Charcot's Neuroarthropathy: A Case Report and Review of Literature

Vimal Upreti[*], *Narendra Kotwal*[*], *Vishesh Verma*[*], *Shrikant Somani*[*], *Yogesh Kumar*[*]

Abstract

Charcot's neuroarthropathy (CN) is a progressive disabling complication of diabetes mellitus, usually seen 10 years after diagnosis of diabetes. There is widespread destruction of affected joint and bones around it leading to severe deformity and loss of function. Its treatment may require multiple corrective surgeries or even amputation apart from application of cast, glycemic control and bisphosphonates. Here, we report such a case of CN, which was treated with multiple strategies aggressively to a good outcome.

Keywords: **Charcot's neuroarthropathy, mid foot collapse.**

Introduction

Charcot's neuroarthropathy (CN), first described by Jean- Martin Charcot in patients with tabes dorsalis, [1] is usually encountered in patients with diabetes mellitus in the current era. It is a progressive deforming and disabling condition of the affected joint that leads to its widespread destruction and associated loss of function. Its pathophysiological mechanisms include neurovascular involvement, and lately, role of inflammatory cytokines and altered bone metabolism is emerging. [14] It is usually seen about a decade after the diagnosis of diabetes but a few cases of diabetes have been described who presented with CN at onset. Here, we report a case of a young male who presented with CN and was detected to have diabetes on evaluation. He was treated aggressively with off loading cast, zoledronic acid and insulin to which he showed a good recovery.

Case Details

A 41 year old male with no previous co-morbidities, presented with history of tingling and numbness of feet and slipping of slippers without awareness for the past four months. He also noticed progressive hyperpigmentation of lower limbs extending from feet till the knee, accompanied with swelling of feet and instability of gait.

Clinically, his BMI was 21.59 Kg/m^2, acanthosis nigricans and skin tags were present at neck and axilla; pulse, blood pressure and rest of the general physical examination were normal. Local examination revealed shiny and swollen legs with loss of hair, hyperpigmentation, multiple calluses present at pressure points, ulceration at medial aspect of left foot, arches of both feet were absent, there was bilateral mid- foot collapse (figure1) and local temperature was raised. He was unable to invert or evert his feet. Neurological examination revealed grade 4 power in both ankles involving all muscle groups, graded loss of all modalities of sensation below the ankle, absent knee and ankle jerks with bilateral mute plantars, and Romberg's sign was positive. Examination of other systems was non – contributory. Investigations revealed elevated plasma glucose (fasting 363 mg/dl, PP 448 mg/dl) and HbA1c was 12.6%. Rest of the biochemistry including lipid profile, hemogram and urinary protein estimation was within normal limits.

[*]Department of Endocrinology, Army Hospital (Research and Referral), Delhi- Cantt
Correspondence to: Dr. Narendra Kotwal, Department of Endocrinology, Army Hospital (Research and Referral), Delhi- Cantt. ***E- mail:*** narendrakotwal@gmail.com

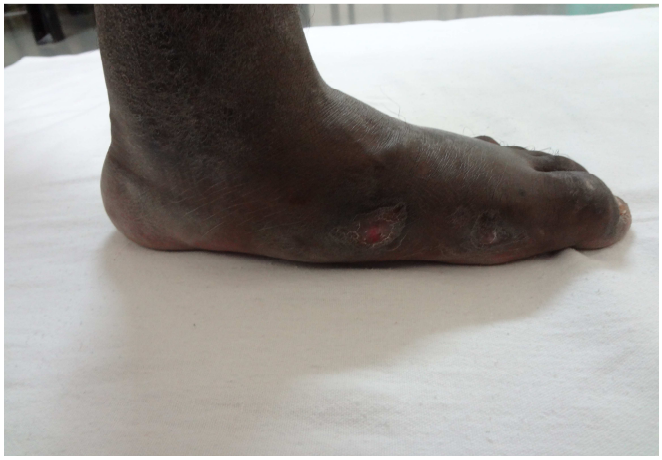

Figure 1.Shiny and swollen left foot with loss of hair, hyperpigmentation, multiple calluses present at pressure points, ulceration at medial aspect and absent arches. Also noted is the hammer toe deformity of great toe.

In view of above, a diagnosis of type 2 diabetes mellitus with Charcot's neuroarthropathy involving both feet was made. Further investigations revealed: radiograph of both feet showed bag of bone appearance with fragmentation of bones of mid- foot (figure 2), nerve conduction velocity study was suggestive of bilateral sensory- motor predominantly axonal neuropathy. Radionuclide bone scan revealed increased tracer uptake in left mid- foot in all three phases suggestive of Charcot's arthropathy (figure 3).

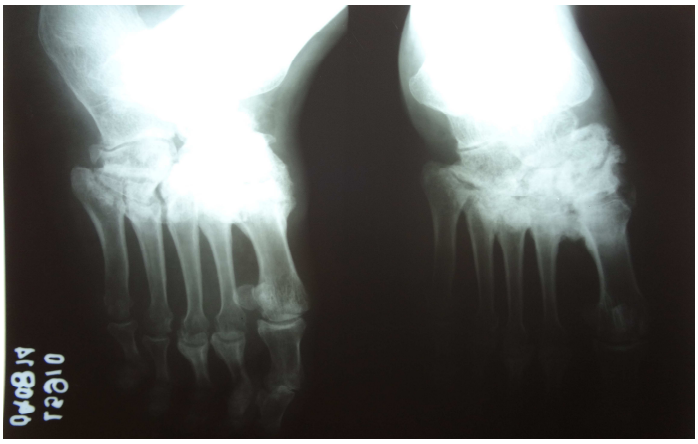

Figure 2.Radiograph of left foot (AP and lateral view) showing bag of bone appearance with fragmentation of bones, loss of joint space of mid- foot, mid- foot collapse and osteopenia.

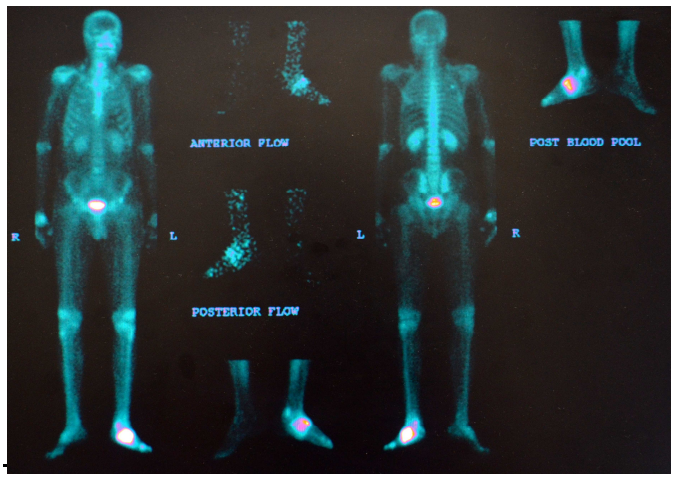

Figure 3.Radionuclide bone scan showing increased tracer uptake in left mid- foot

He was treated with multiple subcutaneous insulin injections, injection zoledronic acid 4 mg and an offloading cast was applied to the feet, which was changed every week.

Gradually, inflammation subsided, swelling reduced and he was gradually allowed to bear weight after discontinuing cast after 2 months. Customized footwear was provided. He was also imparted education about foot and comprehensive diabetes care.

At follow up after 3 months, there was improvement in foot shape and function though he still had instability of gait. Glycemic control had improved (fasting 103 mg/dl, PP of 164 mg; HbA 1c 8.7%/dl). The patient was shifted over to oral agents along with basal insulin and he is on regular follow up.

Discussion

Charcots neuroarthropathy (CN) is a disabling complication of diabetes mellitus. It is a progressive condition characterized by recurrent pathological fractures, joint dislocation and deformities, named after Jean-Martin Charcot who described the neuropathic aspects of the disease in 1868 in patients of tabesdorsalis. The disease is also described in variety of conditions like leprosy, poliomyelitis, syringomyelia, alcohol abuse, traumatic injury, heavy metal poisoning, multiple sclerosis, congenital neuropathy and rheumatoid arthritis. [1] However, diabetes mellitus remains the most common cause.

Though exact prevalence is unknown, it varies from 3 to 11.7 per 1000 patient years. [1, 2, 3] The overall incidence in diabetic population is quite low at about 0.1 – 0.4 %. [4, 5] The disease usually occurs in diabetics with duration of about 10 or more years, however, it can occasionally be the presenting symptom as in our case [4, 6- 8]. CN usually presents in 5th or 6th decade without any sex preponderance. [4, 6- 8] Clinically, initial presentation of bilateral disease is seen in about 9% of the patients, [9] however if CT scan is used for screening, then bilateral disease is present in 75% of the patients. [10]

Typically, CN passes through three stages including development, coalescence and remodeling. [11] The earliest manifestation of CN is persistent edema with discomfort in the foot, though severity of the pain is much less than that might be expected from the clinical and radiologic appearance of the affected joint due to associated peripheral sensory neuropathy. [12] In patients with diabetes, CN primarily affects the foot and the ankle. The most frequently involved joints are the metatarsophalangeal joints (31.5%) tarso- metatarsal (27.4%) and tarsal (21.8%), accounting for almost 65% of the cases. Other joints involved include talonavicular, calcaneocuboid and naviculocuneiform joints (25%), and ankle (10%). [4, 13] The most common deformity seen is mid- foot collapse which was seen in our patient. Soft tissue changes seen are skin discoloration, local edema, raised local temperature and ulcers on medial aspect of left foot. Our patients had a similar clinical picture.

Charcots neuroarthropathy occurs as a result of interaction of various pathological factors such as autonomic and sensory neuropathies, diabetes, trauma and altered bone metabolic and vascular function. [14] Our patient had

sensory- motor peripheral neuropathy that is associated with loss of joint sensation and repeated micro- fractures that heal poorly due to underlying neuropathy and metabolic abnormalities of the bone. Associated vasomotor changes in diabetes as a result of autonomic neuropathy result in arteriovenous shunting and hence increased blood flow to the joint [15] that causes increased bone resorption, weakening, recurrent fractures and deformities. In fact, it has been seen that peripheral vascular disease may exert a protective effect on development of CN [(26)]. Inflammatory cytokines are also elevated in CN and may lead to increased expression of RANKL and subsequently activation of osteoclast and bone resorption. [16] Non- RANKL dependent pathways, mediated by other cytokines, have also been seen in pathogenesis of this condition. [17] Loss of soluble receptors of advanced glycosylation end products (sRAGE) defense, non enzymatic glycation of collagen and impairment of joint mechanics are other pathogenic mechanisms associated with Charcots arthropathy. [18- 20] Any of the above mechanisms in isolation or combination may have been responsible for causation of CN in our patient.

In acute disease, plain radiograph may be mild or non- specific and may reflect only soft tissue swelling, loss of joint spaces and osteopenia. More chronic disease may present with bone resorption in the forefoot leading to osteolysis of the phalanges. In the mid- foot and hind- foot, osseous fragmentation, sclerosis, new bone formation, subluxation, and dislocation are more likely to occur giving rise to bag of bones appearance as was seen in our patient. Three- phase bone scans, based on technetium-99m (^{99m}Tc), are highly sensitive for active bone pathology. However, diminished circulation can result in false-negative exams and, perhaps more importantly, uptake is not specific for osteoarthropathy. Bone scan may point us to the site of active disease and stress fracture.

The treatment consists of offloading the affected limb. This can be done by providing a weight bearing or non weight bearing cast. At least eight weeks, without weight bearing has been recommended for the most common disease of mid- foot. The cast should be changed every one to two weeks to allow for the decrease in edema. Gradually, the individual is shifted to partial weight bearing and then full weight bearing in about four to five months. [21]Various types of orthosis have been studied in small groups of patients and have been found useful, including Charcot restraint orthotic walker (CROW) and total contact laminated, bivalved, rocker- bottom-soled ankle- foot orthosis (TCAFO) but these need to be validated in larger studies. [22, 23] The treatment does not stop at this stage and good chiropody and well- fitting customized shoes are essential for preventing long term complications. We applied same principles of offloading and later gradual weight bearing to our patient.

Oral or intravenous bisphosphonates such as alendronate, pamidronate and zoledronic acid have been tried in CN owing to their anti-osteoclastic activity and have been found to be useful in the active disease. These agents are associated with reduction in symptoms and disease activity, decrease in bone turnover markers and increase in BMD in patients with CN. [24] We administered zoledronic acid to our patient as he had active CN. Calcitonin treatment may be tried in patients who have contraindication to bisphosphonates but its efficacy is yet to be established. [25]

Surgical management includes arthrodesis and correction of deformities by osteotomies and tendon lengthening procedures in chronic CN. [26, 27] Amputation may be required in difficult to treat cases associated with repeated infection and osteomyelitis. Fortunately our patients did not require it.

Conclusion

To conclude, CN is a chronic deforming complication of diabetes mellitus that can lead to significant morbidity due to associated infection and loss of function. Timely recognition and aggressive management can lead to rehabilitation of such patients and may even prevent amputation of affected limb.

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