International Journal of Medical Research & Health Sciences

Research article

CLINICO-BACTERIOLOGICAL PROFILE OF DIABETIC FOOT ULCER AMONG THE PATIENTS ATTENDING RURAL TERTIARY HEALTH CARE CENTRE

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ABSTRACT

Background: Worldwide diabetic foot is a major medical problem leading to disability and economic instability to family and country. **Objectives:** To assess the clinical and bacteriological profile of diabetic foot ulcer among rural Indian residents and its association with demographic factors. **Methodology:** Hospital based cross-sectional study was carried out in the rural tertiary care centre during the year 2010 to 2012. A total 78 diabetic foot ulcer cases were enrolled, interviewed, clinically examined and bacteriological assed as per structured questionnaire and methods. **Results:** Maximum, 70.51% cases were above the age of 50 years with higher proportion, 76.9% seen in males. The majority of cases, 97.4% were belonged to type II DM with maximum, 48.7% cases had a duration of ulcer less than of ten days. Maximum, 67.94% ulcers were seen on Right foot, 53.8% ulcers were of grade III and above. Neuropathy, the major associated complication was seen in 68% cases and average 1.8 bacteria were identified per sample. **Conclusion:** As the grade of diabetic foot ulcer is increased, the bacterial count is also increased.

Keywords: Diabetic foot ulcer, bacterial isolates, neuropathy

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disorder affecting a large segment of the population and in the present scenario, it act as a major public health problem in India[1]. India acts as home for DM and currently carrying the load of 42 million cases and ranking the top most country among the list of the ten nations with the most affected with diabetes[2]. Among diabetic patients, foot ulcer is the most common complication accounts 15% during their lifetime[3]. Diabetic foot lead to limb amputation has major impact on an individual, not only physical deformity, but also lead to economically dependent and socially deprived[4].

The alarming fact is that, India has more people with DM than any other country and incidence of diabetic foot problem as well as limb/foot amputations remain very high, accounting up to 20 % of diabetes related hospital admission. This can be attributed to several social and cultural practices viz., barefoot walking, inadequate facilities for diabetes care and education, and poor socioeconomic conditions[5]. Worldwide, diabetic foot lesions are considered as major medical, social and economic problem and are the leading cause of hospitalization for patients with diabetes[6].Though, there is an obvious increase in

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diabetic foot care awareness, there are tremendous gaps in routine diabetic foot evaluation.

The aim of the present study was to assess the clinic - bacteriological profile of diabetic foot ulcer among the diabetic patients admitted to a tertiary care hospital located in a rural area of western Maharashtra, India. The changes in lifestyle lead to increase the burden of Diabetes in Maharashtra state, India and which was estimated at 6 million by the year 2011[7,8]. Similarly, maximum cases were from age group 20-70 years, which further affect the economic growth of the country.

MATERIAL AND METHODS

A cross sectional study was conducted in tertiary health care centre located in a rural area of western Maharashtra, India. The study was conducted during the period of year 2010 to 2012. A total 78 diabetic patients with foot ulcers admitted at a surgical ward during the study period were enrolled in the study as per inclusion criteria of the study.

Inclusion criteria: Diabetic patients with foot ulcer admitted in rural tertiary health care centre during the study period and willing to participate in the study.

Exclusion criteria: ICU, critical cases and not willing cases. Statistical analysis was carried out after the raw data entered into MS Excel and analysed into frequency percentage distribution. Statistical association and correlation was determined by using chi-square test and correlation coefficient.

Ethical consideration: Institutional ethical clearance was obtained before starting the study and consent also obtained from study subjects.

Foot ulcer patients were categorized into six grades based on Wagner classification system[9]. A pre-tested structured questionnaire was utilized to collect the information pertained to medical history, examination in details and investigation reports. A detailed medical history was taken from all the patients regarding age, sex, type of DM, grade and duration of diabetic foot ulcer and associated complications etc. by personal interview method and clinical examination.

Physical examination was carried out to identify associated medical complications such as Wagner's grade, hypertension, nephropathy, edema, and retinopathy. Sensory neuropathy was assessed by ability to sense touch with 10 gram monofilament and tuning fork[7]. The temperature of the patient was also recorded by using clinical thermometer. The adequacy of peripheral circulation was done by palpating the posterior tibial artery and the dorsalis pedis artery. The foot was examined for the presence of callus or any other abnormality. Touch, pain and joint position sensation were examined in the foot. Foul smell, local rise of temperature, discharge and discoloration of the surrounding area was noted. The base of the ulcer was palpated to assess the depth of the ulcer. When osteomyelitis (to assess bone involvement) was suspected, the foot X-ray was done. The specimens were collected in a sterile culture tube before starting the antibiotics. All these specimens were immediately transported and processed in the Department of Microbiology as per the standard guidelines of Clinical and Laboratory Standard Institute (CLSI-2011) by a researcher.

The foot ulcer in which only one organism isolated as a causative agent categorized as monomicrobial infection like staphylococci, streptococci, Pseudomonas, klebssiela etc., Whereas more than one organism isolated categorized as polymicrobial infection.

Statistical test: Chi-square test (x^2) and correlation coefficient (r) was worked out to find out statistical significant difference and linear relation between variables. SPSS version 17, as statistical software was used to analyse the data.

RESULTS

Table 1: Distribution of cases according to Age and Sex

Age (years)	Male (%)	Female (%)	Total (%)
11-20	1(1.3%)	0	1(1.3%)
21-30	2(2.6%)	0	2(2.6%)
31-40	6(7.6%)	0	6(7.6%)
41-50	13(16.7%)	1(1.3%)	14(17.9%)
51-60	14(17.9%)	4(5.1%)	18(23%)
61-70	15(19.2%)	6(7.6%)	21(29%)
71-80	7(8.9%)	5(6.4%)	12(15.3%)
81-90	2(2.6%)	1(1.3%)	3(3.8%)
91-100	0	1(1.3%)	1(1.3%)
Total	60(76.9%)	18(23.1%)	78(100%)
	Chi-square = 9.07, p value = 0.002*		

(Age: x^2=43.42, p = 0.0001*, Sex: x^2=9.07, p = 0.002*,*= p is significant at 95% confidence interval)

A total of 78 diabetic foot ulcer cases were interviewed, examined and bacteriological investigated

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The lowest and highest age at occurrence of diabetic foot ulcer was 18 and 92 years. Maximum,70.51% cases were above the age of 50 years and as age increases, the chance of getting of Diabetic foot ulcer also increases(^{2}=43.42, p = 0.0001*).The proportion of male cases were higher,76.9% as compared to females, 23.1% and difference was statistically significant (^{2}=9.07, p = 0.002*) (Table 1).

Table 2: Distribution of cases, according to Clinical criteria:

Variables	Frequency (%)	Variables	Frequency (%)
Types of DM:		**Duration of Ulcer (dyas)**	
Type I DM	2 (2.6%)	< 10	38 (48.7%)
Type II DM	76 (97.4%)	10-20	21(26.9%)
Duration of DM (years)		20-30	12(15.4%)
1	13 (16.6%)	> 30	7(8.9%)
2-5	26 (33.3%)	**Grade of Ulcer:**	
6-10	15 (19.2%)	Grade I	7(8.97%)
11- 15	8 (10.2%)	Grade II	17(21.79%)
15 years	3 (3.8%)	Grade III	20(25.64%)
Not known	13 (16.6%)	Grade IV	22(28.20%)
		Grade V	12(15.38%)
Site of Ulcer:			
		Sole-	Toes and others
Rt. Foot	53(67.94%)	32(60.37%)	21(39.62%)
Lt. Foot	25(32.05%)	18(72%)	7(28%)

The majority of patients, 97.4% were belonged to Type II DM and the duration of DM was about 2 to 5 years seen maximum in 33.3% patients. However, 16.6% patients were unknown about the duration of illness. Maximum, 48.7% cases having ulcer was of duration less than of 10 years and maximum, 53.84% ulcers were of grade III and IV types. Majority of ulcers, 67.94% were located on Rt. Foot of which maximum, 60.37% were present over the sole area (Table 2).

Table 3: Diabetic foot ulcer with associated complications

Associated complications	Frequency (%)
Neuropathy	30 (38.5%)
Hypertension (HTN)	4 (5.1%)
Peripheral Vascular Disease (PVD)	3 (3.9%)
Neuropathy + PVD	6 (7.7%)
HTN + PVD	1(1.3%)
HTN + Neuropathy	7 (9%)
Nephropathy	1(1.3%)
Retinopathy	1(1.3%)
Neuro+PVD+HTN+Nephropathy	1(1.3%)
Others	3 (3.9%)
No complication	25 (32%)

Out of a 78 patients, maximum 68% were suffering from one or more of DM associated complications. The Peripheral Neuropathy, most common associated complication was seen in 56.4 % cases (Table 3).

Table 4: Correlation between Grade of ulcer and Bacterial isolates

Ulcer Grade	No. of cases	Mono microbial Infection	Poly microbial infection			Total organisms	Isolates per case
			Two	Three	> Three		
I	7	5	2	-	-	9	1.2
II	17	6	7	4	-	32	1.8
III	20	11	4	3	2	36	1.8
IV	22	11	5	4	-	33	1.6
V	12	1	10	1	-	24	2

(Correlation coefficient(r)= 0.94 with CI of 0.34 -0.99 at 95% , p=0.01*)

A total of 134 bacterial isolates were found from 78 patients, of which mono and poly -microbial isolates were 34 and 100 respectively. The maximum, 53.8% bacterial isolates were seen in ulcer grade III and IV and as the grade of ulcer increases, the number of bacterial isolates also increases and showing linear positive correlation as indicated by the correlation coefficient (r = 0.94, p=0. 01*). The average number of bacteria found was 1.8 per sample (Table 4).

In poly-microbial isolates, two bacteria found in two cases were totaled as four bacteria, similarly for three and more for total number of isolates.

Table 5: Treatment outcome of patient with diabetic foot ulcer

Treatment outcome of cases	Frequency (%)
Debridement	25 (32%)
Amputation	19 (24.3%)
Improved	27 (34.6%)
Expired	4(5.1%)
Against medical advice discharge	3(3.8%)

A total of 78 patients were admitted of which 34.6% cases were totally improved from ulcer whereas debridement and amputation was required for 32% and 24.3% cases respectively. The 5.1% cases were expired during treatment mainly due to multiple organ failure and age of cases (Table 5).

DISCUSSION

Among diabetics, infected foot ulcer lead to dreaded complications like gangrene and amputations which is most often follows trauma to neuropathic foot.

The present study depicts the mean age of the study population was 59.5 years with more than 70% cases were above the age of 50 years and as age increases the chance of getting a foot ulcer also increases (p<0.05). Similar findings have also been reported by Bansal E, 2008[5] and Kahn O et al, 1974[10]. Most of our patients did not have access to diagnostic facilities as they were from rural areas this could be a reason for higher mean age of patients. The proportions of male patients with diabetic foot ulcer have been higher (76.9%) than females. Similar findings have also been reported by Bansal E, 2008[5] and Banashankari G, 2012[11]. The male population predominated the studies and may be due to the fact that males are more involved in outdoor activities in the Indian scenario and is thus more prone to injuries which can predispose to ulcers.

Our study reveals the mean duration of diabetes was 6.5 years, which is almost close comparison to the study of Samaga M et al, 2008[12]. In our study Type II diabetes mellitus predominates and similar findings have also been reported by Bansal E, 2008[5], Gadepalli R, et al, 2006[6] and Paul S et al, 2009[13]. Whereas study by Sapico F, et al, 1984[14] Type I diabetes mellitus predominates Type II. The average duration of foot ulcer observed in this study was 18.9 days with maximum, 47.8% cases having duration of less than 10 days.

Maximum, 53.80% of the cases had ulcers of Grade III and IV, whereas, 12 patients had extensive gangrene i.e. Grade V. The higher proportion of foot ulcer has been predominately seen on Right leg, 67.9% with majority of lesions located over sole area. A similar finding has also been observed by Banashankari G et al, 2012[11].

The peripheral neuropathy, a major associated complication (56.45%) was observed in this study. A similar finding has also been observed by Shailesh K,

2012[15].However, Paul S, et al, 2009[13] observed neuropathy in 33.3% of cases, whereas Banashankari G et al, 2012[11] reported in 76% of cases. The feet were the target of peripheral neuropathy leading chiefly to sensory deficit and autonomic dysfunction could be the cause for high proportion. Our study documented 55.3% of diabetic foot ulcers are polymicrobial similar findings recorded in study by Gadepalli R et al, 2006[6]in contrast to findings of Dhanasekaran G et al, 2003[16], documented monomicrobial infection in 84% patients. The average of 1.8 bacteria per sample was reported in our study. Study by Kahn O et al, 1974[10] and Raja N, 2007[17] documented 1.47 isolates per sample while Gadepalli R et al, 2006[6] showed 2.3 organisms per sample. Staphylococcus was the most predominant pathogen which was isolated in our study and similar findings was recorded by Gadepalli R et al, 2006[6]

There is a positive correlation between bacterial count and the grade of ulcer as indicated by the correlation coefficient (p<0.05). Similar results have been also reported by Paul S, 2009[13] and Jain M et al, 2012[18]. In the present study, the diabetic foot infections are polymicrobial in nature and as the grade of ulcer increased, the prevalence of isolates also increased. This could be due to widespread use of broad spectrum antibiotics, leading to survival advantage of resistance bacteria.

CONCLUSION

Diabetic foot ulcers are more common in and above 5th decade of life with male preponderance. As the grade of ulcer increased, the number of bacterial isolates also increased. Knowledge of diabetes and care of limbs are of paramount importance to reduce the diabetes associated complications.

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