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COMPARATIVE STUDY OF RADIOGRAPHIC ABNORMALITIES IN THE FEET OF DIABETIC PATIENTS WITH OR WITHOUT NEUROPATHY AND FOOT ULCERATION

Radiology

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ABSTRACT

Background: Several studies have validated the use of radiographic findings to assess bone abnormalities such as traumatic fractures, periosteal reaction, osteopenia and charcot changes. The present study was done to identify the radiographically determined foot abnormalities in diabetic patients with and without neuropathy.

Methodology: The present cross-sectional study was conducted on type 2 diabetic patients in tertiary care hospital between July 2015 to September 2017. Abnormalities or deformities in the bones and joints of the feet and legs were recorded using radiographic imaging. Standardized dorsi-plantar and lateral weight-bearing radiographs of both feet of each study subject were taken.

Results: Out of 60 patients, 40 (66.7%) patients had impaired and 20 (33.3%) patients had normal vibration perception. Out of 60 patients, 20 (33.3%) patients had no neuropathy; 3 (5%) patients had mononeuropathy and remaining 37 (61.7%) patients had polyneuropathy.

Out of 60 patients, 24 patients had normal and 36 patients had abnormal X-ray foot with ankle AP & Lateral.

Conclusion: Radiographs can be reasonably beneficial in the detection of previously unknown Charcot changes and other abnormalities and in the assessment of residual bone abnormalities of prior injury, ulceration and surgery, all of which are frequently poorly recalled by the patient. This can aid in improved management of such patients to avert further damage and protect the limb from chronic ulceration and amputation.

KEYWORDS

Diabetes mellitus, Neuropathy, Radiography, Nerve conduction

INTRODUCTION

Diabetes mellitus has been documented as one of the leading causes of morbidity and mortality worldwide. Management of diabetic neuropathy should begin at the initial diagnosis of diabetes. The physician needs to be vigilant for the development of neuropathy or even its presence at the time of initial diagnosis of diabetes because failure to diagnose diabetic polyneuropathy can lead to serious consequences, including disability and amputation. Patients with diabetic peripheral neuropathy require more frequent follow-up, with particular attention to foot inspection to reinforce the need for regular self-care.[1]

Wide range of bone and joint abnormalities usually present in diabetics which might be due to various risk factors such as reduced bone mass and renal complications. Neuropathic changes in the bones and joints causes fragmentation and destruction which is characteristic of charcot fractures. Foot ulcers and amputations leads to severe socioeconomic and irreparable physical burden to the diabetic individuals. Assessment and management of risk factors contributing to amputation can play a key role in plummeting the rate of amputation.[2] Furthermore, radiographs are valuable tool in following the course of diabetes through stages of reconstruction of the ulcerated foot. Several studies have validated the use of radiographic findings to assess bone abnormalities such as traumatic fractures, periosteal reaction, osteopenia and charcot changes.[3] The present study was done to identify the radiographically determined foot abnormalities in diabetic patients with and without neuropathy.

MATERIALS AND METHODS

The present cross-sectional study was conducted on type 2 diabetic patients in Dr. D.Y. Patil Medical College, Hospital and Research centre, Pune between July 2015 to September 2017. Patients with Type 1 Diabetics, Pregnant women, Lactating women, Patients with cerebro-vascular accidents, Patients with compressive Myelopathy, Alcoholics and Previous orthopaedic surgery were excluded from the study.

A total of 60 subjects with diabetes will be included in this study and will be categorised into three groups. Group 1 will consist of 20 diabetic patients without neuropathy and ulceration. Group 2 will be 20 diabetic patients with neuropathy. In Group 3, 20 patients with both neuropathy and foot ulceration will be included. Written informed consent will be obtained from the study subjects, and the study will be approved by the institutional ethics committee. Demographic details and duration of diabetes will be recorded for all the patients. Glycosylated haemoglobin (HbA1c) will be estimated. Abnormalities or deformities in the bones and joints of the feet and legs were recorded using radiographic imaging. Standardized dorsi-plantar and lateral weight-bearing radiographs of both feet of each study subject were taken.

Nerve conduction studies were performed using CLARITY OCTOPUS NCV/EMG machine and values were compared with **Normal nerve conduction values.**[4]

RESULTS

Table 1: Age, gender, duration of diabetes wise distribution of study subjects

Age group (yrs)	Group 1	Group 2	Group 3	Total
25 – 40	17 (85)	1 (5)	0	18 (30)
41 – 55	3 (15)	17 (85)	0	20 (33.3)
55 – 70	0	2 (10)	11 (55)	13 (21.7)
>70Yrs	0	0	9 (45)	9 (15)
Gender				
Female	9 (45)	8 (40)	8 (40)	25 (41.7)
Male	11 (55)	12 (60)	12 (60)	35 (58.3)
Duration of DM (yrs)				
< 5	16 (80)	0	0	16 (26.7)
6 – 10	4 (20)	12 (60)	0	16 (26.7)
11 – 15	0	8 (40)	5 (25)	13 (21.7)
> 15	0	0	15 (75)	15 (25.0)

Group 1 - DM; Group 2 - DM+ Neuropathy; Group 3 - DM + Neuropathy + Foot Ulcer

Out of total 60 patients, 25 (41.66%) were females and 35 (58.34%) were males. Out of 60 patients, 16 (26.70%) patients had diabetes for less than 5 years; other 16 (26.70%) patients had diabetes for 6-10 years duration; 13 (21.70%) patients had diabetes for 11-15 years duration and diabetes for more than 15 years duration was in 15 (25%) patients.

Table 2: Vibration perception among study subjects

Vibration Perception	Group			Total
	Group 1	Group 2	Group 3	
Impaired	0	20 (100)	20 (100)	**40 (66.7)**
Normal	20 (100)	0	0	**20 (33.3)**
Total	20 (100)	20 (100)	20 (100)	**60 (100)**

Group 1 - DM; Group 2 - DM+ Neuropathy; Group 3 - DM + Neuropathy + Foot Ulcer

Out of 60 patients, 40 (66.7%) patients had impaired and 20 (33.3%) patients had normal vibration perception.

Table 3: NCV findings among study subjects

	Group			Total
NCV	**Group 1**	**Group 2**	**Group 3**	
Normal	20 (100)	0	0	20 (33.3)
Mononeuropathy	0	3 (15)	0	3
Polyneuropathy	0	17 (85)	20 (100)	37 (61.7)
Total	20 (100)	20 (100)	20 (100)	60 (100)

Group 1 - DM; Group 2 - DM+ Neuropathy; Group 3 - DM + Neuropathy + Foot Ulcer

Out of 60 patients, 40 (66.7%) patients had impaired and 20 (33.3%) patients had normal vibration perception. Out of 60 patients, 20 (33.3%) patients had no neuropathy; 3 (5%) patients had mononeuropathy and remaining 37 (61.7%) patients had polyneuropathy.

Table 4: Bony Changes among study subjects

Bony Changes	Group 1	Group 2	Group 3*	Total
Normal	18 (90)	6 (30)	0	24 (40)
Charcot changes	0	4 (20)	10 (50)	14 (23.3)
Amputation	0	0	7 (35)	3 (5)
Traumatic fracture	0	1 (5)	5 (25)	6 (10)
Exostoses	0	0	2 (10)	2 (3.3)
Periosteal reaction	0	2 (10)	8 (40)	10 (16.7)
Infection	0	0	11 (55)	11 (18.3)
Osteopenia	2 (10)	5 (25)	10 (50)	15 (25)
Erosion	0	0	7 (35)	7 (11.7)
Osteophytes	0	2 (10)	4 (20)	6 (10)

Group 1 - DM; Group 2 - DM+ Neuropathy; Group 3 - DM + Neuropathy + Foot Ulcer; *Multiple Findings

Out of 60 patients, 24 patients had normal and 36 patients had abnormal X-ray foot with ankle AP & Lateral.

Table 5: Characteristics of the study subjects

Details	Group 1	Group 2	Group 3*	P value
Mean Age	38.70+2.342	46.55+3.052	59.70+3.130	**<0.0001**
Mean duration of DM (years)	4.35+1.226	10.00+2.000	16.20+2.118	**<0.0001**
Mean HbA1c%	7.75+0.444	8.85+0.489	11.15+1.182	**<0.0001**
Mean BSL-F	120.80+15.426	121.60+14.095	136.45+10.768	**0.001**
Mean BSL-PP	208.85+13.558	227.90+18.654	247.95+13.858	**<0.0001**

Group 1 - DM; Group 2 - DM+ Neuropathy; Group 3 - DM + Neuropathy + Foot Ulcer; Values are mean ± SD; Test of significance =ANOVA

DISCUSSION

In present study out of 20 patients with DM+Neuropathy we found that around 12 patients i.e. 60% had diabetes mellitus for 6-10 years and 8 patients i.e. 40% had diabetes mellitus for 11-15 years. Mean duration of diabetes for development of neuropathy in our study was 10.00 ± 2.0 years. A study conducted by Liaquat Ali[5] in 2010 at Bangaladesh found mean duration of diabetes 12 ±8 years. Another study conducted by Faisal Al-Mahroos[6] et al, in 2007 at Baharain found mean duration of diabetes 9.5 ± 8.4 years.

In the present study, out of 20 patients with DM+Neuropathy we found that mean HbA1c of 8.85 ± 0.489. Juhani Partanen et al.[7] among 86 patients of type 2 diabetes over a period of 5 years found that prevalence of neuropathy increases with time and poor control of diabetes as established by HbA1c. Peter J. Dyck et al.[8] studied 24 patients of diabetic neuropathy diagnosed on basis of signs and symptoms and found that mean HbA1c value 7.4% ± 1%.

In the present study, 2 (10%) subjects in group 1 had Osteopenia while Viswanathan V et al.[2] observed 3 (6%), 1 (2%), 1 (2%) subjects in group 1 had Osteopenia, Infection and Amputation respectively**.** In the present study, group 2 had Charcot changes, Traumatic fracture, Periosteal reaction, Osteopenia, and Osteophytes in 4 (20%), 1 (5%), 2 (10%), 5 (25%) cases and 2 (10%) subjects respectively. In study done by Viswanathan V et al[2]. group 2 had Charcot changes, Traumatic fracture, Periosteal reaction, Infection, Osteopenia and Osteophytes in 7 (14%), 3 (6%), 5 (10%), 7(14%), 14(28%) and 1(2%) subjects respectively.

Charcot changes in 10 (50%) vs 27 (54%); Amputation in 7 (35%) vs 16 (32%); Traumatic fracture in 5 (25%) vs 6 (12%); Exostoses in 2 (10%) vs 1 (2%); Periosteal reaction in 8 (40%) vs 23 (46%); Infection in 11 (55%) vs 27 (54%); Osteopenia in 10 (50%) vs 30 (60%); Erosion in 7 (35%) vs 14 (28%) and Osteophytes in 4 (20%) vs 9 (18%) of subjects were seen in present study and Viswanathan V et al[2]. study respectively. Osteopenia, Infection and Charcot changes were the most frequent and significant bony abnormalities in both studies.

CONCLUSION

Overall, the results of this study underline the necessity for heightened suspicion of bony abnormalities in diabetic patients with neuropathy and in particular, neuropathic foot ulcers so as to decrease morbidity caused by the progression of deformity and subsequent ulceration or re-ulceration.

Radiographs can be reasonably beneficial in the detection of previously unknown Charcot changes and other abnormalities and in the assessment of residual bone abnormalities of prior injury, ulceration and surgery, all of which are frequently poorly recalled by the patient. This can aid in improved management of such patients to avert further damage and protect the limb from chronic ulceration and amputation.

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