

Management of Osteomyelitis and Bone Loss in the Diabetic Charcot Foot and Ankle

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KEYWORDS

- Osteomyelitis • Bone loss • Diabetes mellitus • Charcot foot • External fixation
- Bone grafting

KEY POINTS

- Bone loss secondary to osteomyelitis in diabetic Charcot neuroarthropathy (CN) can be challenging to manage and especially in the presence of multiple medical comorbidities and poorly controlled diabetes mellitus.
- A staged approach to reconstruction is recommended with an initial surgical debridement of the infected osseous and soft tissue structures in the patient with diabetic CN with concomitant osteomyelitis.
- Surgical procedure selection, fixation methods, and bone-grafting techniques are determined on an individualized clinical case scenario and best managed by a multidisciplinary team approach with an interest in the management of the diabetic foot.

INTRODUCTION

Large osseous defects in the ankle joint due to diabetic Charcot neuroarthropathy (CN), fracture/dislocation, avascular necrosis or osteomyelitis of the talus, and/or revision surgery may need to be addressed in a single or staged reconstruction and according to the patient's past medical and surgical history, medical comorbidities, local or systemic infection, and severity of condition. Jeng and colleagues,¹ in a retrospective review of 32 patients with tibiototalcalcaneal arthrodesis and allogeneic femoral head allograft for large osseous defects of the ankle concluded that patients with diabetes mellitus were at higher risk for nonunion with an overall functional lower

Disclosure: The authors have nothing to disclose.

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Clin Podiatr Med Surg ■ (2017) ■-■
<http://dx.doi.org/10.1016/j.cpm.2017.02.008>

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extremity salvage of 71%. In addition, the treatment of osteomyelitis with bone loss in the diabetic CN has been reported in the literature with various studies and case reports. Pinzur and colleagues² reported on 95.7% diabetic lower extremity salvage rates on a single surgical resection of osteomyelitis, deformity correction, and utilization of circular external fixation for the management of diabetic CN and concomitant osteomyelitis. Similarly, Dalla Paola and colleagues,³ in a retrospective study of 45 patients treated for diabetic CN foot and ankle osteomyelitis, concluded that circular external fixation and arthrodesis of the resected joint(s) osteomyelitis was an alternative option to lower extremity amputation. In another study by Dalla Paola and colleagues,⁴ it was concluded that the extent, anatomic location, and stage of osteomyelitis in the diabetic CN did not affect the overall rate of diabetic lower extremity salvage. Tibiocalcaneal arthrodesis for the diabetic CN and talar body loss also has been reported by Aikawa and colleagues⁵ by using a locking plate fixation.

Management of bone loss in the diabetic population with CN must be tailored to the individual and requires multiple treatment strategies and options. Bone loss secondarily to osteomyelitis in the diabetic CN can be challenging to manage and especially in the presence of multiple medical comorbidities and poorly controlled diabetes mellitus. The effect of medical comorbidities in the inpatient diabetic CN management was found to significantly impact the cost and patient's hospitalization in a study by Labovitz and colleagues.⁶ In another retrospective study of 116 patients by Ramanujam and colleagues,⁷ the overall lower extremity amputation and mortality rates in the reconstructed diabetic CN foot and ankle with external fixation was noted to be 6.0% and 4.3%, respectively.

PREOPERATIVE CONSIDERATIONS

Management of bone loss in the patient with diabetic CN should begin with a thorough history and physical examination by determining the anatomic location and size of the defect, joint contracture and range of motion, presence and degree of deformity, concomitant soft tissue injury, vascular supply, and the presence of infection (**Fig. 1**). Additionally, retained hardware and/or surgical complications from previous surgeries as well as the overall health status and management of medical comorbidities need to be determined and thoroughly addressed before the surgical reconstruction.

Radiographic evaluation includes foot, ankle, and calcaneal axial and lower extremity weight-bearing views when feasible. In the presence of open wounds, osteomyelitis, and/or infected hardware, advanced medical imaging is indicated. Computed tomography scans are useful for further evaluation of the anatomic region, including the quality of the remaining surrounding bone and preoperative planning. MRI and nuclear imaging are effective in evaluating the presence of concomitant soft tissue and osseous infection. Equal attention is given to the lower extremity vascular status and history of peripheral vascular disease. Basic arterial noninvasive studies are followed by vascular surgery consultation when necessary. In addition, an infectious disease consultation also may be initiated in the presence of significant bone loss due to osteomyelitis, infected hardware, and revision surgery. Medical optimization and management of uncontrolled blood glucose levels in the diabetic patient with multiple medical comorbidities and end-organ disease is crucial for the patient's healing and recovery process.

The goals of managing diabetic CN of the foot and ankle are achieving a stable and plantigrade foot that is free from ulceration and infection and allows a degree of independent ambulation. When diabetic CN is complicated by segmental bone loss due to

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