

Internal Amputation in Charcot Neuroarthropathy Complicated by Diabetic Foot Osteomyelitis

Devon Consul DPM¹, Eric So DPM², Nisha Shah DPM², Daniel Logan DPM, FCFAS^{3,4}

1: PGY-1 Grant Medical Center, Columbus OH

2: PGY-3 Grant Medical Center, Columbus OH

3:Foot & Ankle Specialists of Central Ohio Foot & Ankle Surgery Fellowship Director

4: Foot & Ankle Surgeon, Private Practice, Columbus OH

Purpose & Literature Review

Diabetic foot osteomyelitis (DFO) is associated with high risk of amputation, and morbidity and mortality. (1-4) DFO contributes up to 25-50% of lower-extremity amputations in diabetic patients. (5) An estimated 10-30% of diabetic patients with a foot ulcer will eventually require an amputation, approximately 60% of which are preceded by an infected ulcer. (6) Osteomyelitis is a secondary complication of diabetic foot ulceration. The ulceration allows contiguous spreading of infection to bone. (7)

The surgical treatment of DFO can impair foot balance. A partial amputation can increase biomechanical impairments of the foot and promote re-ulceration or new ulcerations in different areas. (8) One study evaluated the incidence of dehiscence and ulcer recurrence in diabetic patients with forefoot osteomyelitis. (9) There was no difference in the rates of repeat ulceration in patients who underwent internal pedal amputation compared to traditional amputation.

Link and Witzel performed internal Chopart amputations for the treatment of skeletal tuberculosis. (10,11) An internal midtarsal amputation, known as the “Link-Witzel” procedure, is associated with an extensive volume of bone loss. (11) With the rarity of this condition in the present day, this procedure has become infrequently performed in favor of transtibial or transfemoral amputations. (11) However, recent improvements of prosthetic and custom bracing justify the reevaluation of individual and atypical resections and amputations within the foot. (12) A functional stump capable of accepting repeated weight-bearing should be the goal regarding lower extremity amputation surgery. Additionally, the need to amputate and re-amputate should be avoided in diabetic patients who have a higher mortality following major amputations. (12)

The purpose of this case study is to present internal pedal amputation as a viable option to eradicate infection and produce a plantigrade, stable foot that is amenable to custom bracing. Studies have demonstrated the importance of preserving plantar surface area, lever arm length, as well as plantar soft tissues in affording patients a plantigrade, stable, and functional limb. We describe a case of a patient who underwent internal pedal amputation that was amenable to functional bracing in custom-molded orthotics.

Case Study & Surgical Procedure

Patient History

54 year old male with past medical history of Hypertension, Gastroesophageal reflux disease Hyperlipidemia, End stage renal disease, Charcot, Diabetes mellitus type 2, had been seen in the office since September 2014 for right foot pain due to diabetic ulcer. The patient underwent a MRI which showed no osteomyelitis. However, in October he returned to the office with inflammation and drainage. Surgery was discussed as an option at this time. The patient subsequently underwent internal amputation with resection of the Medial cuneiform, Intermediate cuneiform, Navicular, and Talar head. External fixation with placement of antibiotic cement, infection management, and offloading of ulcer site.



Figure 1.



Figure 2.



Figure 3.



Figure 4.



Figure 5.



Figure 6.

Intervention

54 year old male with past medical history of Hypertension, Gastroesophageal reflux disease Hyperlipidemia, End stage renal disease, Charcot, Diabetes mellitus type 2 presented with a diabetic ulcer along the lateral column of the foot. Patient was treated with local wound care, off-loading and underwent X-ray and MRI which showed no evidence of osteomyelitis.(Fig.1,2) Patient failed to improve and six weeks later underwent right midfoot osteotomy and application of a skin substitute. Patient was seen routinely in office and had a non-complicated post-operative course at that time. The wound continued to decrease in size over the next couple of months, eventually closing. However, patient presented 3 months later with a one week history of an ulcer to his right foot. A CROW boot was recommended to stabilize the foot and reduce plantar foot pressure but the patient did not obtain due to cost.

The patient presented to the emergency room three months later with a stable chronic non-healing ulceration to the plantar right foot. The patient was scheduled to have a Charcot reconstruction two days later; however, patient was found to have pneumonia and the surgery was delayed. In addition, a swab culture was taken of his wound on admission and was positive for methicillin susceptible staphylococcus aureus. MRI was ordered and demonstrated the midfoot was consistent with progressive neuropathic arthropathy. The patient underwent a right foot midtarsal arthrodesis and medial column arthrodesis, Achilles tendon lengthening, and application of external fixation with a ring fixator.(Fig.3,4) The patient was seen in the office post-operatively and was advised to remain non-weight bearing. The patient progressed to wound healing over the next month. Three months later the patient presented with cellulitis and leg pain.

The Patient was started on IV antibiotics and taken to the operating room the following day for incision and drainage with bone biopsies. The patient returned to the operating room again for hardware removal, removal of infected bone, bone biopsies, application of antibiotic cement in the foot and the tibia, and application of mini-rail external fixator.(Fig.5,6) The patient was discharged from the hospital a few days later with antibiotic therapy. Post-operative visits were done routinely in the office to monitor clinically and radiographically. The patient underwent two further debridements for removal of old antibiotic delivery system and placement of new one, removal of infected bone, and more bone biopsies to the foot and ankle to confirm the infected bone had been removed. All wounds healed and a plantigrade foot was achieved, undergoing an internal amputation. The patient was ambulating pain free for months following the surgery until he sprained his foot on a concrete parking strip. MRI was obtained and revealed a return of acute Charcot. A referral to Infectious Disease was made due to the concern for the possibility of persistent osteomyelitis given his recent infections. The patient underwent a bone scan which was negative for white blood cell accumulation.(Fig.7) The patients symptoms resolved and he did obtain a CROW boot which he still ambulates in without recurrence of pain or ulceration, having undergone a successful internal amputation of the foot while preserving his leg.

Patient Progress & Outcome:

The patient had an uneventful post-operative course. At the last office visit the patient presented in CROW boot and reported satisfaction with results of surgery and absence of pain. White blood cell scan demonstrated no further evidence of osteomyelitis or changes evident of progressive Charcot Neuroarthropathy. There was no noted recurrence of ulceration, infection, and relief of osseous prominences at 27-month follow-up.



Figure 8.



Figure 9.



Figure 7.



Figure 10.



Figure 11.

Discussion

External amputations increase plantar pressures during ambulation by decreasing the support surface. Therefore, there is an increased risk of further amputations. (12) Although, the lever length is preserved with the “Link-Witzel” procedure, which allows for stable and durable plantar soft tissue that is amenable to functional bracing in custom-molded orthotics. Furthermore, custom-molded shoes and braces are well accepted by patients following internal amputation. (12)

Koller et al performed a retrospective review of 6 patients of the Link-Witzel operation for diabetic neuroarthropathy and chronic osteomyelitis of the tarsus with plantar ulcerations were followed for a mean of 55 weeks. (12) 5 patients could be fitted with custom-molded braces and returned to ambulation. There were no recurrence with ulcerations or infection and no further proximal amputation were required. (12) Attinger and brown propose that postoperative function rather than limb salvage should be the goal in diabetic limb salvage. (13)

Caution should be used in the presence of rigid deformities that may result in undue pressure on the plantar soft tissue, resulting in re-ulceration. Internal pedal amputations often require transection of muscle and tendinous tissues that cannot be re-attached or transferred, however, because the tendons are less likely to fully retract, a fairly well-balanced residual foot remains. (11) Despite the shortened lever-arm that reduces the dorsiflexion force about the forefoot, soft-tissue equinus contraction does not occur as a consequence of internal pedal amputation. (11) Foot deformity after partial foot amputations can cause re-ulceration, however internal pedal amputation reduces this risk by avoiding secondary deformities.

Internal pedal amputation can be a viable option to eradicate infection and produce a plantigrade, stable foot that is amenable to custom bracing. An internal pedal amputation has the advantage of preserving lever length and plantar soft tissue.

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