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Original Research Article

Aetiopathological and demographic profile of diabetic foot: a prospective cross sectional study from a tertiary hospital in South India

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ABSTRACT

Background: Diabetes mellitus is a chronic disorder affecting large segment of population and is a major public health problem.
Methods: A prospective cross sectional study of 150 patients conducted in the Department of Surgery at Government Medical College, Kozhikode, Kerala, India
Results: Maximum numbers of patients were in the age group of 60-69. Male to female ratio is 3.04:1.50% had duration of diabetes <10 years and 50% had duration ≥10. years. 81 (54%) patients had neuropathy, 53 (35.3%) had PVD, 41 (27.3%) had history of prior foot ulcer, 70 (46.7%) had poor glycemic control (RBS >200 mg/dl) at the time of admission and 44 (29.3%) had history of smoking.
Conclusions: Most important risk factors for diabetic foot ulcers were neuropathy (54%), poor glycemic control (46.7%) and PVD (35.3%), diabetic foot requires a comprehensive management.

Keywords: Diabetes mellitus, Diabetic ulcer, Osteomyletis

INTRODUCTION

Diabetes mellitus is a chronic disorder affecting large segment of population and is a major public health problem. Diabetes and foot problems are almost synchronous. Foot disorders such as ulceration, infection and gangrene are the leading causes of hospitalization in patients with diabetes mellitus.[1,2]

Unfortunately, many of these patients will require amputation within the foot or above the ankle as a consequence of severe infection, peripheral ischemia or neuropathy. Ulceration is the most common single precursor to amputation and approximately 85% of all diabetes related lower extremity amputations are preceded by foot ulcers2. The diabetic foot and its sequelae account for a lot of medical expenditures, as well as lengthy hospital stay and period of disability3. India has large number of people with diabetes, and foot problems account for most of hospital admissions in these patients.

METHODS

Prospective study was done at Department of Microbiology and Surgery, Government Medical College, Kozhikode, Kerala, India. 150 patients admitted in surgery wards were studied. Study was done for one year from 1 April, 2015 to 31 March 2016.

Diabetic foot ulcers ≥Wagner's grade 2 were included in the study.

Diabetic foot ulcers of Wagner's grade 0 and 1 were excluded from the study.

As per the inclusion criteria 150 patients were studied. Patients were assessed with the help of proforma including personal details, diabetic history, control of diabetes, complications of diabetes, neurological evaluation, details regarding foot ulcers, blood investigations (blood urea, serum creatinine and liver function test) urine routine examination and other relevant investigations. Ulcers were graded according to Wagner's classification.

In this study, quantitative variables were expressed as mean±standard deviation and qualitative variables expressed as percentage. The associations of study variables were analyzed using chi square test and a p value of <0.05 was taken as significant. SPSS software was used.

RESULTS

Patients in the age group of 24 years to 92 years were included in this study. Maximum numbers of patients were in the age group of 60-69 (Table 1). In this study, male patients were predominant, 113 cases, constituting about 75.3% of total patients. Female patients were 37 in number, constituting 24.7% of total cases. Male to female ratio is 3.04:1 (Table 2). Majority of the patients had type 2 DM (98%). Only 3 patients had type 1 DM (2%) (Table 3). In this study 50% had duration of diabetes <10 years and 50% had duration ≥10 years (Table 4).

Table 1: Distribution of cases according to age.

Age group	No of patients	Percentage
<29	6	4
30-39	6	4
40-49	24	16
50-59	45	30
60-69	48	32
>70	21	14
Total	**150**	**100**

Table 2: Distribution of cases in relation with gender.

Gender	Number	Percentage
Male	113	75.3
Female	37	24.7
Total	**150**	**100**

Table 3: Distribution of cases according to type of DM.

Type of DM	Number	Percentage
Type 1	3	2
Type 2	147	98
Total	**150**	**100**

Out of the 150 patients, 81 (54%) patients had neuropathy, 53 (35.3%) had PVD, 41 (27.3%) had history of prior foot ulcer, 70 (46.7%) had poor glycemic control (RBS >200 mg/dl) at the time of admission and 44 (29.3%) had h/o smoking (Table 5). Table 6 shows distribution of associated comorbid conditions among diabetic foot ulcer patients. Maximum number of patients had hypertension (46.7%) followed by anemia (42%), nephropathy (28%), osteomyelitis (9.3%), IHD (8.7%) and sepsis (3.3%). Table 7 shows that majority of patients had Wagner's grade 2 and 3 (39.3 and 41.3% respectively).

Table 4: Distribution of cases according to duration of diabetes.

Duration of DM	Number	Percentage
≥10 years	75	50
<10 years	75	50
Total	**150**	**100**

Table 5: Distribution of cases according to risk factors.

Risk factors	Number	Percentage
Neuropathy	81	54
PVD	53	35.3
Prior ulcer	41	27.3
Poor glycemic control	70	46.7
Smoking	44	29.3

Table 6: Distribution of comorbid conditions.

Comorbid conditions	Number	Percentage
Anemia	63	42
Nephropathy	42	28
Hypertension	70	46.7
IHD	13	8.7
Osteomyelitis	14	9.3
Sepsis	5	3.3

Table 7: Distribution of cases according to Wagner's grade.

Grade	Number	Percentage
Grade 2	59	39.3
Grade 3	62	41.3
Grade 4	28	18.7
Grade 5	1	0.7
Total	**150**	**100**

Table 8 shows that 92 (61.33%) patients had ulcers > 2 weeks' duration and 58 (38.67%) had ulcers ≤2-week duration. Out of 150 patients 132 (88%) had ulcer size >4 cm2 and 18 (12%) had ulcer size ≤4 cm^2 (Table 9). All patients were followed up until discharge from hospital. Out of 150 patient's ulcers were healing in 102 patients (68%), 36 patients underwent surgical procedures (24%),

5 patient's ulcers were non-healing (3.3%) and 7 patients expired (4.6%) (Table 10). Poor prognosis of patient showed significant association with presence of PVD (p value 0.0001), higher age group (p value 0.001) and higher Wagner's grade (p value 0.0001).

Table 8: Distribution of cases according to duration ulcer.

Duration	Number	Percentage
≤2 week	58	38.67
>2 week	92	61.33
Total	**150**	**100**

Table 9: Distribution of cases according to ulcer size.

Size	Number	Percentage
≤4cm^2	18	12
>4cm^2	132	88
Total	**150**	**100**

Table 10: Distribution of different surgical procedures.

Surgical Procedures	Number (%)
Mid tarsal amputations	15 (41.7)
Toe disarticulation	9 (25)
BK amputation	8 (22.2)
AK amputation	4 (11.1)

DISCUSSION

Majority of patients were males 75.3% (113) with male to female ratio 3.04:1. Similar sex predominance were noted in the following studies conducted by Bansal E et al., Alavi SM et al and Sasikala et al.[4-6] This predominance may be due to the fact that majority of diabetic patients are males and are more involved in outdoor activities than females.

Majority of patients were in the age group of 60-69 (32%), followed by 50-59 (30%). Study by Bansal E et al. showed similar results, with majority in the age group of 51-70 years (56.31%).[4] Age of patients in this study varied from 24 to 92 years with mean age of 56.18±11.93 years. Majority of the subjects had type 2 DM, 98% (147) and this is because, the prevalence of type 2 DM is more than type 1 DM. The mean duration of DM was 10.2±7.31 years.

It is well recognized that a number of contributory factors working together ultimately result in foot ulceration in diabetic patients. The commonest causes for diabetic foot ulceration include peripheral neuropathy, foot deformity, external trauma and peripheral vascular disease. With the exception of trauma, none of the above risk factors will cause ulceration in isolation.[7] With the increasing duration of diabetes, there is increased risk of diabetes related complications especially sensory neuropathy and peripheral vascular disease. The incidence of type 2 DM is rising to epidemic proportion in India and whole world.[4] The increasing longevity and expanding population of diabetic patients have resulted in greater number of diabetic foot infections that continue to be the major cause of hospital admissions among these patients.[8] Because of its low case fatality rate, prevalence of associated chronic complications is expected to increase. The burden of diabetic foot is set to rise in future since its contributory factors such as peripheral neuropathy and peripheral vascular disease are present in more than 10% of patients at the time of diagnosis.[4] In this study, 54% (81) of patients had neuropathy and 35.3% (53) had peripheral vascular disease. Gadepalli et al. reported a high prevalence of neuropathy and peripheral vascular disease of 86.2% and 85% respectively.[1] Several other studies also showed a high prevalence of neuropathy and peripheral vascular disease.[4,9,10] Vimalin et al and Zubair et al. Reported a high prevalence of neuropathy with 80% and 66.6% respectively in their studies.[11,12]

Other risk factors associated with diabetic foot ulcers that were studied include past history of ulcer 27.3% (41) and smoking 29.3% (44). Almost similar prevalence was reported by Ekta Bansal et al. in their study4. A diabetic patient with a history of previous ulceration or amputation is at increased risk of subsequent ulceration and amputation.[13] This fact highlights the need of giving special care to those with past history of ulcer. Though smoking is not considered as an independent risk factor for diabetes, it is associated with increased risk of mortality in diabetic patients because of increased chance of ischemic heart disease.[14]

In this study prevalence of poor glycaemic control was 46.7% (70). In a retrospective study conducted by Ramakant et al. noted a prevalence of 57% of poor glycemic control. Bansal E et al and Zubair et al reported a high prevalence of poor glycemic control of 67% and 69% respectively in their study.[4,11] Close monitoring of blood sugar is very important because a rise in blood sugar level suggests worsening of infection even though other signs and symptoms are absent.[15] In addition to that hyperglycemia impairs neutrophil function and reduces host defenses and delays wound healing.[16]

Co morbid conditions like anemia, hypertension, nephropathy and IHD associated with diabetes have been studied. 42% (63) of patients in this study had anemia whereas Ekta Bansal et al. in their study reported a prevalence of 54% (56).[4] Correction of anemia is an important factor, as it can impair wound healing. Prevalence of nephropathy was 28% (42) which is low as compared to study by Shakil et al. (61.8%).[17] Almost similar results were shown by Ozer et al. in their study18. Prevalence of hypertension and IHD were 46.7% (70) and 8.7% (13) respectively as per this study. Prevalence of osteomyelitis was very low (9.3%) as compared to the study conducted in AIIMS (62.5%).[1] In our study radiological evaluation was used for detection of

osteomyelitis whereas in other study bone scan also was used for detecting osteomyelitis. Only 3.3% of patients had features of sepsis in this study.

41.3% of the patients in this study had Wagner's grade 3 ulcer followed by 39.3% with grade 2 and 18.7% with grade 4 whereas study by Bansal et al. and Ozer et al. showed maximum number of patients in grade 4 (44.6% and 33.3% respectively).[4,18] Wagner's grade 1 was not included in this study because most of them can be managed as out patients and seeks medical advice from peripheral units.

CONCLUSION

Majority of patients in the study were males (75.3%). Mean age of study population was 56.18±11.93 years. Most important risk factors for diabetic foot ulcers were neuropathy (54%), poor glycemic control (46.7%) and PVD (35.3%). Other comorbid conditions include anemia (42%), nephropathy (28%) and hypertension (46.7%). Prevalence of osteomyelitis in this study was 9.3%, most of the patients had ulcer duration > 2 weeks (61.33%), majority of patients were included in Wagner's grade 3 (41.3%) followed by grade 2 (39.3%). A careful examination of foot and early assessment of risk factors associated with diabetic foot ulcer by the physician is essential.

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REFERENCES

1. Gadepalli R, Dhawan B, Sreenivas V, Kapil A, Ammini AC, Chaudhry R. A clinico-microbiological study of diabetic foot ulcers in an Indian tertiary care hospital. Diabetes care. 2006;29(8):1727-32.
2. Armstrong DG, Lavery LA, Harkless LB. Validation of a diabetic wound classification system: the contribution of depth, infection, and ischemia to risk of amputation. Diabetes care. 1998;21(5):855-9.
3. Bansal E, Garg A, Bhatia S, Attri AK, Chander J. Spectrum of microbiological flora in diabetic foot ulcer. Indian J Pathology Microbiology. 2008;51(2):204-8.
4. Sasikala R, Latha R, Muruganandam N, Senthilkumar K. Surveillance on multi drug resistant organism (MDRO) associated with diabetic foot ulcers in Pondicherry. Internet J Microbiology. 2008;5(2):1-7.
5. Alavi SM, Khosravi AD, Sarami A, Dashtebozorg A, Montazeri EA. Bacteriologic study of diabetic foot ulcer. Foot. 2007;23(5):681-4.
6. Boulton AJ. The diabetic foot: grand overview, epidemiology and pathogenesis. Diabetes Metab Res Rev. 2008;24(1):3-6.
7. Tan JS, Friedman NM, Miller CH. Can aggressive treatment of diabetic foot infections reduce the need for above-ankle amputation? Clinical Infectious Diseases. 1996;23:286-91.
8. Shanker EM, Mohan V. Bacterial aetiology of diabetic foot infection in South India. European J Internal Medicine. 2005;16(8):567-70.
9. Ramakant P, Verma AK, Misraet R. Changing microbiological profile of pathogenic bacteria in diabetic foot infections: time for a rethink on which empirical therapy to choose? Diabetologia. 2011;54:58-64.
10. Zubair M, Malik A, Ahmad J. Clinico-bacteriology and risk factors for the diabetic foot infection with multidrug resistant microorganisms in north India. Biol Med. 2010;2(4):22-34.
11. Hena JV, Growther L. Studies on bacterial infections on diabetic foot ulcer. African J Clinical Experimental Microbiol. 2010;11(3):146-9.
12. Amstrong DG, Lavery LA. Diabetic foot ulcer, prevention, diagnosis and classification. J American Academy Family Physician. 1998;57(6):1325-32.
13. Bowering CK. Diabetic foot ulcers, pathophysiology, assessment, and therapy. J Canadian Family Physician. 2001;47:1007- 16.
14. Levin ME. An overview of the diabetic foot: pathogenesis, management and prevention of lesions. Int J Diab Dev Countries. 1994;14:39-47.
15. Weintrob AC, Sexton DJ. Overview of diabetic infections of the lower extremities. 2011.
16. Shakil S, Khan AU. Infected foot ulcers in male and female diabetic patients: a clinic - bioinformative study. Annals Clinical Microbiol Antimicrobials. 2010;9:2.
17. Ozer B, Kalaci A, Semerci E. Infections and aerobic bacterial pathogens in diabetic foot. African J Microbiol Research. 2010;4(20):2153-60.

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