Indian J. Surg. (July-August 2008) 70:175–180

ORIGINAL ARTICLE

Evaluation of foot problems among diabetics in rural population

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Received: 23 August 2006 / Accepted: 24 April 2008

Abstract

Introduction Diabetes is the most common metabolic disease encountered by a surgeon. A sound knowledge of symptomatology, clinical signs and etiology can prevent most of the disease burden and complications and thus reduce social burden. The study tells about common foot problems among diabetes and correlates it with the awareness among people.

Aim and objectives The study aims to obtain an initial and representative data sample to identify the common pedal complications of diabetes mellitus and to provide an initial projection for the development of a podiatric foot health education program within the Hospital-Medical Centre Complex.

Materials and methods 500 diabetic patients were examined of whom 52 had diabetic foot lesions. The symptoms, signs and grade of foot lesion were cross studied with duration, type and occupation of patient. Chi square test was performed and a probability value of $p < 0.05$ was considered significant.

Conclusion The prevalence of diabetic foot in a hospital based rural diabetic population was observed to be 10.4%. Foot lesion were common in the age group 41–60 years. The most common symptom was numbness in foot (40.6%) and was more common in long duration diabetes, Type II diabetes and outdoor workers. Common foot deformity observed were callosities (54.6%) and Hallux valgus/ varus (28%). The least common was Charcot's deformity (3.6%). Ulceration (23%) and amputation (5.7%) were higher in outdoor workers. Wagner's grade 2 lesions were the most common foot lesion with diabetic foot. The questionare regarding knowledge, awareness and foot care showed. 99.8% did not inspect the feet properly and 74% washed their feet properly.

Keywords Diabetes · Foot deformities · Wagner's grade · Lesions

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Introduction

Diabetes is the most common metabolic disease encountered by a surgeon. At least 30 million people are affected worldwide. It is an iceberg disease with the tip showing only minority of cases and a large spectrum of disease being hidden inside.

While Type I diabetes mellitus is mostly juvenile (<40 years), Type II is old age related (> 40 years). 10.4 % of the Americans aged 64 years or older have diabetes mellitus. The major causes of prolonged ill health in diabetics are coronary heart disease, glomerulosclerosis, retinopathy, gangrene of the lower extremity, stroke and cataract. Eliott P. Joslin (an American diabetologist) in his study of 50 years detected that the most feared complication of long

term diabetes mellitus was loss of leg and foot and that increased awareness and education can reduce the rate of amputations.

The three etiological mechanisms involved in the formation of diabetic foot ulcer are ischemia, neuropathy and infection. These mechanisms do not work in isolation, most foot problems result from complex interplay among all three.

At Mahatma Gandhi Institute of Medical Sciences, Sevagram, Wardha, analysis of 50 consecutive patients undergoing lower extremity amputation for non-traumatic diseases revealed 22 (44%) as diabetic. Despite the magnitude of the problem to diabetic foot ulcer and its consequences, very little attention has been paid. Effective prevention requires detailed knowledge of the pathogenesis and its correlation with complications, evaluation of risk factors and knowledge and awareness about foot health care.

Material and methods

The study was conducted at Kasturba Hospital attached to Mahatma Gandhi Institute of Medical Sciences, Sevagram between January 2002 and May 2003. 500 diabetic patients (both outdoor and inpatients) were examined of whom 52 patients had diabetic foot lesions. The basic data on age, sex and occupation was collected from all patients and a detailed history was obtained regarding present complaints (pain, numbness, claudication, pedal edema), past history of ulceration or amputation, type and duration of diabetes along with habits of tobacco smoking and self-care behavior. General physical examination was done. Foot ulcers were present in 52 patients at the time of clinical examination and detailed local examination of the same was recorded. The knowledge and awareness of the patient about foot care, especially if associated with diabetes mellitus was evaluated.

Observation

The diabetic foot lesions were most common in the age group of 41–60 years (48.1% mean age 55.6 ± 12). 84.6% of the patients with diabetic foot were males and 15.4% were females. The M: F ratio was 5.5: 1.71% had Type II diabetes and 29% had Type I diabetes with type II: type 1 ratio of 2.4: 1. The mean duration of diabetes was 4.2 years. The most common symptom in this study group was numbness in foot (40.6%). Symptoms like pain in foot (62.5%), numbness (73.2%), pedal odema (28.6%) were more common in long duration diabetics, Type II diabetics and outdoor workers ($p < 0.05$). History of foot ulceration and amputation was more common in long duration diabetics (> 10 years), Type II diabetics and outdoor workers. Claudication and smoking were not associated with duration of diabetes ($p > 0.05$) Claudication was not associated with type of diabetes as was foot ulceration, amputation and smoking ($p > 0.05$). Claudication and pedal odema were not related to occupation of the diabetic patient ($p > 0.05$). Rest studies were significant. 291 (58.2%) persons were indoor workers and 209 (41.8%) were outdoor workers. It was observed that 49.7% of the outdoor workers complained of pain in foot and 46% complained of numbness in foot. The past history of ulceration (23%) and amputation (5.7%) was also higher in outdoor workers (Table 1).

The common lesion found were callosities (54.6%). Clawing (46.4%), great toe deformities (66%), pes cavus (12.5%), Charcot's deformity (12.5), callosities (76.7%) and reduced bulk of extensor digitorum brevis muscle were higher in long duration diabetics (> 10 years), Type II diabetics and outdoor workers ($p < 0.05$) (with exception of pes cavus common in indoor workers) ($p > 0.05$).

Callosities was the most common lesion present in both Type I (35.1%) and Type II diabetics (62.5%) and also in outdoor (77.5%) and indoor workers (38.1%). The next common foot lesion was deformity of the great toe (28%). Pes cavus was not related to duration of diabetes ($p > 0.05$). Pes cavus, Charcot's deformity and diabetic foot were not associated to type of diabetes ($p > 0.05$). Charcot's deformity was not related to occupation of patient ($p > 0.05$). Rest studies were significant. The commonest foot deformity was callosities present in 35.1% of patients with Type I diabetes and in 62.5% of patients with Type II diabetes. Callosity is the most common lesion found among 162 (77.5%) outdoor workers and 111 (38.1%) indoor workers. Overall, callosities were observed in 54.6% of the study population. The next common foot lesion was deformity of the great toe found in 28% of patients and third was clawing or hammer toes (18%). With the exception of pes cavus, the foot deformities were more common among individuals with outdoor occupation (Table 2).

Wagner's grade 2 lesions (30.8 %) were the most common foot lesion among diabetic foot ($p<0.05$). Wagner's grade 2, 4 and 5 were most common among long duration diabetics (> 10 years) and grade 2, 3, 4 lesions were common in Type I diabetics ($p < 0.05$). Grade 1 and 3 lesions were more common in diabetes < 5 years and grade 1 and 5 lesion more common in Type II diabetics ($p < 0.05$). This study also showed that 52 patients had diabetic foot and Type II diabetics was more common (69.3 %) than Type I (30.7 %).Whole of the study was found to be significant (Table 3).

All 500 patients included in the study were given a questionnaire regarding their knowledge, awareness and self foot care behavior. 99.8% patients did not inspect their feet for cracks, fissures, trauma, and callosities regularly. Only 30.2% patients checked the inside and outside of the shoes before wearing. 56.4% patients walked barefooted both indoors and outdoors. Only 74%

Table 1 Symptomatology and its relationship with the duration of diabetes, type of diabetes and occupation of patients

Findings	Duration of diabetes (yrs)			p	Type of diabetes		p	Occupation		p
Total patients out of 500	< 5 (yrs) 319 63.8%	5–10 yrs 125 25%	> 10 (yrs) 56 11.2%		I 145 29%	II 355 71%		Indoor 291 [58.2(%)]	Outdoor 209 [41.8(%)]	
C/o Pain in foot N=199	94 (29.4)	70 (56)	35 (62.5)	<0.05	33(22.7)	166 (46.7)	<0.05	95 (32.6)	104 (49.7)	<0.05
C/o Claudication N=14	5 (1.6)	6 (4.8)	3 (5.3)	>0.05	3 (2.1)	11 (3.1)	>0.05	7 (2.4)	7 (3.3)	>0.05
C/o Numbness N=203	85 (26.6)	77 (61.6)	41 (73.2)	<0.05	21(14.5)	182 (51.2)	<0.05	107 (36.7)	96 (46)	<0.05
C/o Pedal edema N=77	46(14.4)	15 (12)	16 (28.6)	<0.05	35(24.1)	42(11.8)	<0.05	40(13.7)	37(17.1)	>0.05
H/o Smoking N=89	53 (16.6)	24 (19.2)	12 (21.4)	>0.05	29 (20)	60 (16.9)	>0.05	NA	NA	
H/o Foot ulceration N=84	30 (9.4)	27 (21.6)	27 (48.2)	<0.05	20 (13.8)	64 (18)	>0.05	36 (12.3)	48 (23)	<0.05
H/o Amputation N=18	6 (1.9)	4 (3.2)	8 (14.3)	<0.05	4 (2.7)	14 (3.9)	>0.05	6 (2)	12 (5.7)	<0.05

Table 2 Signs on examination of the feet and their relationship to the duration of diabetes, type of diabetes and occupation of patients

Findings on foot examination	Duration of diabetes (yrs)			p	Type of diabetes		p	Occupation		p
Total number of patients out of 500	<5 (%) 319	5–10 (%) 125	> 10 (%) 56		I (%) 145	II (%) 355		Indoor (%) 291	Outdoor (%) 209	
Clawing/ Hammer toe N=90	20 (6.2)	44 (35.2)	26 (46.4)	<0.05	8 (5.5)	82 (23)	<0.05	43 (14.7)	47 (22.4)	<0.05
Hallux valgus/ varus/ limitus N=140	53 (16.6)	50 (40)	37 (66)	<0.05	12 (8.3)	128 (36)	<0.05	70 (24)	70 (33.5)	<0.05
Pes cavus N=57	39 (12.2)	11 (8.8)	7 (12.5)	>0.05	19 (13.1)	38 (10.7)	>0.05	42 (14.4)	15 (7.1)	<0.05
Charcot's deformity N=18	1 (0.3)	10 (8)	7 (12.5)	<0.05	3 (2)	15 (4.22)	>0.05	8 (2.7)	10 (4.8)	>0.05
Callosities N=273	143 (44.8)	87 (69.6)	43 (76.7)	<0.05	51 (35.1)	222 (62.5)	<0.05	111 (38.1)	162 (77.5)	<0.05
Reduced bulk of extensor digitorum brevis muscle N=97	42(13.1)	26 (20.8)	29 (51.8)	<0.05	36(24.8)	61(17.1)	<0.05	47 (16.1)	50(23.9)	<0.05
Diabetic foot N=52	21 (6.6)	17 (13.6)	14 (25)	<0.05	16 (11)	36 (10.1)	>0.05	16 (5.5)	36 (17.2)	<0.05

patients washed their feet regularly whereas 39.4% cleaned and dried thoroughly in between the toes after washing (Table 4).

Discussion

A man walks 75000–100000 miles during his life time and if the foot is diabetic it cannot withhold stress. Foot disease is a common complication of diabetes that can have tragic consequences. Tight glucose control can reduce microvascular complications and prevent ulceration. Thus patient education is essential for risk factor modification and early recognition of foot complication.

Any foot with arterial disease or neuropathy is liable for complications. The relationship between foot ulceration, neuropathy and vascular disease was first recorded by Pryce (1887). Ischaemia due to inadequate perfusion leads to cellular death and involves the distal arteries.Neuropathy is nerve damage due to reduced blood flow to nerves because of hypoglycaemia. Infection occurring secondary to neuropathy and vascular disease creates opportunity for polymicrobial infection. The usual inflammatory response is blunted with diminished eythema and edema.

The diabetic foot may present as ulcer or gangrene or infection. It usually starts as a minor injury, skin become black and gangrene extends to the great toe. It is mainly due to atherosclerotic occlusion of arteries or arteriosclerotic occlusion of digital arteries. The areas of gangrene occur on pressure points which include heel, malleoli, base of first and fifth metatarsal. It may also occur in foot not subject to pressure because of embolism of atheromatous debris and in interdigital clefts because of pressure from adjacent toes. Ulcers are characteristic neuropathic foot lesions of diabetics. They are typically painless and present with initial signs of hyperkeratosis over metatarsal head. Initially it begins as small split in the skin and finally develops into a big ulcer.

The diabetic is liable to a whole range of infections. Loss of pain and late appearance of systemic signs make diagnosis late. It may present as deep infection as abscess caused by staphylococcus or streptococcus or anaerobic infection which speads very rapidly and may cause septicaemia caused by clostridial or nonclostridial group.

Diabetic foot may also result in neuropathic joint degeneration. It may occur as chronic painless degerative process affecting weight bearing joints of the foot, mostly metacarpophalangeal joint (30%), joint of tarsal and metatarsal bones (60%) and ankle joint (10%). Repeated strain causes ligament laxity and fragmentation of bone. Incurable ulceration is the frequent outcome.

Table 3 Prevalence of foot lesions with duration and type of diabetes

Wagner's Grade of the lesion	Duration of diabetes			p	Type of diabetes		Total
	< 5 yrs (%) n=21	5–10 yrs (%) n=17	> 10 yrs (%) n=14		I (%) n=16	II (%) n=36	
1 N=9	4 (19)	3 (2.4)	2 (14.3)	<0.05	1 (6.25)	8 (22.2)	<0.05
2 N=16	6 (28.6)	5 (4)	5 (35.7)	<0.05	6 (37.5)	10 (27.8)	<0.05
3 N=13	6 (28.6)	5 (4)	2 (14.3)	<0.05	5 (31.25)	8 (22.2)	<0.05
4 N=11	4 (19)	3 (2.4)	4 (28.6)	<0.05	4 (25)	7 (19.5)	<0.05
5 N=3	1 (4.8)	J (0.8)	1 (7.1)	<0.05	0 (0)	3 (8.3)	<0.05

Table 4 Frequency of foot health care practices among the diabetic population

Question about self care behaviour	Response of the patient	
	No (%)	Yes (%)
Do you inspect your feet daily (using mirror) ?	499 (99.8)	1(0.2)
Do you check the inside and outside of your shoes before wearing?	349 (69.8)	151 (30.2)
Do you walk barefoot indoors/outdoors?	282 (56.4)	218(43.6)
Do you wash your feet daily with warm water?	130(26)	370 (74)
Do you dry your feet thoroughly (in between the toes) after washing ?	303 (60.6)	197 (39.4)
Do you know that diabetic patients need to take special care of their feet?	382 (76.4)	118(23.6)

Wagner classified diabetic foot into six grades:
Grade 0 high risk foot, no ulcer
Grade 1 superficial ulcer not clinically infected
Grade 2 deeper ulcer often with cellulitis and infection
Grade 3 deep ulcer with bony involvement and ulcer formation
Grade 4 localized gangrene
Grade 5 gangene of the whole foot

Another classification system was given by the University of Texas as:

Stage A pre/post ulcerative lesion completely epithelised
Stage B pre/post ulcerative lesion completely epithelized without infection
Stage C pre/post ulcerative lesion completely epithelized with infection
Stage D pre /post ulcerative lesion completely epithelized with ischaemia and infection

Foot disease is an important complication affecting diabetic patients. It very often leads to amputation. The present study was undertaken to find out the pattern of complications related to diabetic foot and the risk factors for lower extremity ulceration and amputation in diabetic patients of Kasturba Hospital. In the present study out of 500, 448 patients did not have any foot lesion and 52 (10.4 %) patients had diabetic foot at the time of examination. The prevalence of diabetic foot ulcers as reported are : Neil et al [1] (7%), McLeod et al [2] (2.6 %), Kumar et al [3] (1.4%), Borssen et al [4] (0.75%)and Pendsey [5] (3.6%). The reason for higher prevalence in this study may be because the study population was a hospital based population and Mahatma Gandhi Institute of Medical Sciences is a tertiary referral care centre.

Out of the 500 cases, 69.6% were males and 30.4% were females (male: female ratio 2.2:1). 63.8% patients had diabetes for less than 5 years, 25% for 5–10 years and 11.2% for more than 10 years. The mean duration of diabetes was found to be 4.2 ± 4 years. Lehto et al [6] (1996), Frykberg et al [7] and Lavery et al [8] reported mean duration of diabetes among diabetic patients as 9.6 ± 0.5, 17 ± 9.5 years and 14.5 ± 9.1 years respectively. In the present study, the mean duration of diabetes was comparatively shorter than the previously reported studies.

In the present study, 39.8% patients had pain in the foot as one of the symptoms similar to Helfand [9] (40.6%). Harris et al [10] reported numbness as the most common symptom (28.2%) as compared to pain in the foot (26.8%) similar to the present study. Callosities was present in 54.6% patients and hallux valgus in 28% patients. Helfand [9] in his study also reported incidence of callosities as high as 46.3% and hallux valgus in 44.7%. In the present study, 15.4% patients had pedal edema whereas Harris et al [10] in their study reported pedal edema in 34.1%. In the present study, it was observed that 16.8% of the patients had history of foot ulceration and 3.6% had history of amputation in the past. Lavery et al [8] reported that 37% patients had past history of lower extremity ulceration or amputation. Rith-Najarian et al [11] reported that 12.5% of the patients had past history of lower extremity ulceration or amputation. Harris et al [10] reported that 18.4% patients had past history of foot ulcers. In the present study the rates of past history of lower extremity events are lower than the study by Lavery et al are in agreement with the studies by Harris et al [10] Rith-Najarian et al [11]. The present study included 52 patients with diabetic foot and it was observed that maximum number of patients (40.3%) had diabetes for less than 5 years, followed by 32.7% patients with diabetes for 5–10 years and 27% patients with diabetes for more than 10 years duration. A study by Bell [12] reported similar results. The observations in the present study are in agreement with the previously reported studies.

Conclusions

The prevalence of diabetic foot in a hospital based rural diabetic population was observed to be 10.4%. Among all diabetics, numbness in the foot was the commonest presenting complaint (40.6%) followed by pain in foot (39.8%). Only 2.8% had claudication in legs. These symptoms were more common among patients with history of long duration diabetes (>10 years) and Type II diabetes. Wagner's grade 2 (37.5%), 3 (31.25%) and 4 (25%) lesions were more common among patients with Type I diabetes while grade 1 (22.2%) and grade 5 (8.3%) lesions were more common among Type II patients. Among the diabetics studied, the most common foot lesion observed was callosities in 54.6%, followed by Hallux valgus/ varus in 28%.The least common was Charcot's deformity present in only 3.6% patients. The prevalence of these foot deformities was the highest among patients with longer duration of diabetes and Type II diabetes. Maximum number of patients with diabetic foot (40.3%) had history of diabetes less than 5 years. 69.3% had Type II diabetes and 30.7% patients had Type I diabetes.

In our study that 76.4% of the diabetics did not know that the feet require special attention and care. 99.8% patients did not inspect their feet for cracks, fissures, trauma, and callosities regularly. 56.4% patients walked barefooted both indoors and outdoors. It was therefore observed that there was lack of knowledge and awareness about foot care among the diabetic study population. This unawareness was so widespread that it resulted in ulceration and finally amputation and increase in social burden and dependency in a family. Regular education regarding symptoms and signs in diabetic population may reduce the disease burden and its complications.

References

1. Neil HAW, Thompson AV, Thorogood M, et al (1989) Diabetes in the elderly: The Oxford community diabetes study. Diabet Med 6:608–613
2. McLeod A, Williams DRR, Sonksen PH, Boulton AJM (1991) Risk factors for foot ulcers in hospital clinic attenders. Diabetologia 34:A39
3. Kumar S, Ashe HA, Parnell LN, et al (1994) The prevalence of foot ulceration and its correlates in type 2 diabetic patients: a population based study. Diabet Med 11:480–484
4. Borssen B, Bergenheim T, Lithner F (1990) The epidemiology of foot lesions in diabetic patients aged 15–50. Diabet Med 7:438–444
5. Pendsey S (1994) Epidemiological aspects of the diabetic foot. Int J Diabet Dev Countries 2:37–38
6 Lehto S, Pyorala K, Ronnemaa T, Laakso M (1996) Risk factors predicting lower extremity amputations in patients with NTDDM. Diabetes Care 19: 607–612
7. Frykberg RG, Lavery LA, Pham H, Harvey C, Harkless L, Veves A (1998) Role of neuropathy and high foot pressures in diabetic foot ulceration. Diabetes Care 21: 1714–1719
8. Lavery LA, Armstrong DG, Vela SA, Quebedeaux TL, Fleischli JG (1998) Practical criteria for screening patients at high risk for diabetic foot ulceration. Arch Intern Med 158: 157–162
9. Helfand AE (1974) Hunting diabetics by foot. J Am Podiatr Assoc 64:399–406
10. Harris M, Eastman R, Cowie C (1993) Symptoms of sensory neuropathy in adults with N1DDM in the US population. Diabetes Care 16:1446–1452
11 Rith-Najarian SJ, Stolusky T, Gohdes DM (1992) Identifying diabetic patients at high risk for lower-extremity amputation in a primary health care setting. Diabetes Care 15:1386–1389
12 Bell ET (1957) Atherosclerotic gangrene of the lower extremities in diabetic and non-diabetic persons. Am J Clin Pathol 28:27–36