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Case Report

A Revision Arthrodesis of Severe Charcot Foot with Intramedullary Nail: a Case Report and Literature Review

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Abstract
Diabetic Charcot foot is characterized by varying degrees of bone and joint disorganization secondary to underlying neuropathy, perturbations of bone metabolism and trauma. Offloading is the most important initial treatment recommendation. Surgery can be helpful in early stages involving acute fractures of the foot or ankle or in later stages when offloading is ineffective. Incorrect diagnosis and improper treatment often result in the extremity having to be amputated.
There are several surgical procedures accepted in Charcot foot surgery. Their goal is to obtain a plantigrade foot and prevent recurrent ulcerations. Arthrodesis is a well-known surgical procedure that addresses severe joint derangement through a surgically induced bony fusion. In Charcot foot, arthrodesis is usually indicated when there is significant skeletal instability. This procedure can be done by internal or external fixation.

Keywords
Charcot foo; arthrodesis; nail

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Background

Charcot's foot affects approximately three out of 1000 diabetics, is characterized by joint dyslocations, bone fractures leading to a collapse of the bone anatomy of the foot.

There is a big dilemma in the management of the Charcot's foot, because of no uniformity in the clinical and surgical care of this condition, and the treatment is a very challenging.

We represent our experience in treatment of a severe case.

Case presentation

We report the case of a patient aged 62 years followed for type II diabetes evolving for 15 years, poorly balanced (HbA1c oscillating between 9 and 10%), insulin since 2003, At the clinical examination noted a deformed right foot, swollen but painless (Fig. 1). Moreover, there were no inflammatory signs. Imaging showed significant bone destruction. Infectious, tumoral and degenerative causes were eliminated by interrogation, clinical examination, biological and radiological. The diagnosis of Charcot's right foot was retained, it was

arthrodesized at the beginning, 3 years ago by a screwing but nonunion and screw migration was noted in the evolution (Fig. 2), resumed 6 months later by tibiotalar and subtalar arthrodesis with retrograde intramedullary nail (Fig. 3).

Figure 1. Clinical image showing the Charcot foot deformity.

The operation was carried out with the patient in supine position under tourniquet, usually under epidural anesthesia. Approach was on previous lateral incision starting from about 4 cm from the tip of the lateral malleolus and is curved anteriorly towards the sinus tarsi, we prepared the joint surface and removed all devitalized bone and soft tissues to obtain excellent bone to bone contact.

We determined the entry point for the guidewire using fluoroscopy, it is passed through the calcaneus into the tibia, progressive reaming was done then the nail is assembled and gently hammered in maintaining the ankle in 5°dorsiflexed, 5°valgus and slight external rotation.

The postoperative follow-up was good, patient was discharged from the hospital at day 7, below knee plaster cast was applied and no weight bearing for 8 weeks. Then gradual weight bearing started. Full weight bearing allowed after 6 months.

Evolution at 1 year is good, bone healing at plantigrade position, no recurrent ulcerations, with

Figure 2. X-rays showing a nonunion after first arthrodesis with screw.

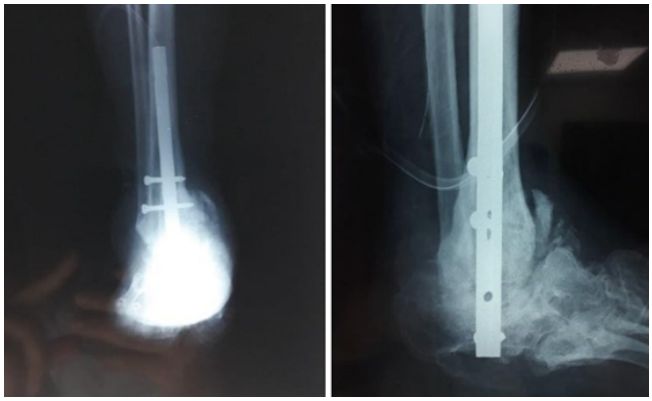

Figure 3. Image after the final revision.

resumption of walking and normal daily activities.

Discussion

Diabetic osteoarthropathy is a complication that is manifested, at the early stage, by local inflammation of the foot or ankle secondary to osteolysis of inflammatory and neuropathic origin. JM Charcot, in 1868, hypothesized that the damage was secondary to the loss of a nutrient substance in the bone, associated with an abnormality of vasomotor regulation and an increase in foot circulation, the association between the occurrence of a Charcot foot and diabetic neuropathy was described by WR Jordan only in 1936 as a diabetic nerve osteoarthropathy. If, currently, the first cause of "Charcot's foot" is diabetes, there are many other etiologies (tabes, rheumatoid arthritis, multiple sclerosis, multiple myeloma, alcoholism...) [1, 2].

The balance of diabetes and the type of diabetes seem to play a role, with a ratio of two-thirds of type 2 diabetic patients to one-third of type 1 diabetics [2, 3].

The difficulty of the diagnosis lies in the lack of clinical specificity of the acute phase. It is characterized by a rapid onset, even brutal, manifested by an inflammatory aspect of the foot (edema, redness, heat and, depending on the presence of pain).

The symptoms of the acute phase are related to neuropathic and inflammatory disorders. The most cited are bouncing pulses, an abolition of Achilles osteotendinous reflexes, a decrease in tactile sensitivity and sometimes articular hypermobility. The affected foot systematically increases the temperature by 3° above the contralateral foot. Generally, there is no fever and inflammatory markers are decreased, although the latter parameter is variable. The presence of pain is described in 75% of cases. Its intensity is absolutely not related to the severity of the clinical or radiological situation [4, 5].

In chronic phase the most severe deformation is characterized by the complete dislocation of the arch to the point of observing a collapse of the vault. This deformity will lead to a major reduction in joint mobility, a typical ulceration of the arch and a foot in the form of "tampon-blotter".

The X-ray of the foot is the exam of choice to confirm the clinical diagnosis. And establishes radiological classifications for Charcot's foot such as Sanders and Frykberg classification that matches the risk of skin lesion with the affected articular area in Charcot's foot. It aims to predict the risk of ulceration by distinguishing five zones. The most affected areas are those of the Lisfranc joint (tarsometatarsal joint) followed by the cuneonavicular and talonavicular and calcaneocuboid joints [6].

MRI is the most contributory in the acute phase. It allows visualization of medullary edema and periarticular inflammation, even during the "Charcot in situ", which allows to start treatment more quickly. These signs are unfortunately also present in case of osteitis [7, 8].

Conservative treatment is the treatment of choice in the acute phase, combining immobilization for 8 to 12 weeks and Bisphosphonates to reduce local inflammation, but without a longer-term favorable effect on the risk of complications, there is also the targeted monoclonal antibody therapy targeting RANKL such as denosumab, which is proposed for the treatment of osteoporosis.

The failure of conservative treatment leads to severe bone deformities, surgery is then indicated, it consists of either an osteotomy to prevent iterative ulcerations or arthrodesis.

Ankle arthrodesis in severe deformities due to Charcot neuro-arthropathy joint is a good operation. However, it is a technically challenging procedure, because of severe deformities, previous multiple surgeries, poor skin conditions and hight risk of infection. The key points for arthrodesis are proper joint preparation, compression of all the fusion areas, appropriate position of the foot and stable fixation. There are multiple techniques described for Charcot foot arthrodesis, with variable success. The reported techniques have included the use of locking plates, screws, staples, external fixation with or without bone transport, but with a high rate of complications (infections, nonunion...). Ankle arthrodesis with intramedullary nail is generally reserved to salvage the failed arthrodesis [9].

Retrograde nailing for fusion of ankle and subtalar joint is a successful and benefit procedure. Jehan

S et al reviewed 33 studies, 641 patients treated with retrograde nail. Union rate was in 86.7%. Complication rate was 55% with reoperation rate 22% [10]. Tibiotalar and subtalar arthrodesis with an IM nail has relatively good fusion rates. However, it carries a high risk of complications. This might be because of the preoperative comorbidities.

Conclusions

Charcot's neuroarthropathy is difficult to treat. Most difficulties are deformities and joint instability. Retrograde nailing for ankle and subtalar joint fusion is a successful procedure. In comparison to old techniques as plates or screws, with very poor results including malunion, nonunion and recurrence of deformity.

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