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Original research

Salient features and outcomes of Charcot foot – An often-overlooked diabetic complication: A 17-year-experience at a diabetic center in Bangkok

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ABSTRACT

Background: Charcot foot is a rare but a serious diabetic condition. Recognition of this often overlooked condition to provide timely and proper management is important for a better prognosis. Limited data on Charcot foot was available in Asians.

Aims: The aim of this study is to describe salient features and outcomes of Charcot foot in Thai patients.

Method: We presented our experience of 40 cases of Charcot foot patients who were treated from 2000 to 2016 at Theptarin Hospital, Bangkok, Thailand.

Results: A total of 40 Charcot foot patients were identified (13 acute, 27 chronic; mean age 58.7 ± 10.2 years; duration of diabetes 18.0 ± 8.8 years; T2DM 95%). The average serum HbA_{1c} level was 9.2 ± 1.9%. While acute Charcot foot was frequently misdiagnosed as cellulitis in almost one-third of patients, osteomyelitis was a leading cause of misdiagnosis in 15% of chronic Charcot foot patients. Ulcer-free rate at 6 and 12 months were observed in 60% and 58% of patients, respectively. The mortality rate was 13% during a median follow-up period of 57 months. Only 61% of the patients resumed walking normally while almost one-fourth of them were wheelchair-bound.

Conclusions: Charcot foot in Thai patients mainly developed in long-standing poorly controlled type 2 diabetes with neuropathy, and presented late in the course of the disease. It was often misdiagnosed resulting in improper management and poor outcome which included amputation.

Introduction

Charcot foot is a rare disease but a serious complication of diabetes that occurs in patients with diabetic neuropathy [1–3]. Previous data from Western countries showed that this condition affected only 1% of patients with neuropathy but was an independent risk factor for mortality after controlling for foot ulcer and other co-morbidities [4]. Correct diagnosis of Charcot foot was important to prevent a 10 time-higher risk of amputation in these patients [5]. Unfortunately, this condition was frequently misdiagnosed resulting in a delay of appropriate treatment and poor outcome [6,7].

Misdiagnosis of Charcot foot in its early state when a patient's foot demonstrated changes typically of inflammation in the neuropathic foot often led to a deformed foot from continued weight bearing [8,9]. Limited data on Charcot foot was available in Asians. Therefore, the aim of this study was to determine clinical characteristics and outcomes of diabetic Charcot foot treated at Theptarin hospital which is one of the largest comprehensive diabetes centers in Thailand [10]. It is also aimed to create awareness of this often overlooked condition among practicing physicians.

Subjects and methods

We conducted a retrospective study of all patients with diabetes with Charcot foot who were treated from July 2000 to June 2016 at Theptarin hospital, Bangkok, Thailand. Demographic data, previous history of diabetic foot ulcer in the previous 12 months prior to the onset of Charcot foot, chronic diabetic complications, other co-morbidities during the study period, clinical characteristics of the foot lesion, serum glycated hemoglobin (HbA_{1c}) level at the initial presentation, serum creatinine, and outcomes of Charcot foot were retrieved from medical records. In the absence of these data in the patient records, telephone contact was made by a foot specialist and/or diabetic nurse educators.

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Acute Charcot foot was defined by the presence of a hot swollen foot with or without erythema of the overlying skin after the exclusion of conditions resembling Charcot foot (such as cellulitis, deep vein thrombosis, gout, etc.). Chronic Charcot foot was defined as fracture or dislocation with or without gross deformity of foot in the presence of sensory neuropathy with loss of protective sensation. The diagnosis of osteomyelitis in Charcot foot, included a clinical evaluation, positive probe-to-bone test (palpable bone on inserting a blunt metal probe into a diabetic foot wound), advanced radiological imaging, and/or demonstrating positive findings on a bone specimen for both culture and histopathology. In the patients with bilateral involvement, details of each foot were retrieved and analyzed separately.

High-risk diabetic foot patients were referred to the foot clinic which was led by endocrinologists with an expertise in diabetic foot management working together with a multi-disciplinary foot care team. This retrospective study was approved by the Ethics committee of Theptarin hospital (No. 03/2016).

Statistical analysis

Continuous variables were presented as mean (± standard deviation) and categorical variables were presented as proportions. Comparison between an acute Charcot foot and a chronic one was done using an unpaired Student's *t*-test for continuous data and a Chi-square test for categorical data. All statistical analyses were conducted using the Statistical Package for the Social Sciences (version 17.0; SPSS, Chicago, IL, USA).

Results

During the study period, 40 patients (16 males and 24 females) were included (the mean age was 58.7 ± 10.2 years, the mean duration of diabetes 18.0 ± 8.8 years, and the median follow-up time 57.1 months (range 1–266 months). Thirty-eight patients had type 2 diabetes mellitus and two patients had type 1 diabetes mellitus. A total of 40 Charcot foot cases represented 0.5% of the total diabetic patients who attended our foot center during the study period. The mean body mass index (BMI) was 28.2 ± 5.5 kg/m^2 and the average serum HbA_{1c} level at baseline was 9.2 ± 1.9%. Thirteen patients (41.9%) had poor glycemic control (serum HbA_{1c} level > 8% and ≤10%) and 8 (25.8%) patients had serum HbA_{1c} level > 10%. The prevalence of ischemic heart disease and chronic kidney disease were 2.5% and 48.6%, respectively. Only one patient had a peripheral vascular disease. Diabetic retinopathy was present in 59.1% of the patients. Thirty-three patients (82.5%) had prior histories of foot ulcers. At presentation, Charcot foot was classified as acute in 13 patients (33%) and chronic in 27 (67%). Superimposed ulceration and osteomyelitis at the presentation of Charcot foot were common, and occurred in 48% and 13% of the patients, respectively. The details of the baseline characteristics were shown in Table 1. While acute Charcot foot was frequently misdiagnosed as cellulitis in almost one-third of patients, osteomyelitis was a leading cause of misdiagnosis in 15% of chronic Charcot foot patients. As shown in Table 2, other initial misdiagnosis included gout, ankle sprain, simple fracture, and osteoarthritis. The duration of delayed diagnosis varied from 2 to 4 months in acute Charcot foot and 2–12 months in chronic Charcot foot. One patient with chronic Charcot foot was referred for cuboid bone resection from misdiagnosis of osteomyelitis.

Interestingly, previous episodes of acute Charcot foot were reported to have occurred in almost 20% of patients, and two patients had bilateral disease at the initial presentation. Five chronic Charcot foot patients went on to develop bilateral chronic Charcot, within 9 years. According to Sanders and Frykberg's classification of Charcot foot, 50% of all episodes were localized to the tarsometatarsal joints (Lisfranc's joint) area (Pattern II). The schematic illustration of anatomical involvement of Charcot foot was demonstrated in Fig. 1. Regarding treatment, offloading and immobilization were indicated for initial treatments in both phases of the disease. As shown in Fig. 2, ulcerating chronic Charcot feet at the initial presentation was still common in our study. Initial off-loading was a total contact cast in 85.7% of acute

Table 1
Baseline characteristics of diabetic Charcot foot patients at the initial presentation.

	Total patients (N = 40)	Acute Charcot (N = 13)	Chronic Charcot (N = 27)	p-value
Age (years)	58.7 ± 10.2	56.1 ± 9.2	60.5 ± 10.6	.204
Female (%)	24 (60.0%)	9 (69.2%)	15 (55.6%)	
DM duration (years)	18.0 ± 8.8	16.6 ± 8.3	16.9 ± 9.7	.931
Type 2 diabetes (%)	38 (95.0%)	12 (92.3%)	26 (96.3%)	
Follow-up time (months)	80.7 ± 74.5	73.2 ± 77.4	86.9 ± 77.4	.604
BMI (kg/m^2)	28.2 ± 5.5	26.8 ± 4.8	29.1 ± 5.8	.243
Serum HbA_{1c} (%NGSP)*	9.2 ± 1.9	9.1 ± 2.3	9.3 ± 1.8	.854
Serum creatinine (mg/dL)#	1.2 ± 0.6	1.0 ± 0.2	1.4 ± 0.8	.020
Side of foot involvement (%)				
Right	17 (42.5%)	5 (38.5%)	12 (44.4%)	
Left	16 (40.0%)	8 (61.5%)	8 (29.6%)	
Both feet	7 (17.5%)	0(0%)	7 (25.9%)	
Ex or current smoking status (%)	6 (15.0%)	4 (30.8%)	2 (7.4%)	
Comorbidities				
Myocardial infarction	5.0%	7.7%	3.7%	
Stroke	2.5%	7.7%	0.0%	
Peripheral vascular disease	2.5%	0%	3.7%	
Chronic kidney disease[1]	48.6%	53.8%	45.8%	
Diabetic retinopathy[2]	58.8%	61.5%	57.1%	
Diabetic neuropathy	100.0%	100.0%	100.0%	
Previous diabetic foot ulcer (%)	33 (82.5%)	10 (76.9%)	23 (85.2%)	
Precipitating factors (recent trauma or surgery)	35 (87.5%)	13 (100%)	22 (81.5%)	
Misdiagnosis (%)	7 (17.5%)	2 (15.4%)	5 (18.5%)	
Concomitant osteomyelitis (%)	5 (12.5%)	2 (15.4%)	3 (11.1%)	
Concomitant diabetic foot ulcer (%)	19 (47.5%)	2 (15.4%)	17 (63.0%)	

* Data were available in 31/40 patients.
\# Data were available in 33/40 patients.
[1] Data were available in 37/40 patients.
[2] Data were available in 34/40 patients.