthrodesis with both internal and external fixation.[6] Lowery et al. demonstrated that if instability is present along with recurrent ulcerations or pain, arthrodesis may provide a viable option despite a high rate of incomplete bony union.[15] Our case demonstrates that arthrodesis for severe ankle deformity provided sufficient alignment and reduced the underlying bony pressure to the lateral ankle.

Conclusions

This case demonstrates a successful outcome for treating a non-healing wound due to chronic structural changes from charcot neuroarthropathy. The main goal was achieved for this patient who now has a brace-able functional foot with elimination of a chronic non-healing ulceration. However, it is imperative to stress continued education along with proper off-loading during the postoperative state. Non-compliance may compromise the correction and can lead to further deformity and ulcerations. Further studies need to done to examine the effectiveness of muscle flaps in diabetic charcot neuropathic patients.

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