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Research Article

**CLINICO-BACTERIOLOGICAL PROFILE OF THE PATIENTS
WITH DIABETIC FOOT ULCER**¹Dr Jawaria Abbas, ²Dr Affaf Yousaf, ³Dr Haseeb Farooq¹Bolan Medical College, Quetta²Azra Naheed Medical College³Azad Jammu & Kashmir Medical College, Muzaffarabad**Article Received:** October 2020**Accepted:** November 2020**Published:** December 2020**Abstract:**

Introduction: The worldwide diabetic foot is a major medical problem leading to disability and economic instability of the family and the country.

Objectives: To evaluate the clinical and bacteriological profile of diabetic foot ulceration and its relationship to demographic factors.

Methodology: A hospital cross-sectional study was conducted in the Surgical Unit-II of Jinnah Hospital, Lahore for one-year duration from March 2019 to March 2020. A total of 78 diabetic foot ulcers were screened, interviewed, clinically investigated and bacteriologically assessed according to a structured questionnaire and methods.

Results: Up to 70.51% of cases were over 50 years of age, with a higher percentage, 76.9% in men. The majority of cases, 97.4%, were type II diabetes, with the maximum 48.7% of cases having ulcers for less than 10 days. Up to 67.94% of the ulcers were found on the right foot, 53.8% were Grade III or higher. Neuropathy, the major accompanying complication, was observed in 68% of cases, with an average of 1.8 bacteria per sample.

Conclusion: As the severity of diabetic foot ulceration increases, so does the number of bacteria.

Key words: diabetic foot ulceration, bacterial isolates, neuropathy

Corresponding author:**Dr. Jawaria Abbas,**

Bolan Medical College, Quetta

QR code



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INTRODUCTION:

Diabetes mellitus (DM) is a chronic disease affecting a large proportion of the population and, in its current scenario, is a major public health problem in Pakistan. Pakistan is home to DM and currently carries a load of 20 million cases and ranks 3rd among the countries with the highest number of diseases in the list of the top 10 countries most affected by diabetes. Among diabetic patients, foot ulceration is the most common complication in their lifetime, accounting for 15%. A diabetic foot leading to limb amputation has a great impact on the individual, not only physically but also leading to economic dependence and social exclusion.

The worrying fact is that there are more people with DM in Pakistan than in any other country and the incidence of the diabetic foot problem as well as limb / foot amputation remains very high, accounting for up to 20% of diabetes-related hospitalizations. This can be attributed to several social and cultural practices, namely barefoot walking, inadequate diabetes care and education facilities, and poor socio-economic conditions. Worldwide, changes in the diabetic foot are considered to be the major medical, social and economic problem and the leading cause of hospitalization of diabetic patients. While there is an obvious increase in awareness of diabetic foot care, there are huge gaps in the routine assessment of the diabetic foot.

The aim of the study was to evaluate the clinical and bacteriological profile of diabetic foot ulceration in diabetic patients in Pakistan. Lifestyle changes have increased the diabetes burden in Pakistan, which by 2015 was estimated at 6 million. Similarly, the maximum cases concerned the age group 20-70 years, which additionally affects the economic growth of the country.

MATERIAL AND METHODS:

A cross-sectional study was conducted at the Surgical Unit-II of Jinnah Hospital, Lahore for one-year duration from March 2019 to March 2020. A total of 78 diabetic patients with foot ulcerations admitted to the surgical unit during the study period were enrolled in the study according to the study entry criteria.

Inclusion criteria: Diabetic patients with foot ulceration during the study period and willing to participate in the study.

Exclusion criteria: ICU, critical cases and cases of aversion. Statistical analysis was performed after the raw data was entered into MS Excel and analyzed as a percentage frequency distribution. Statistical

association and correlation were determined using the chi-square test and the correlation coefficient.

Ethical considerations: Ethical approval was obtained from the institution prior to the initiation of the study, and consent was also obtained from study participants.

Patients with foot ulceration were categorized into six grades based on the Wagner classification system⁹. A pre-tested structured questionnaire was used to gather information on medical history, detailed research, and study reports. Detailed medical history was obtained from all patients regarding age, sex, type of diabetes, degree and duration of the diabetic foot ulcer and related complications etc. by personal interview and clinical examination.

A physical examination was performed to identify related medical complications such as Wagner's grade, hypertension, nephropathy, edema, and retinopathy. Sensory neuropathy was assessed on the basis of the ability to sense touch using a 10 g monofilament and a tuning fork. The patient's temperature was also recorded with a clinical thermometer. The adequacy of the peripheral circulation was assessed by palpation of the posterior tibial artery and the dorsal artery of the foot. The foot was examined for callus or other abnormalities. Touch, pain and feeling of position in the joint were examined in the foot. Bad smell, local temperature rise, discharges and discoloration of the surrounding area have been noted. The base of the ulcer was palpated to assess the depth of the ulcer. When osteomyelitis was suspected (to assess bone involvement), an X-ray of the foot was taken. The samples were collected in a sterile culture tube before starting the antibiotics. All these samples were immediately transported and processed by the researcher at the Department of Microbiology according to the standard guidelines of the Clinical and Laboratory Standard Institute (CLSI-2011).

A foot ulcer in which only one organism has been isolated as a causative agent classified as a monomicrobial infection such as staphylococcus, streptococcus, Pseudomonas, Klebsiella, etc., while more than one isolated organism has been classified as a multi-bacterial infection.

Statistical test: Chi-square test (χ^2) and correlation coefficient (r) was developed to establish a statistically significant difference and linear relationship between the variables. SPSS version 17 as statistical software was used for data analysis.

RESULTS:

A total of 78 cases of diabetic foot ulceration were examined, examined and examined bacteriologically.

The lowest and highest age of onset of diabetic foot ulcer were 18 and 92 years. Up to 70.51% of cases were over the age of 50, and as age increases, the chance of developing diabetic foot ulcers also increases ($\chi^2 = 43.42$, $p = 0.0001$ *). The percentage of cases for men was higher and amounted to 76.9% compared to 23.1% for women, and the difference was statistically significant ($\chi^2 = 9.07$, $p = 0.002$ *) (Table 1).

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*			

The majority of the patients, 97.4%, were type II diabetes and the duration of diabetes was approximately 2 to 5 years with a maximum of 33.3% of the patients. However, 16.6% of patients were unaware of the duration of the disease. Up to 48.7% of ulcers were less than 10 years old, and up to 53.84% of ulcers were type III and IV. The majority of ulcers, 67.94%, were on Rt. Foot, of which a maximum of 60.37% was on the sole (table 2).

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:	
Rt. Foot	53(67.94%)	Sole-	Toes and others
		32(60.37%)	21(39.62%)
Lt. Foot	25(32.05%)	18(72%)	7(28%)

Of the 78 patients, a maximum of 68% had one or more complications from DM. Peripheral neuropathy, the most common complication, occurred in 56.4% of cases (Table 3).

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%)

A total of 134 bacterial isolates from 78 patients were found, including 34 and 100 monomicrobial isolates, respectively. A maximum of 53.8% of bacterial isolates were found in stage III and IV, and as the degree of ulceration increased, the number of bacterial isolates also increased, showing a linear positive correlation, as indicated by the correlation coefficient ($r = 0.94$, $p = 0.01$ *). The mean number of bacteria found was 1.8 per sample (Table 4).

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

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%)

In the poly-microbial isolates, the two bacteria found in two cases were summed up as four bacteria, similarly for three or more bacteria in the total number of isolates. A total of 78 patients were admitted, 34.6% of which completely recovered due to ulceration, while debridement and amputation were required in 32% and 24.3% of cases, respectively. 5.1% of the cases expired during treatment, mainly due to multiple organ failure and the age of the cases (Table 5).

DISCUSSION:

In diabetics, infected foot ulcers lead to horrific complications such as gangrene and amputations,

which most often follow a neuropathic foot injury. In this study, the mean age of the study population was

59.5 years, of which over 70% of cases were over 50 years of age, and the risk of foot ulceration increases with increasing age ($p < 0.05$). Similar findings were also reported by Bansal E, 2008 and Kahn O et al., 1974. Most of our patients did not have access to diagnostic facilities because they came from rural areas, which could be the reason for the higher mean age of patients. The proportion of men with diabetic foot ulcers was higher (76.9%) than women. Similar conclusions were also made by Bansal E, 2008 and Banashankari G, 2012. The male population dominated the research and may be due to the fact that men are more involved in outdoor activities in the Pakistan scenario and are therefore more prone to injuries that may predispose to ulceration.

Our study reveals that the average duration of diabetes was 6.5 years, which is almost in line with the 2008 study by Samaga M et al. Our study was dominated by type II diabetes, and similar findings were also presented by Bansal E, 2008, Gadepalli R, et al., 2006 and Paul S et al., 2009. While the study by Sapico F et al., 1984, type I diabetes dominated. The mean duration of foot ulceration observed in this study was 18.9 days. with the maximum number of cases being 47.8% less than 10 days.

Up to 53.80% of cases had Grade III and IV ulcers, while 12 patients had extensive gangrene, ie Grade V. A greater percentage of foot ulcers were mainly observed on the right leg, 67.9% with the majority of lesions located in the plantar area. A similar discovery was also observed by Banashankari G et al., 2012

In this study, peripheral neuropathy was observed, the major companion complication (56.45%). A similar result was also observed by Shailesh K, 2012, however Paul S et al. 2009 observed neuropathy in 33.3% of cases, while Banashankari G et al., 2012 reported 76% of cases. The feet were the target of peripheral neuropathy, leading mainly to a sensory deficit, and autonomic dysfunction could be the cause of the high percentage. Our study found that 55.3% of diabetic foot ulcers were multi-microbial-related symptoms reported in the study by Gadepalli R et al., 2006, in contrast to the results of Dhanasekaran G et al., 2003, 84% of patients have documented monomicrobial infection. Our study recorded an average of 1.8 bacteria per sample. A study by Kahn O et al., 1974 and Raja N, 200717, documented 1.47 isolates per sample, while Gadepalli R et al., 20066 showed 2.3 microorganisms per sample. Staphylococcus was the most dominant pathogen that was isolated in our study and similar findings were reported by Gadepalli R et al., 2006.

There is a positive correlation between the number of bacteria and the degree of ulceration as indicated by the correlation coefficient ($p < 0.05$). Similar results were also obtained by Paul S, 2009 and Jain M et al., 2012. In this study, diabetic foot infections are of a polymicrobial nature, and as the degree of ulceration increased, the incidence of isolates also increased. This may be due to the widespread use of broad-spectrum antibiotics, leading to a predominance of survival-resistant bacteria.

CONCLUSION:

Diabetic foot ulcers are more common in the fifth decade of life and beyond, with a predominance of men. As the degree of ulceration increased, so did the number of bacterial isolates. Knowing about your diabetes and caring for your limbs is of great importance in reducing the complications associated with diabetes.

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