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Charcot ankle arthrodesis with retrograde nailing: Case report

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Abstract
Charcot neuroarthropathy is a destructive disease. It is very important to recognize early; and with appropriate management can prevent catastrophic outcomes. Delaying the diagnosis often preclude successful conservative management of these deformities which necessitate surgical intervention for limb salvage.
Materials and Methods: We review the current literature on surgical reconstruction of Charcot neuroarthropathy and present a case report of ankle arthrodesis with retrograde nail after evaluating the patient with complains of deformity of left ankle clinically, radiologically who came to KIMS Hospital and research centre.
Surgical management: The primary indication for surgical reconstruction is deformity associated with instability. Other indications include impending ulceration, osteomyelitis, presence of in and/or significant pain. Arthrodesis of the ankle is the method of choice when surgically correcting Charcot Neuropathy deformities. The choice of fixation (i.e. internal or external fixation) depends on largely on the presence or absence of active infection and bone quality.
Conclusion: Surgical reconstruction of ankle CN is associated with a high rate of infectious and noninfectious complications. Despite this high complication rate, surgeons recommended on surgical reconstruction of ankle CN should strive for limb salvage rates approximating 90% with non-weight bearing mobilization for atleast 6 months with fusion taking upto 11 months.

Keywords: Charcot, ankle, hindfoot, surgery, reconstruction, diabetes

1. Introduction
Charcot neuroarthropathy (CN) was originally described in 1868 [1] as a rare affliction of patients with leprosy and alcoholism that resulted in fragmentation, collapse, and subsequent deformity of the pedal joints in the neuropathic lower extremity. The demographics of patients with CN today reflect the exponential rise in the prevalence of diabetes mellitus over the last twenty years.
Charcot neuroarthropathy develops in approximately 0.3-7.5% of patients with diabetic peripheral neuropathy, and has significant long term prognostic implications. Charcot collapse of pedal architecture predictably progresses to plantar deformity, ulceration, and ultimately,
if not addressed, infection and amputation. Ten to fifteen percent of patients with diabetes mellitus will undergo lower extremity amputation in their lifetime, with CN deformity a clear amputation risk factor. The neurotraumatic and neurovascular theories are well described about the pathophysiology. According to Eichenhotz's classification in the coalescent CN stage, it is stage of healing with decreasing edema absorption of debris and healing fractures. Radiographs show coalescing new bone at site of fracture or dislocation with subchondral cyst formation, peri-articular fragmentation and severe dislocation and subluxation of the midfoot and/or rearfoot and ankle joints. The ulcerations are usually chronic in nature and have been refractory to previous wound care. Charcot neuroarthropathy most commonly affects the tarsometatarsal joints (27-60%), but may also affect the Chopart joint complex (30%), the subtalar (35%) and/or ankle (9%) joints and, rarely, the calcaneal tuberosity. The prognosis of rearfoot and ankle CN deformity is universally accepted as poorer than that of forefoot and midfoot deformities Controversy exists in the literature regarding surgical intervention on CN foot and ankle deformities.

Most authors advocate intervention in the coalescent or consolidative CN stages [2, 3], but early arthrodesis and open reduction and internal/external fixation during the developmental stage have been reported [2, 4, 5]. Surgical intervention is recommended when the patient's deformity is recalcitrant to appropriate conservative treatment and potentiates an ulceration, is not amenable to bracing or custom shoe gear, when osteomyelitis is present, or when the deformity endangers the intact skin envelope. Published literature has reported greater than 90% limb salvage rates after major foot and ankle reconstruction in patients with CN deformity [3, 6], but the importance of proper patient selection, exacting technique and familiarity with the natural history of the disease cannot be underestimated.

Charcot neuroarthropathy (CN) of the ankle is challenging to treat surgically or nonsurgically. For the purposes of this manuscript, we will be discussing the management of Sanders/Frykberg Type IV CN, which involves the tibiotalar joint, subtalar joint and fractures of the medial or lateral malleoli [7].

Sanders and Frykberg [8] reported that 10% of CN involved the ankle and/or subtalar joints. Brodsky [3] has proposed an alternative classification that reported a higher involvement of the ankle and hindfoot, estimating that 20% of his series involved the ankle joint alone. Several studies have demonstrated that CN has a profoundly negative impact on quality of life (QOL), affecting physical QOL to a greater degree than mental QOL

2.1 Case report

A 65 year old female came with chief complains of pain over the left ankle with swelling and difficulty in walking since 8 months. She gives history of road traffic accident 8 months back after which she complains of pain and swelling of left ankle after which she was treated outside by a medical practitioner with six months of cast immobilization, The patient's medical history was significant for type 2 diabetes mellitus, peripheral neuropathy and hypertension. Family history was significant for diabetes mellitus on general physical examination, the patient's vital signs was stable with cardiopulmonary exam revealed no abnormalities. The local examination was significant with swelling around the left ankle with skin appears to be stretched and shiny and tenderness present over medial and lateral malleolus of left ankle. Lateral and medial malleolus malleolus was tender thickened and irregular. Distal pulsations well felt. Sensation to light touch was diminished to all nerve distributions of the foot bilaterally to the ankle level.

Radiographs of the left ankle with foot revealed a trimalleolar fracture with talus dislocation, as well as hypertrophic osseous growth and fragmentation and sclerosis with coalescing new bone at site of fracture. Laboratory testing was unremarkable except for elevation of serum glucose (215 mg/dL). Chest x-ray and electrocardiogram were within normal limits.

After discussion, the patient was taken up for surgery. Under general anesthesia pneumatic thigh tourniquet was applied on left thigh, the patient was put in supine position and the parts were scrubbed painted and drapped. After the arthrodesis site is prepared and stab incision was taken over the dorsum of the foot and guidewire was placed through the heel pad in line with the center of the tibia. The pin exits the calcaneus into the center of the medullary canal of the tibia noted under image intensification.

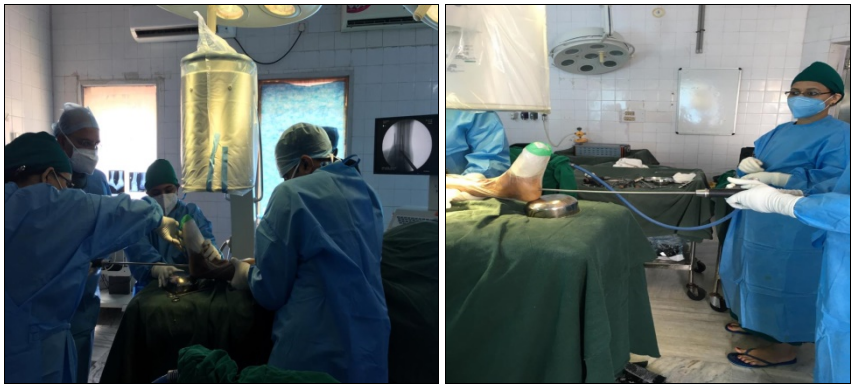

Fig 1: Figure showing Reaming done for retro grade nailing

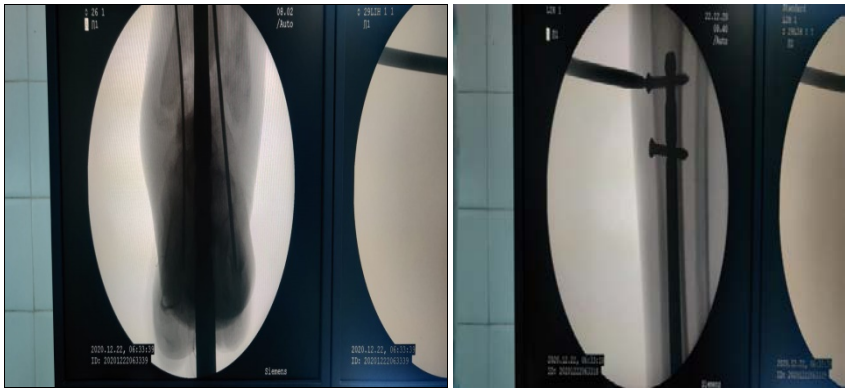

Fig 2: Intra op xray

Reaming of the calcaneus and tibia in 1-mm increments was done followed by loading of intramedullary nail onto a guide A nail of 10mm in diameters and 30cm length was inserted. Drill guide sleeves was put through the drill guide on a back table to ensure they line up correctly with the holes in the nail. Locking screws was placed sequentially from the calcaneus to

the tibia to allow impaction at each joint level. Post-operative radiographs demonstrated maintenance of the lower extremity alignment.

2.2 Results

On post-operative day four, she worked with physical therapy on transfers to chair while maintaining strict non-weight bearing mobilization and was discharged on pod 6

The patient was seen at post-operative day 14 and suture removal was done and below knee cast was applied. Radiographs demonstrated bony bridging at post operative week six and the patient underwent an uncomplicated post-operative course.

She remained non-weight bearing for 3 months, and subsequently began partial weight bearing mobilization in a walking cast for 1 month then cast removal mobilisation for 1 month and was noticed 1 screw backout for which under local anesthesia screw was introduced back and cast with weight bearing mobilisation, without evidence of soft tissue with protected weight bearing mobilization

Fig 3: Pre-op x-ray of Standing AP

Weight-bearing radiograph of a 64 year old with Charcot neuroarthropathy of the ankle and subtalar joints. Her left ankle is dislocated and the talus is rotated 86 degrees in the ankle mortise. The subtalar joint is widened and the calcaneus is in extreme valgus (normal hindfoot valgus is<10 degrees)

Fig 4: Postoperative anteroposterior and lateral radiographic view showing the tibiotalocalcaneum arthrodesis sites with internal fixation with intramedullary nail

Fig 5: Post op x-ray of 6weeks

Fig 6: Post op x-ray at 3months Screw back out noted which was reintroduced

Fig 7: Post op x-ray at 6months

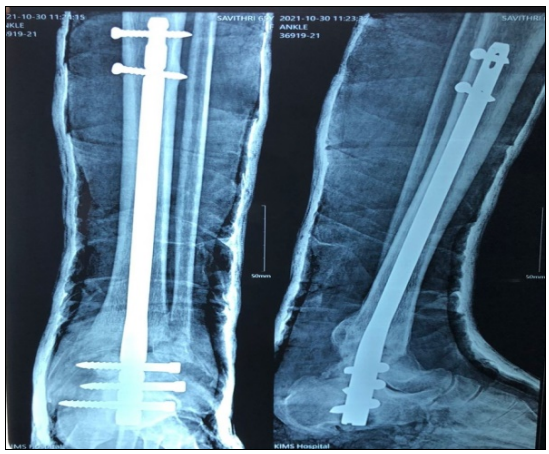

Fig 8: Post op x-ray at 11 months showing fusion at tibiocalcaneal tibiotalar and talocalcaneal fusion is noted

3. Discussion

Options for surgical management of patients with CN range from simple exostectomy with ulcer excision to major reconstruction with arthrodesis. The treatment is planned according to each patient's specific manifestations of the disease process. Reconstructive surgery is a must for unstable and progressive deformity with or without evidence of osteomyelitis. Internal fixation with intramedullary nail is one of treatment of choice in the severely deformed foot.

The primary goal of surgery is to establish a plantigrade foot with a well aligned, stable ankle. Other goals include relieving pain, eradicating ulcers, and improving quality of life. After healing has occurred, some patients may require long term bracing with a stable boot. Deformities involving the body of the talus or ankle generally require a tibiotalocalcaneal (TTC) or pantalar arthrodesis. The advantage of a TTC arthrodesis over a pantalar arthrodesis is that some motion at the transverse tarsal joints (talonavicular and calcaneocuboid) remains, permitting a small amount of plantarflexion and dorsiflexion. Various methods of internal fixation for TTC arthrodesis have been utilized including screws, plates and intramedullary devices. Recently, intramedullary nails have become popular and offer the biomechanical advantage of being load sharing [9, 10]. The postoperative course typically involves 3 months of non-weight bearing in a short leg cast regardless of the method of internal fixation. The use of crutches, walkers and/or wheelchairs should be employed during this period. Compliance with non-weight bearing may be difficult due to underlying neuropathy and a rolling knee walker can be very helpful during the perioperative period. Once healing of the bone is observed, protected weight-bearing is allowed in a removable boot or cast, and eventually patients can progress to a cane for ambulation assistance. A recent retrospective controlled series cited an overall complication rate of 43% in patients with diabetes who underwent TTC arthrodesise [10]. Approximately 30% of patients experienced a superficial or deep infection, and 25% experienced a noninfectious complication (nonunion, malunion or hardware failure). Additional unplanned surgery was required in 34% of the diabetic patients in this series. Despite this high complication rate, overall patient satisfaction was 80%, and limb salvage was achieved in 97% of patients. Our review of the published literature over the past 25 years has identified 24 articles that have reported on TTC arthrodesis for diabetic CN [9, 10, 11-31].

Retrograde intramedullary ankle arthrodesis nails were utilized in 354 patients, and successful limb salvage (i.e. avoidance of a major amputation) was achieved in 319 patients (90.1%).

Two recent studies published in 2015 have demonstrated particularly encouraging results with limb salvage rates of 97% (N=44) and 100% (N=20) in patients with diabetic CN [9, 10]. The smaller of the two studies reported on a single stage correction of CN deformities with an intramedullary nail [9]. Although this was a small (N=20 patients) noncontrolled, retrospective study, the authors reported encouraging results with a limb salvage rate of 100% in a very high-risk group, 75% of whom had associated foot ulcers. Self-reported quality of life measures demonstrated significant improvement in this case series. The majority of these patients have multiple end organ sequelae of uncontrolled diabetes mellitus, including severe peripheral vascular compromise and often silent coronary artery disease. Prudent multi-disciplinary evaluation osn a case-by-case basis of the risk-benefit ratio of lower extremity reconstruction and salvage versus amputation is fundamental and in the best interest of the patient.

4. Conclusion

Charcot neuroarthropathy of the ankle most often requires surgical intervention with intramedullary nailing fixation is the treatment because of the ability to successfully brace and stabilize these complex with multiplanar deformities. Despite this high complication rate, surgeons embarking on surgical reconstruction of ankle CN should strive for limb salvage rates approximating 90%. Our study concludes that after intramedullary nail fixation of charcot joint of ankle a minimum of 6 months of non-weight bearing mobilization is required after the procedure to reduce complications like screw back out which was noted in our case with complete fusion taking upto 11 months

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