

Evaluation of different stage of Charcot Foot in Type 2 Diabetic Patients Attending Primary Care Setups in District Faisalabad, Pakistan

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1. Abstract

1.1. Background: Today DM affects 240 million people worldwide and this number is likely to increase significantly to 380 million by 2025. Poor glycaemic control in diabetes may lead to different complications. Charcot foot is one of most common severe complication related to type 2 diabetes mellitus. The range of the diagnosed cases of Charcot foot related with diabetes varies widely from 0.08% to 7.5%; there is lot of difficulty to measure the actual incidence because mostly untrained clinicians fail to detect such.

1.2. Objective: To evaluate the different stages of charcot foot in Type-2 diabetic patients (age > 30 years) attending routine clinical setups in district Faisalabad.

1.3. Material and Method: This study included consecutive 350 patients with diabetes mellitus, irrespective of the duration of illness, age, sex, therapy used, hospitalized or non-hospitalized. The patients were screened for Charcot foot problems. A detailed examination of feet was done (by using lab investigations, radiographic techniques and clinical examination) and findings noted. Conclusions were drawn according to the modified Eichenholtz stages system of Charcot foot.

1.4. Results: The results showed the high prevalence rate of Charcot foot in our society is quiet high. The incidence of different stages of Charcot foot found were as, 1.42% for stage zero, 4.28% for stage one, 2.28% for stage two and 1.42% for stage three. Influx

of the patients was found more in private primary care setups as compared to government sector. Furthermore, it was observed that Charcot foot has significant correlation with other medical problems like foot deformity, ischemic heart disease, hyper tension etc.

1.5. Conclusion: Charcot foot complication is more prevalent among diabetic patients (with poor glycaemic control) particularly in males during their fifth and sixth decade of life.

2. Introduction

Diabetes Mellitus (DM) is a foremost public health problem of whole world, most markedly in the middle income countries (Qidwai & Ashfaq, 2010). According to WHO, DM affects 422 million people worldwide annually, and cases are suspected to be increased 580 million until 2025. Additionally, ≈ 1.6 million deaths are directly attributed to diabetes mellitus annually, thus ranked as 4th leading cause of death in most developed countries (Ogurtsova et al., 2017). In Pakistan, currently the prevalence of diabetes is 6.9 million which is expecting to be doubled (11.5 million) until 2025 (Cho et al., 2018). Several predisposing factors responsible of diabetes progression are population growth, aging, urbanization, overweight/obesity and sedentary life style (Dora, Kramer, & Canani, 2008). Most common and chronic, complications associated with type 2 diabetes are hypertension, micro-albuminuria, retinopathy, dyslipidemia, non-alcoholic fatty liver disease, cardiovascular and atherosclerotic disorder, neuropathy and charcot foot (Dean, 1998). However, studies have shown that regular treatment

may minimize the risk of complications (Kawahara et al., 1994). Neuropathic feet were first explained by Jean Marie Charcot (1868) and named as Charcot foot after the name of researcher. This disorder mostly occurs in patients suffering from tabes dorsalis (Agoada, 1999). The Charcot arthropathy mostly affects foot and its ankle (Frykberg & Belczyk, 2008). Charcot neuropathy (CN) can be supposed in any patient who shows the symptom like pain, swelling and redness. Mostly, the patients facing the diabetes do not complaint about trauma and the medically it looks like cellulites without any similarity with infection. The Erythrocyte Sedimentation Rate (ESR) and C-reactive protein values fall in normal range (Mankin, 1992). Its distinguishing characteristic is the comparatively painless annihilation of bones and joints of the foot. The weakening of the bones is due to neurogenic under nourishment that produces impulsive osteonecrosis which is mostly non traumatic (Agoada, 1999; Wukich & Sung, 2009). The diagnosis of Charcot foot is difficult due the lack of trained clinicians (Rajbhandari, Jenkins, Davies, & Tesfaye, 2002). The incidence of the diagnosed cases of Charcot foot related with diabetes ranges from 0.08% to 7.5% (Sanders). To distinguish the Charcot foot process from infectivity related to plantar ulcers can be distinguished by a test explained by Brodsky (Lecube, Hernández, Genescà, & Simó, 2006). With the patient supine, the involved lower extremity is elevated for 5 to 10 minutes. This test tells that if inflammation and defensive response are not present, then identification of a Charcot process becomes easy but in other case chances of infection may get stronger (Brooks, 2015).

This problem of diabetes badly reduces the quality of life and radically increases the morbidity and mortality of affected individual. In present study, we determined incidence of different stages of Charcot foot in type-2 diabetic patients according to most recent classification system "Modified Eichenholtz classification system of Charcot foot" (Ali, 2016). The main aim and objective of current study was to resolute different significant signs and symptoms related to Charcot foot which will provide help to clinicians and diabetes specialists to diagnose complication at early stages so that we can minimize the chances of morbidity and mortality in long run (Gjylbegaj & Abdi, 2019).

Shortly, Charcot neuropathy is a limb destructive process in which sensory, motor, and autonomic functions are badly disturbed. Different signs and symptoms like pain, heat, edema, or pathologic damage should be closely monitored by physicians treating diabetic patients (Del Core et al., 2018). Early detection and prompt treatment can prevent joint and osseous destruction, which can result in morbidity and high-level amputation (Armstrong & Peters, 2002). Most of the patients suffering from CN are in inactive phase, because for them immobilization and offloading is necessary (Jeffcoate, 2005). Treatment is usually selected on the basis of patient condition. The advantage of early diagnosis is the early treatment at initial stages by using medical and conventional

procedures. The option of Surgery is mostly reserved for those patients who are at severe and end stages (Frykberg, Eneroth, & Brooklandville, 2010). In diabetic patients the major susceptible organ is blood vessels, once affected affects all organs of the body. Likely, when the supply of the blood to the foot is not sufficient, then cardiac compromise occurs. Even when the best prosthesis is available, the chance of cardiac damage will be more than 15%, which may lead to cardiac collapse. A combine effort is required so that chances of advancement of disease and limb loss can be prevented (Dhawan et al., 2005).

The main focus in current study was on diabetes related neuropathic complications. We observed the important predisposing factors and the relationship of Charcot foot with other concomitant diseases like hypertension and ischemic heart disease.

3. Methodology

3.1. Study Design

This Study was observational, randomized single blinded study, carried out in different government and private setups of primary care. These clinics were at primary care level but have the well-organized setups for registration, detailed clinical workup, examination, investigations, education, and counseling with well recorded follow up of diabetic patients. To carry out the study, a specified questionnaire was designed to collect the information related to diabetic complication. Once the information was gathered, all the data were subjected to specific statistical mode like SPSS and t test.

3.2. Data Collection and Follow-up Protocol

This study included consecutive 350 patients enrolled from June 2007 to June 2009. with diabetes mellitus, irrespective of the duration of illness, age, sex, therapy used, hospitalized or non-hospitalized. These patients were screened for Charcot foot problems.

The study comprised of three steps:

- A detailed history was taken from all patients
- A detailed examination of feet was done and findings noted
- Conclusions were drawn according to the modified Eichenholtz stag's system of Charcot foot.

4. Results

Demographic characteristics of all patients are described in table 1. Data showed that out of 358 patients 33.4% (117) were males and 66.5% (233) females. While median age was of 52 years with 11.7% (> 70 years), 21.1% (61-70 years), 30.2% (51 to 60 years), 23.4% (41-50 years), and 13.4% (31-40 years) respectively. Majority (n = 320) of the patients indulged in this research project were screened out from private clinics. While only 8.5% patients were used to go to Government setups for routine checkup (Table 1). On average, the duration of diabetes mellitus of every diabetic patient (from point of incidence to maximum) was ranged upto 30

years or greater than this. As findings showed that 32.57% (114 patients) had history of disease up to 20 years while 88 patients (2.1%) were diabetic from last ten years. In addition, 18.85 % (66 patients) had diabetes mellitus from more than 31 years (Table 1). In context of DM treatment, all patients were taking medical therapy except 3 males (0.85%), as they were trying to control the glycemic level through diet and exercise. Data obtained exhibited that 68.5% patients (n = 240) were on oral hypoglycemic therapy and 30.5% (n = 1073) were on combined therapy (insulin+ oral hypoglycemic agents). Interestingly, it was observed that no female was using diet and exercise therapy to control the diabetes (Table 1).

Data in table 2 demonstrated diabetic patient’s division on basis of their clinical charcot foot symptoms settled by “Modified Eichenholtz classification of charcot foot”. Out of 350 patients, 317 (90.57%) had no evidence of joints/bone weakness. While 33 (9.4%) patients were suffered with charcot foot infection. While fifteen diabetic patients (4.28%) indicated severe neuropathic symptoms (like osteopenia, peri-articular pigmentation, fracture and increase ligamentous laxity) thus graded in stage-1 of Charcot foot infection. Moreover, eight patients have been attributed in stage-2 due to presence of minimal swelling, warmth, early fusion

and sclerosis. At the end, clinical examination of five diabetic patients showed joint arthrosis, osteophytes, stability and decrease inflammation hence, they were classified in stage-3 of Charcot foot infection (Table 2).

Besides this, general complaints (numbness/burning, redness, pain/tenderness, deformity and ulcer) of the diabetic patients related to foot are also presented in Table 3. Almost 2/3 of them showed numbness and tenderness while half (50%) exhibited some kind of deformity and redness problem. In addition, ulcer or skin lesion on the foot has been observed in few patients (Table 3).

Data in Table 4 is represented relationship of comorbidities (hypertension, Ischemic Heart Disease (IHD, foot ulcer/trauma and foot deformity) with incidence of Charcot foot in diabetic patients. Findings showed that patients suffering from diabetes along with other medical problems have significant chances to face danger of Charcot foot as compared to non-comorbidities. Moreover, 30% Charcot foot diabetic patients were observed to be smoker. In addition, data showed that patients suffering from diabetes along with other medical problems have more chances to face danger of Charcot foot due to change in blood flow towards peripheries (Table 4).

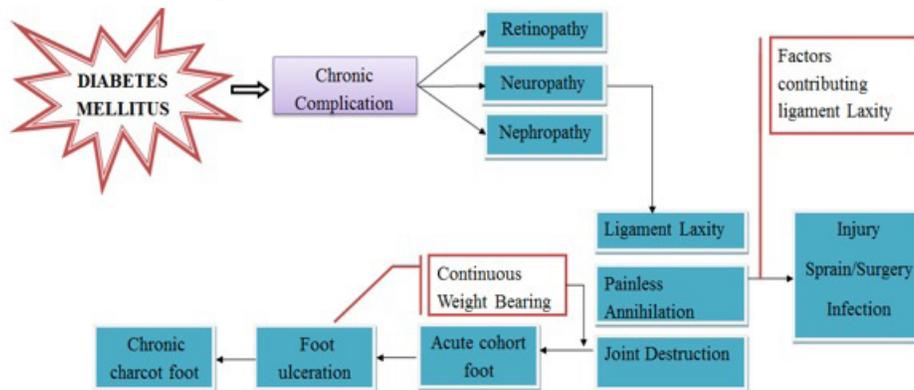


Figure: Pathophysiology of Charcot foot

Table 1: Baseline characteristics (gender, age, clinical setups, history of disease and recommended therapy) of the study population.

Age range			
	Male	Female	Total
31-40	14	33	47
41-50	26	56	82
51-60	38	68	106
61-70	23	51	74
71 and above	16	25	41
Total	117	233	350
Clinical setups			
Government	13	17	30
Private 1	55	30	85
Private 2	18	42	60
Private 3	67	108	175
History of DM (Years)			
0-10	31	51	82
11-20	65	49	114
21-30	19	59	88
31-40	31	28	59
Recommended Therapy			
Diet + exercise	3	0	3
Oral therapy	93	147	240
Insulin+ Oral therapy	36	71	107

Table 2: Classification of patients according to their clinical symptoms of Charcot foot infection

Stages of Charcot Foot	Number of Patients			Percentage
	Male	Female	Total	
Normal DM Patients	137	213	317	90.57%
Stage zero	2	3	5	1.42%
Stage-1	6	9	15	4.28%
Stage-2	3	5	8	2.28%
Stage-3	3	2	5	1.42%

Table 3: Estimation of general complaints related to charcot foot

	Numbness/ Burning	Warm/ Redness	Pain/ Tenderness	Deformity	Skin Lesion/ Ulcer
	Yes	256	175		274
No	94	175	76	174	277

Table 4: Relationship of comorbidities with incidence of Charcot foot in diabetic patients

	HTN	IHD	Foot Ulcer	Foot Trauma	Congenital Foot Deformity	Acquired Foot Deformity	Smoker/Non Smoker	Charcot Foot
Yes	251	112	40	71	33	117	109	33
No	99	238	310	279	317	233	241	317

5. Discussion

In Pakistan, primary care setups play an important role in early detection of a disease by using the basic facilities (Varma, 2013). A similar study was conducted with the aim to evaluate the impact of different stages of Charcot foot in diabetic patients. To commence with, several studies have been showed that female (> 40 years) have more tendency towards diabetes type-2 disease (Lecube et al., 2006). Moreover, age of patients is also equally important as many other factors (Eagar & Poulos, 2007) The results obtained in present study were co-related with previous findings that diabetes is more prevalent in females than males in selected regions of district Faisalabad. While majority of the diabetic patients were belonged to 5th and 6th decades of their life attributed that diabetes is more frequent after the age of fifty. From various pre- and clinical studies, it is already known that chronic diabetes is inter-linked with charcot foot disease (Goldner, 1960). In addition, few studies have been proved that chances of charcot foot infection are considered to be high in elder people because of their poor glycemic control, alteration in blood supply and foot calcification (Varma, 2013). Moreover, duration of disease is a prerequisite for disease severity (Kim, Newton, & Knopp, 2002) therefore, history of DM type-2 patients was carefully noted in current study. Literature review has been showed more reliability of patients on private centers as compared to Government setups due to wide range of facilities, more focused treatment plan and regular follows ups (Varma, 2013). In present study, 8.5% patients were enrolled from Government setup while 91.5% were from private clinics indicated extraordinary increasing trend of people towards private setups for clinical examination. In this contemporary era, multiple preventive and symptomatic treatment plans e.g., oral hypoglycemic

agents, diet, exercise and insulin have been used for management of DM type-2 (Frykberg & Belczyk, 2008) At the time of failure of oral combination therapy, use of “insulin” gives definite results in diabetic patients (Jeffcoate, Game, & Cavanagh, 2005). In current research work, most of the diabetics prefer to use oral hypoglycemic agents and lifestyle modifications as they were found to be reluctant to use insulin therapy due to needle fear, hypoglycemia risk and weight gain problems. Furthermore, studies have been exhibited that in poor glycemic control patients monitoring of HbA1c indicated higher risk to face danger of diabetic complications especially charcot foot (Elhawary et al., 2011)

The Second part of present study was examined different stages of Charcot foot as per “Modified Eichenholtz classification” in selected population. First stage is characterized by inflammation due to initial superficial or non-superficial injury subsequently, lead to restricted inflammation, flush and increased temperature at affected foot. In next, developmental stage, radiographic presentation shows bone structure changes along with increased warmth, inflammation (Elhawary et al., 2011) bony wreckage, sub-chondral fragmentation of bone, partial/complete dislocation, and fractures. In 3rd Coalescence stage, fracture bones are healing (Brooks, 2015) without any typical signs like warmth, inflammation, and flush (Johnson & Ray, 2016) In present study, among 350 patients 9.4% (n = 33) were found to be suffering from charcot foot. Five patients (15%) of total Charcot foot patients were diagnosed in stage-zero on the basis of appeared symptoms e.g., local warmth, swelling and redness. While, fifteen patients (45%) were categorized in Stage-I of Charcot foot representing symptoms with more severity as compared to stage zero. Radiographic examination of that Charcot foot patient also showed involvement of bony fracture

as well. Moreover, 3rd stage was found quite obvious because the changes in bones and joints of foot had been observed clearly with naked eye in eight patients (24%). In addition, clearance of debris around fracture parts, joints fusion and bony fragments were also clearly seen. However, in remodeling stage most of the patients were in stable condition. Hence, this study plays imperative role in providing an important input to outcomes regarding estimation of Charcot foot disease severity in diabetic patients on the basis of established standards.

6. Conclusion

Charcot foot complication is more prevalent among diabetic patients (with poor glycaemic control) particularly in males during their fifth and sixth decade of life. The treatment options for Charcot foot are more pronounced in private clinical setups as compared to government sector due to regular follow ups and diagnostic facilities. The early identification of different Charcot foot stages may reduce the rate of complication, morbidity and mortality among diabetic patients.

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