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Original Article

Cutaneous manifestations of diabetic foot

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Abstract

Introduction Diabetes mellitus is a multi-system disorder and foot infection is seen in 25% of diabetics during their life time. Diabetes is associated with scores of cutaneous manifestations consequent to hyperglycemia, vasculopathy, neuropathy and other metabolic changes. Autoimmune conditions like vitiligo and lichen planus also develop in some diabetics. Current study was targeted to see the frequency of cutaneous changes on the feet of diabetic patients in our community.

Patients and methods This cross-sectional study was carried out in the outpatient department of Dermatology, Ziauddin University Hospital, KDLB campus, Karachi during the month of January 2008. All the patients presenting with diabetes mellitus irrespective of age, sex, type or duration of illness, blood sugar levels and types of treatment were included in the study. Diabetic patients with any other dermatological disorder involving feet were also enrolled. After a detailed history, general and systemic examination as well as cutaneous examination of the feet was done. Routine as well as relevant investigations were carried out.

Results 112 patients comprising 49 males (44%) and 63 females (56%), age range being 52 years completed the study. Of these, 82 patients (73%) suffered from the disease for more than 10 years. 7 (6.3%) patients had type 1 and 105 (93.7%) patients type 2 diabetes. One hundred one (90%) patients had a raised fasting blood sugar level while 92 (82%) patients a raised random blood sugar. 100 patients (89%) had an elevated HbA_1c level (normal <6.5). Sensory neuropathy manifested as numbness, aching and burning in 42 patients (38%, $p<0.05$), loss of temperature, touch and pain in 40 (36%, $p=0.1$) and decreased vibration sensation in 38 patients (34%, $p=0.4$). Among the motor changes, dorsally subluxed digits were seen in 32 (29%) patients, ($p<0.05$), depressed metatarsal heads in 30 (27%) patients, (p<0.05) and pes cavus in 30 (27%) patients, ($p<0.05$). Ankle jerk was absent in 34 (30%) patients, ($p=0.08$). Autonomic changes observed were burning feet and restless legs in 44 (39%) patients, ($p=0.4$), decreased sweating 38 patients (34%, $p<0.05$), edema, loss of hair follicles and erythema were observed in 38 (34%, $p=0.01$), 44 (39%, $p=0.01$) and 42 (38%) patients, ($p=0.01$), respectively. Fungal infections included tinea pedis in 11 patients (9.8%), candidosis in 9 (8%), onychomycosis in 1 (0.9%) and paronychia in 5 (4.5%) patients, ($P=0.4$). Among bacterial infections folliculitis was seen in 5 patients (4.5%), carbuncle 4 (3.6%), ecthyma in 4 (3.6%) and cellulitis in 1 (0.9%) patient ($p=0.2$). Ulcers were seen in 5 (4.5%), ($p<0.05$) while atrophy in 32 (29%) patients, ($p=0.1$). Vitiligo and lichen planus (5%, 4%) were observed in five patients each ($p=0.4$).

Conclusion Neuropathies and cutaneous infections are common complications seen on the feet of diabetics.

Key words
Blood sugar, diabetic foot, diabetic angiopathy, diabetic ulcers, glycosylated hemoglobin, infections, neuropathies.

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Introduction

Diabetes mellitus is a disorder involving multiple systems of the body leading to various physical and psychological issues.

Insufficient action of insulin in peripheral tissues is responsible for such complications. Major concerns for clinicians are pain, discomfort and disability.[1-3]

Foot infection is seen in 25% of these patients during their life time. There is evidence that granulocyte chemotaxis, phagocytosis and intracellular bactericidal activity are impaired in diabetic patients.[4] Skin and soft tissue infections are observed in up to 30% of diabetics.[5, 6] Diabetic foot ulcers are a major cause of hospitalization and result due to venous or arterial insufficiency, minor trauma and infection.[7]

Diabetes mellitus is a common cause of peripheral nerve disorders in adults leading to sensory and motor as well as autonomic neuropathy.[8-10] Bullae due to multiple reasons and xanthomas are other cutaneous changes observed in these patients. Autoimmune conditions like vitiligo and lichen planus also develop in some diabetics.

Various studies have been conducted in the past to see these changes in diabetic patients. The current study was targeted to see the frequency of cutaneous changes on the feet of diabetic patients in our community.

Patients and methods

This cross sectional study was conducted in the outpatient clinic of Department of Dermatology, Ziauddin University Hospital, KDLB campus, Karachi, during the month of January, 2008. Patients fulfilling the selection criteria were referred from the outpatient department of medicine and were enrolled after an informed consent. All the patients presenting with diabetes mellitus irrespective of age, sex, type or duration of illness, blood sugar levels and type of oral/injectable treatment were included in the study. Diabetic patients with any other dermatological disorder involving feet were also enrolled.

After a detailed history, general and systemic examination was carried out. A detailed examination of the feet was done to see cutaneous changes. Examination of the feet was mainly directed to see neuropathic changes, vascular changes, infections, any specific lesions as well as diseases. Routine as well as relevant investigations were carried out in all the enrolled patients. These included routine hematological and relevant biochemical profile. Swabs or scrapings for staining, microscopy and culture were carried out. Skin biopsy and histopathology were performed wherever required. All findings pertaining to the study were recorded on a predesigned proforma. Results were then compiled, tabulated and analyzed with the help of statistical software "SPSS 10.0". Chi-square test was applied for statistical analysis and a p value equal to or less than 0.05 was considered significant.

Results

A total of 112 patients comprising 49 males (44%) and 63 females (56%) completed the study. Minimum age of presentation was 23 years and maximum 75 years, the age range being 52 years. Mean age of presentation was 49±10.6 years.

Thirty (27%) patients had diabetes for a period ≤10 years while 82 patients (73%) suffered from the disease for >10 years. Among these 7 (6.3%) patients had type 1 and 105 (93.8%) patients type 2 diabetes.

Table 1 Frequency of sensory changes (n=112)

Sensory changes	*n (%)*	*p Value*
Numbness, aching and burning	42 (38)	<0.05
Loss of temperature, touch and pain	40 (36)	0.1
Decreased vibration sensation	38 (34)	0.4

Table 2 Frequency of motor changes (n=112)

Motor changes	*n (%)*	*p value*
Dorsally subluxed digits	32 (29)	<0.05
Depressed metatarsal heads	30 (27)	<0.05
Pes cavus	30 (27)	<0.05
Absent ankle jerk	34 (30)	=0.08

Table 3 Frequency of autonomic changes (n=112)

Autonomic changes	*N (%)*	*p value*
Burning feet and restless legs	44 (39)	=0.4
Decreased sweating	38 (34)	<0.05
Edema	38 (34)	=0.01
Loss of hair follicles	44 (39)	=0.01
Erythema	42 (38)	=0.01

Oral hypoglycemics were being taken by 71 (63%) patients, 30 (27%) patients were using insulin alone while 11 (10%) patients were being treated by the combination of both therapies. One hundred one (90%) patients had a raised fasting blood sugar level from the standard value of 80-120mg/dl. Raised random blood sugar level (120-180mg/dl) was seen in 92 (82%) patients. Normal HbA_1c (<6.5) was a feature in 12 patients (11%), while remaining 100 (89%) patients had an elevated HbA_1c level.

Cutaneous changes secondary to sensory, motor and autonomic neuropathy are shown in **Tables 1-3**. The statistically significant features (*p<0.05*) were: numbness, aching and burning in 42 (38%), ulcers in 5 (4.5%), dorsally subluxed digits in 32 (29%) patients, depressed metatarsal heads in 30 (27%), pes cavus in 30 (27%), decreased sweating in 38 (34%), edema in 38 (34%), loss of hair follicles in 44 (39%) and erythema in 42 (38%) patients.

Multiple fungal and bacterial infections were observed in these patients. Fungal infections included tinea pedis in 11 (9.8%) patients, candidiasis 9 (8%), onychomycosis 1 (0.9%) and paronychia in 5 (4.5%) patients (p=0.4). Among bacterial infections folliculitis was seen in 5 (4.5%) patients, carbuncle 4 (3.6%), ecthyma 4 (3.6%) and cellulitis in 1 (0.9%) patient (p=0.2).

Vitiligo and lichen planus were seen in 5 (4%) patients each (p=0.4).

Discussion

Diabetes mellitus is a multisystemic disorder. Complications of diabetes mellitus remain an obvious public health problem. As course of the disease progresses, complications develop, which include a number of vascular abnormalities, neuropathy, poor wound healing and enhanced risk of infections.[11,12] Skin complications are the result of a combined effect of hyperglycaemia, neuropathy and vascular abnormalities which include both microvascular and macrovascular angiopathy.[4]

Investigators have reported that 30% of patients with type 1 diabetes mellitus and 36% to 40% with type 2 diabetes mellitus experience neuropathic symptoms.[13] In the current study, multiple changes were observed in patients' feet due to underlying neuropathies. These changes were noted in 39% of our patients. Naheed *et al*.[14] reported neuropathic changes in 66% of their patients. The relative higher percentage may be due to variation in population studied as well as difference in study design and set up.

However, the data are comparable to Fedele *et al*.[15] who found neuropathy in 32% of their patients. Nadia *et al*.[16] reported neuropathy in 53% of their patients with non-insulin dependent diabetes. Although, the percentage is higher as compared to our data but since majority of our patients also had noninsulin dependent diabetes, it can be deduced that neuropathy is a common complication observed in this group of diabetics. Neuropathic involvement was seen more commonly in patients with a longer duration of disease i.e. more than 10 years. Nadia *et al*.[16] made a similar observation and neuropathy has consistently been related to the duration of diabetes in a number of other studies.[17,18] Therefore, our findings regarding the frequency of neuropathy in diabetics and its association with the type of diabetes and its duration are in agreement with the reports in literature.

In the current study, changes due to the involvement of motor nerves were seen in 32 patients (29%, $p<0.05$), autonomic changes in 44 patients (39%, $p=0.4$) while sensory neuropathy manifested as numbness, aching and burning in 42 patients (38%, $p<0.05$). Multiple studies have been conducted world wide to see neuropathic changes in diabetic patients but they have not mentioned such a breakup. Spruce *et al*.[19] have stressed a careful clinical examination of the lower extremities and feet of diabetics, yearly regardless of its type and duration. Thus an aggressive approach towards diabetic neuropathy requires patient's education regarding its prevention, diagnosis, controlling its secondary complications and possibly reversing it.

Foot infection is a common and potential serious problem in patients with diabetes. Nearly 25% diabetics in United States suffer from infections of lower extremity.[20,21] Naheed *et al*.[14] reported a frequency of 62% in diabetics as far as different cutaneous infections are concerned. In our study, tinea pedis was seen in 10% and bacterial infections in 4% of the enrolled patients. Milos *et al*.[22] have reported the frequency of fungal and bacterial infections to be 4.3% and 3% respectively in diabetics. Therefore, the frequency of fungal and bacterial infections in our study is comparable to the reports in literature.[22] Different workers have reported a higher frequency of fungal infections (onychomycosis) in diabetics as compared to controls.[23] Many studies have reported that majority of their patients with diabetes mellitus suffered from bacterial and fungal infections.[22,23] On the contrary, Romano *et al*.[24] reported that the frequency of cutaneous infections is not higher in diabetics as compared to healthy individuals. Underlying neuropathy, angiopathic changes, poor glycemic control and lack of proper care are the factors responsible for these common infections in diabetics.

Autoimmune conditions like vitiligo and lichen planus were seen in 4% ($P=0.4$) of our patients. Naheed *et al*.[14] noticed vitiligo in 6.7% and lichen planus in 4.4% of their patients. Therefore, our finding regarding the frequency of vitiligo and lichen planus is comparable to other studies.[14]

Conclusion

Neuropathies and cutaneous infections are common complications seen on the feet of diabetics. Frequency of these complications is influenced by the type of diabetes and its duration.

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