The Journal of Foot & Ankle Surgery 54 (2015) 120–125

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Use of a Definitive Cement Spacer for Simultaneous Bony and Soft Tissue Reconstruction of Mid- and Hindfoot Diabetic Neuroarthropathy: A Case Report

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
cement spacer
Charcot arthropathy
diabetic foot wound
internal fixation
osteomyelitis

ABSTRACT

The prevalence of diabetes mellitus has been increasing, and ≤25.8 million people, or 8.3% of the US population, have diabetes. Diabetic Charcot arthropathy and foot ulcers are serious complications of diabetes mellitus. They have been associated with greater risks of lower extremity amputation and mortality. Studies have shown that the amputation risk relative to patients with Charcot arthropathy alone is 7 times greater for patients with a foot ulcer, and 12 times greater for patients with Charcot arthropathy and a foot ulcer. Surgical reconstruction of Charcot arthropathy of the foot is often difficult, because of bone loss, deformities, vasculopathy, and the presence of active infection with or without soft tissue loss. It will be even more challenging if >1 region of the foot has been affected, such as the mid- and hindfoot. In such situations, an amputation would usually be the surgical option. We present a case of limb-threatening Charcot deformity with instability complicated by osteomyelitis, bone loss, and a large soft tissue defect. We used a limb salvage strategy with hindfoot fusion combined with an antibiotic-impregnated cement spacer for reconstruction of the midfoot, which was performed simultaneously with a local adipofascial flap for soft tissue coverage, resulting in a plantigrade, painless, and functional foot.

The prevalence of diabetes mellitus has been increasing. The 2011 National Diabetes Fact sheet published by the Centers for Disease Control and Prevention and the American Diabetes Association has estimated that 25.8 million people, or 8.3% of the US population, have diabetes mellitus (1). Individuals with diabetes have a 10% to 25% lifetime risk of developing foot ulcers (2). Diabetic Charcot arthropathy and foot ulcers are serious complications of diabetes mellitus and can lead to limb loss if left untreated (1–6).

Charcot arthropathy of the foot is a complication of chronic diabetes mellitus characterized by bone and joint destruction leading to deformity. Charcot arthropathy of the foot increases the risk of skin breakdown, recurrent ulceration, and amputation secondary to foot deformity (3). Sohn et al (4) performed a retrospective study of patients with Charcot arthropathy to compare the risks of lower extremity amputation in patients with Charcot arthropathy alone and those with diabetic foot ulcers in 2010. They found that the amputation risk in Charcot arthropathy is multiplied in the presence of ulcer complications. The study showed that patients with Charcot and those with ulcer had 4.1 and 4.7 amputations per 100 person-years, respectively. In patients aged <65 years, the amputation risk relative to patients with Charcot arthropathy alone was 7 times greater for patients with ulcer alone and 12 times greater for patients with Charcot arthropathy and ulcer (4).

The options for surgical treatment of Charcot arthropathy of the foot can range from simple ulcer debridement and exostectomy to major reconstructive surgery that requires arthrodesis with internal or external fixation and amputation. Surgical reconstruction of Charcot arthropathy of the foot is often difficult because of bone loss, deformities, vasculopathy, and the presence of active infection with or without soft tissue loss. In addition, it is even more challenging, especially if >1 region of the foot is affected, such as the mid- and hindfoot. In such situations, amputation would usually be the surgical option.

Financial Disclosure: None reported.
Conflict of Interest: None reported.

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http://dx.doi.org/10.1053/j.jfas.2014.10.009

The purpose of the present report was to describe a case of limb salvage with reconstruction in the setting of Charcot arthropathy with major bone and soft tissue loss in the presence of osteomyelitis and active infection. This involved a combined bony and soft tissue reconstruction with the use of an antibiotic-impregnated cement spacer as definitive fixation.

Case Report

Our patient was a 53-year-old female with a medical history of type 2 diabetes mellitus complicated by retinopathy and nephropathy, hypertension, gastritis, and bilateral renal calculi. She was taking oral hypoglycemic agents and insulin. She initially presented to the general orthopedic clinic with an 8-month history of right ankle and foot swelling, with an inability to ambulate. On physical examination, she was a 5.5-ft tall and weighed 257.9 lb. She had marked hindfoot varus deformity and was unable to ambulate owing to severe instability of the hindfoot. The foot pulses were palpable, and the ankle brachial index of the right foot was 0.9 and toe brachial index was 0.45. On sensory testing using the Semmes-Weinstein 5.07 monofilament test, she had profound loss of sensation with the right scoring 1 of 10 sites and the left 3 of 10 sites. In addition, she had severe diminished vibration perception on both limbs using the Bio-Thesiometer (Bio-Medical Instrument Co, Newbury, OH). The initial radiographs showed destruction of the talus, calcaneum, and the tarsometatarsal joints. She was then placed in a boot immobilizer (XP Walker; Aircast, Summit, NJ).

She presented 4 months later with a lateral malleolus ulcer associated with surrounding cellulitis. She reported she was able to ambulate with the boot but that the malleolus had abraded onto the lateral side of the boot. She was then admitted to the hospital and underwent surgical wound debridement and excision of an infected ankle bursa as the index operation. The wound culture grew methicillin-sensitive *Staphylococcus aureus,* which was treated with intravenous cloxacillin. Poor wound healing with hypertrophic granulation tissue was noted over the lateral malleolus wound. A bone biopsy performed during the index surgery revealed osteomyelitis of the bone. Radical debridement of the wound with partial fibulectomy of the distal fibula was performed 8 days later. Because the resultant defect was large and the hind- and midfoot was markedly unstable, she was referred for an opinion from our service. We reviewed the radiographs, which showed progression of Charcot arthropathy with hindfoot and midfoot destruction (Fig. 1). Clinically, a defect over the lateral malleolus was present, measuring approximately 7 × 4 cm, which was not amenable to primary closure (Fig. 2). We also noted that the tissue and bone cultures were positive for infection. Given the extensive bony destruction in the presence of infection and osteomyelitis, an amputation was suggested. She did not agree with an amputation and wanted to explore options for limb salvage.

The patient then underwent modified hindfoot fusion and insertion of a cement spacer into the midfoot with local adipofascial flap coverage. Under general anesthesia and intravenous cloxacillin coverage, we used the lateral malleolar wound to access the mid- and hindfoot. The wound was first debrided and pulsatile lavaged with 9 L of sterile normal saline. The ankle joint was then explored, and a repeat tissue with bone culture was sent. We found that the talus was dislocated to the plantar midfoot and almost one half of the talus was destroyed. The rest of the talus was avascular. The navicular, cuboid, and cuneiforms were also destroyed, with very little left of the medial cuneiform bone. On further exploration, the middle and anterior articulating surface of subtalar and calcaneocuboid joint were eroded and destroyed. The talus was removed using a bone hook. The previous fibula stump was revised, and the sharp edges were filed to a smoother edge. A tibial osteotomy was performed just proximal to the subchondral bone of the tibial plafond until good bleeding was visualized. The distal articular surface of the posterior facet of the calcaneum was removed. The calcaneum was then rotated approximately 50° and allowed to appose to the cancellous surface of tibial plafond. Next, tibiocalcaneal fusion was performed, with the ankle in a plantigrade position, using the hindfoot arthrodesis nail inserted percutaneously under compression from the heel pad. Proximal locking screws were then inserted with bicortical purchase. At that point, we inserted the cement spacer (polymethylmethacrylate), which was molded into a block to the midfoot cavity, which was devoid of the destroyed and avascular talus. The cement spacer was allowed to set and bridge the defect between the fore- and hindfoot. Subsequently, we inserted the distal posteroanterior locking screws through the hindfoot arthrodesis nail and cement spacer (Fig. 3). The cement spacer was impregnated with vancomycin, which was chosen

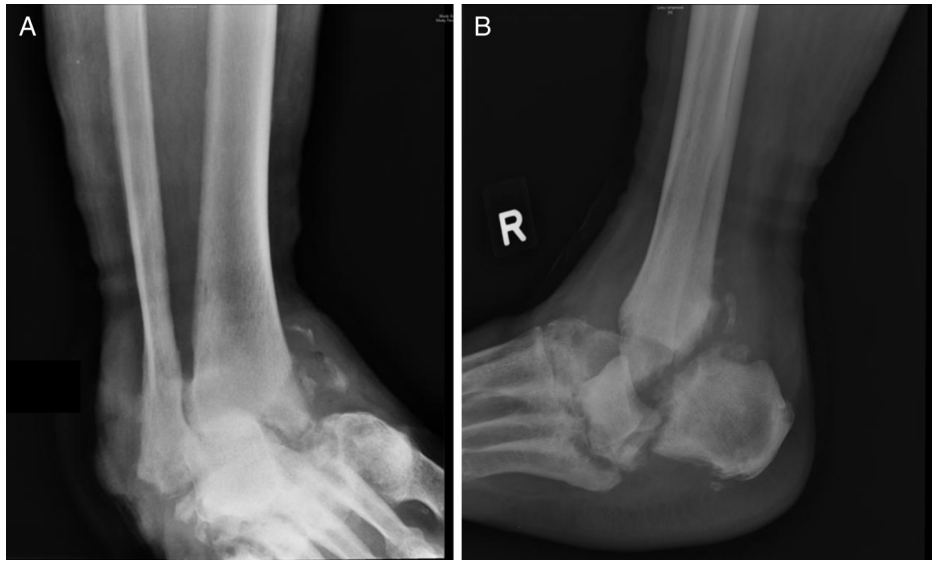

Fig. 1. (*A* and *B*) Preoperative radiographs of the patient's right foot and ankle.