Reconstruction of Lisfranc Joint Dislocations Secondary to Charcot Neuroarthropathy Using a Plantar Plate

Dave Garchar, DPM 1, Lawrence A. DiDomenico, DPM, FACFAS 2, Kaj Klaue, MD 3

1 Ryan Foot and Ankle Clinic, Charlotte, NC
2 Ankle and Foot Care Centers, Boardman, OH
3 Clinica Luganese, Sede Moncucco, Lugano, Switzerland

A B S T R A C T

Lisfranc joint dislocation secondary to Charcot arthropathy is a debilitating condition that often leads to ulceration and infection. After conservative treatment, such as bracing and appropriate shoe wear fail, the only option might be amputation. However, we have seen good clinical outcomes from applying a plate to the plantar (tension) side of the medial midfoot. In our retrospective study, 24 consecutive patients (25 feet) from April 1999 through July 2004 underwent Charcot reconstruction for Lisfranc dislocation. Clinical and radiographic follow-up examinations were performed every 3 weeks during the postoperative course. Union was achieved in 24 (96%) of the 25 feet. The average time to ambulation was 11.68 (range 7 to 20) weeks for the 24 patients. The average follow-up period was 38.0 (range 17 to 64) months. The union and interval to ambulation rates showed that a plate applied to the plantar aspect of the medial midfoot provides a strong, sturdy construct for arthrodesis and ambulation.

© 2013 by the American College of Foot and Ankle Surgeons. All rights reserved.
treated with local wound care and antibiotic therapy, as needed. If conservative treatment is ineffective, patients become at risk of skin/bone breakdown, which can become limb or life-threatening. Therefore, surgical treatment aimed at correcting the deformity could be indicated. The primary goal of surgical treatment is to create a functional plantigrade foot, allowing the patient to return to functional activity, prevent additional breakdown, and decrease the medical costs.

**Patients and Methods**

**Indications**

The indications for surgical treatment include the chronic ulcers associated with bony deformities or contractures, unstable joints of the foot and ankle that cannot be treated with a shoe or brace, recurrent infected ulcers with bony prominences, and acute displaced fractures in neuropathic patients with adequate circulation (Fig. 1) (3,15). Traditionally, surgical treatment has been limited to the inactive phase of the disease. All of the patients were identified in the senior author's (L.A.D.) practice and consecutively enrolled between April 1999 and July 2004. The authors identified the patients based on operative records and abstracted the data. Subsequent surgical management, identification of bony union, and identification of postoperative complications was determined by the attending surgeon (L.A.D.).

Gross instability at the tarsometatarsal articulation will lead to the characteristic symptomatic medial and plantar bony prominences, which can cause ulceration and infection, often resulting in amputation of the limb (16). Osteotomy alone does not address the biomechanical instability and thus does not provide long-term benefit (17). However, amputation, in addition to the effect of the loss of limb, puts the patient at additional risk of amputation of the contralateral limb (18). Pinzur (19) demonstrated that energy consumption with a unilateral amputation is directly proportional to the number of functional joints remaining and inversely proportional to the length of the remaining limb. Additionally, because of the energy costs, patients often adapt their lifestyle by becoming less active, resulting in reduced physical conditioning of the remaining limb. Additionally, because of the cost of energy, patients often adapt their lifestyle by becoming less active, resulting in reduced physical conditioning of the remaining limb. Furthermore, Waters et al (21) demonstrated that energy consumption increases 10% to 40% with a unilateral below-the-knee amputation and 50% to 70% with a unilateral above-the-knee amputation.

Limited information is available from published reports concerning midfoot arthrodesis using the planter plate for neuropathic joints. However, we believe that benefits exist for those who fit the appropriate clinical history and surgical criteria.

**Procedure**

The patients were taken to the operating room and placed in the supine position. After administration of general anesthesia, cotton padding was placed over the upper thigh of the foot undergoing surgery, and a pneumatic thigh tourniquet was applied. The foot was then prepared and draped in the usual sterile manner. The tourniquet was applied and elevated. Attention was then directed to the Achilles tendon, where a linear incision was made over the distal one third of the lower leg. Tendonorrhaphy lengthening was performed with an open Z-plasty, achieving approximately 2 cm of lengthening. Attention was then directed to the planter medial aspect of the foot. A straight incision was made, beginning at the talonavicular joint and extending to the distal one third of the first metatarsal shaft. The incision was deepened by sharp and blunt dissection down to the first metatarsal, medial cuneiform, and navicular. A full-thickness tissue flap was then retracted off the tarsometatarsal joints. Attention was directed toward the base of the Lisfranc articulation. An osteotomy was used to remove an approximately 1-cm block of necrotic bone across the Lisfranc joint, down to good, healthy, bleeding bone. If all the Charcot bone could not be removed through the medial incision, a second incision was made on the lateral aspect of the foot between the fourth and fifth metatarsals. This incision was deepened down to the base of the metatarsals and cuboid. All necrotic bone from the lateral to the medial aspect was removed, completing the resection of the Charcot bone across the Lisfranc joint. Depending on the extension of the Charcot destruction, the same procedure was performed through the innominate (ie, naviculocuneiform joints) to restore the medial arch of the foot. The Lisfranc joint was adducted and held in a plantarflexed position using two 0.062-in. Kirschner wires for temporary fixation. Next, a 3.5-mm reconstruction plate was eccentrically loaded and applied to the planar aspect of the first metatarsal, medial cuneiform, and navicular (Fig. 2). One 3.5-cm cortical screw was placed outside the plate in an oblique fashion, seating on the medial wall of the first metatarsal and aiming at the lateral edge of the navicular. Its length depended on the extension of the debrided region. A second cortical screw was inserted outside the plate from the medial cuneiform or navicular into the second or third metatarsal base. No fixation was used on the fourth and fifth rays. Autogenous or alloplastic cancellous bone can be used to fill any void or space at the arthrodesis site. The incisions were then dressed using Betadine-soaked adhesive dressings (Purdue Fredrick Co, Stamford, CT), 4 × 4 dressings, and Kling bandages (Johnson & Johnson, New Brunswick, NJ). A dry sterile dressing was applied, followed by a posterior splint or Jones compression dressing. The postoperative course included serial radiographs every 3 weeks, and the patients were kept non-weightbearing, depending on the radiographic and clinical appearance (Figs. 3 and 4). The patients were placed in a walking cast or controlled ankle motion walker for an additional 2 to 3 months, after the initiation of weightbearing with physical therapy.

**Results**

A total of 25 feet in 24 patients underwent the procedure. The mean age of the 14 (58%) males and 10 (42%) females in our study was 58.8 (range 42 to 74) years. All the patients were neuropathic. 22 (91.67%) had diabetes, and 12 (50%) were insulin dependent. One (4.17%) patient had alcoholic neuropathy, and 1 (4.17%) patient had idiopathic neuropathy. The 24 patients were either in late stage II or stage III of Charcot deformity. Postoperative complications, including infection (n = 4 [16%]), ulcers (n = 2 [8%]), Charcot developing into other joints (n = 3 [12%]), wound dehiscence (n = 1 [4%]), and heel decubitus ulcers owing to a poorly fitted cast (n = 1 [4%]), were noted in 10 (42%) patients. Union, determined by a clinically stable foot with no evidence of sclerosis or gapping at the fusion site, maintenance of solid hardware, and trabeculation identified on radiographs, was achieved in all but 1 foot. The patient whose foot did not consolidate was the patient who had undergone bilateral surgery. The 50-year-old male, a noninsulin-dependent diabetic smoker, experienced a good outcome with the right foot and was ambulating within 8 weeks.
However, the left foot posed problems with infection and recurrent ulceration. Tobacco use was not uncommon in the present cohort, with 10 (42%) reporting active smoking. The mean interval to ambulation in a walking boot was 11.68 (range 7 to 20) weeks. The average length of follow-up was 38.0 (range 17 to 64) months.

Discussion

The accepted treatment of neuropathic arthropathy has historically been immobilization in a cast or brace until consolidation has occurred. However, some patients will have a disabling fixed deformity or severe instability that will not respond to bracing or casting alone (22). Research has shown that a plate applied to the plantar (tension) aspect of the medial midfoot provides a stronger, sturdier construct than midfoot fusion with screw fixation (23). Studies have also revealed that a plantar plate allows significantly less initial displacement and maintains stabilization at a much greater load (23). By maintaining correction during high and repetitive loading, the patient should be able to ambulate earlier while maintaining the arthrodesis. To date, data have not been published concerning the outcome of using a plantar plate for Charcot reconstruction and the return to earlier ambulation. Using the plantar plate on the tension site and employing AO principles, we have found that a sturdy construct on which to ambulate markedly increases the stability of the reduction and helps to facilitate arthrodesis and early ambulation.

Fig. 3. Postoperative anteroposterior radiograph at 24 months revealing consolidation across Lisfranc joint.

Fig. 4. Postoperative lateral radiograph at 24 months showing medial arch height maintained.

References