

## Research Article

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## A Clinical Study to Estimate Prevalence of Diabetic Foot Ulceration and its Association with Risk Factors at Tertiary Care Centre

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### Abstract

**Introduction:** Diabetes mellitus is a growing worldwide pandemic. impact of diabetes is increasingly substantial in many developing countries.

**Aim:** To estimate prevalence of diabetic foot ulceration and its association with risk factors.

**Methods:** This was a hospital based cross-Sectional study on 180 cases by systematic random sampling technique of diabetes of age >18 years were included and labelled with diabetes according to WHO and ADA guidelines. Those who were seriously ill, gestational diabetic, diabetic patients who had traumatic ulcer, and clinically suspected of having Charcot foot are excluded. A total of 900 patients with Diabetes were admitted and followed up during the study period from Aug 2021 to July 2022, out of them 180 had diabetic foot lesion. The clinical pattern of foot lesions, Investigations done, treatment given and the associated complications were analyzed.

**Results:** mean age of study population was  $59.6 \pm 15.64$  yr with age range of 20-79 yr. 70% were male, 60% were rural, 50% subjects were in lower socioeconomic group (V) and 51.11% patients present with ulcer either foot or toe. About 110 patients presented with Diabetic foot ulcers with infection of this 74.55% were of single organisms like Klebsiella, E. coli, Proteus, etc. Only 16.36% had mixed organism grown in culture. 70.00% cases were treated by slough excision followed by 13.33% by antibiotics. The average number of days of hospitalization was  $14 \pm 11.5$  days. In our study mortality rate was 5% and survival rate was 95%.

**Conclusion:** Foot ulcer among diabetic patients is in increasing trend in India. Majority were old aged rural male with low socioeconomic status with Most common risk factor was obesity and poor diabetic control followed by neuropathy and bony deformity. Early diagnosis and strict control of diabetes and foot care decreases mortality and hospital stay.

**Keywords:** clinical study; diabetic foot ulceration; risk factors

### Introduction

Diabetes mellitus is a growing worldwide pandemic. Impact of diabetes is increasingly substantial in many developing countries including India due to population growth, consumption of unhealthy diets, obesity, and physical inactivity. Among people with diabetes, high blood glucose and metabolic aberrations affect multiple organs leading to chronic but insidious complications that affect every system in the body [1]. Diabetic foot disease is linked to excess disability and morbidity, placing an exorbitant burden on the health system across the world. Individuals with diabetes who are living with foot complications experience limited mobility, social isolation, disruption to work and leisure activities, sleep disturbance, depression, and pain [2]. The increase in the prevalence of diabetes is accompanied by an increase in its complications such as foot ulcers

and lower extremity amputations [3]. According to who's estimation in 2016, about 1.6 million deaths were directly caused by diabetes with a lifetime incidence of foot ulcers occurring in one fourth of diabetes patients [4]. The international diabetes federation estimates that at least one limb is lost due to diabetes foot ulcers somewhere in the world every 30 s. Barefoot walking, inappropriate footwear, poor foot hygiene and delay in seeking medical attention were reported as factors contributing to the risk of lower limb amputations in the patients with diabetes apart from peripheral vascular disease and peripheral neuropathy [5]. Regular evaluation and early treatment are the most effective mechanism to prevent the devastating diabetic foot complications. Aggressive control and management of diabetes mellitus with proper foot caring can prevent these devastating conditions.

**Aim:** To estimate prevalence of diabetic foot ulceration and its association with risk factors.

## Methods

This was a hospital based cross-sectional study on 180 cases by systematic random sampling technique of diabetes of age >18 years were included and labeled with diabetes according to WHO and ADA guidelines. Those who were seriously ill, gestational diabetic, diabetic patients who had traumatic ulcer, and clinically suspected of having Charcot foot are excluded. A total of 900 patients with Diabetes were admitted and followed up during the study period from Aug 2021 to July 2022, out of them 180 had diabetic foot lesion. The clinical pattern of foot lesions, Investigations done, treatment given and the associated complications were analyzed. Data collected through a validated, pretested, structured questionnaire was developed after reviewing different literature. The questionnaire contains socio-demographic factors, behavioral variable, clinical variables, and anthropometric measurements. Clinical variable was taken from the history and examination of patients, and anthropometric measurements were measured. Body weight was measured with an adjusted weight scale, height measured in meters on flat surface, BMI for nutritional status in kg/m<sup>2</sup>. Michigan neuropathy screening instrument used to evaluate the presence of diabetic peripheral neuropathy.

**Table 1:** Sociodemography.

Age (yrs.)	Number	Percentage
20 - 39	10	5.56
40 - 49	40	22.22
50 - 59	50	27.78
60 - 69	60	33.33
70 - 79	20	11.11
Sex		
Male	126	70
Female	54	30
Residence		
Rural	108	60
Urban	72	40

52.22% cases had 5 - 10 yr. duration of diabetes followed by 41.11% had <5 yr. with mean duration of diabetes for diabetic foot ulcer was  $6.1 \pm 4.9$  yr. in our study population. 70% cases had foot trauma that was unnoticed whereas 30% had spontaneous development of foot lesion. 61.11% were obese followed by 20% had normal BMI whereas minimum 18.89% had overweight. 57.78% reported to hospital after 15 days of onset of symptoms

## WHO and ADA guidelines

According to the criteria of WHO and ADA guidelines diagnosis of diabetes mellitus is confirmed on the basis of (1)-Symptoms of diabetes mellitus with random blood sugar level more than 200 mg/dl (2)-HbA1C  $\geq 6.5$  (3)-Fasting blood sugar level > 126 mg/dl (4)- 2hr PPG level >200 mg/dl after oral glucose tolerance test

## Data analysis

All data were analyzed on EPI-info statistical software. Qualitative data was expressed in the form of proportion; Quantitative data was expressed in mean SD.

## Results

A total of 900 patients with Diabetes were admitted and followed up during the study period out of them 180 had diabetic foot lesion. The clinical pattern of foot lesions, Investigations done, treatment given and the associated complications were analyzed. Peak Incidence of diabetic foot 33.33% was seen in the Age group of 60- 69 years age with mean age of study population was  $59.6 \pm 15.64$  yr. with age range of 20 -79 yr. 70% were male, 60% were rural, 50% subjects were in lower socioeconomic group (V).

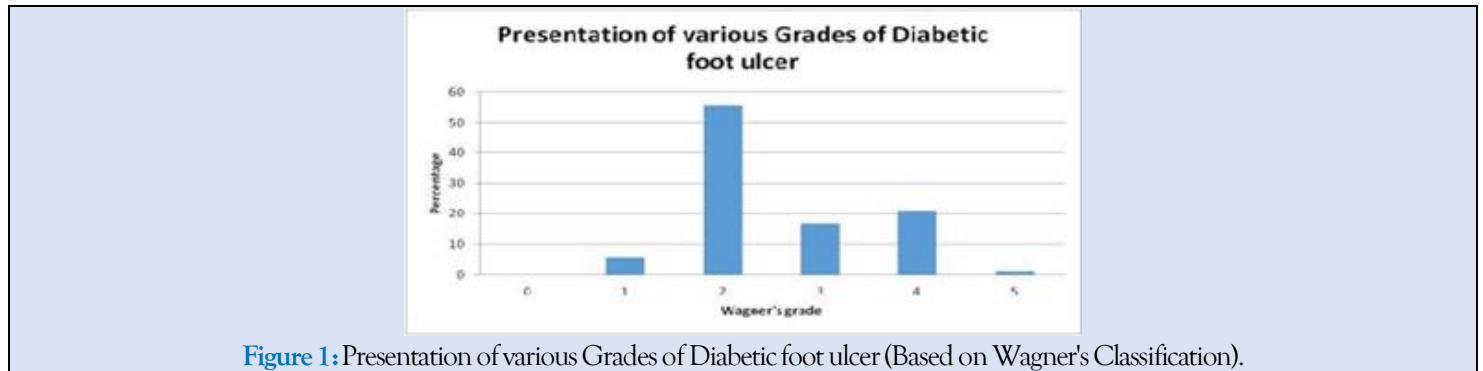
followed by 25.56% within 7-14 days whereas only 16.67% of patients reported to hospital within 1 week of onset of symptoms. 51.11% patients present with ulcer either foot or toe, followed by 25.56% had cellulitis whereas minimum 4.44% had abscess formation followed by 18.89% gangrene. Charcot arthropathy was also seen in 6 (3.33%) cases along with other presentation.

**Table 2:** Cause and duration of symptoms.

Duration	No. of Patients	%
< 1week	30	16.67%
7-14 days	46	25.56%
> 15 days	104	57.78%
Cause		
Spontaneous	60	30
Trauma	120	70
Presentation		
Abscess	8	4.44
Cellulitis	46	25.56
Ulcer	92	51.11
Gangrene	34	18.89
Joint involvement	6	3.33

52.78% had random blood sugar level between 201-300 mg/dl followed by 25% had >301mg/dl level whereas minimum 22.22% had less than 200 mg/dl at the time of admission. 30.56% had HbA1c level more than 10%

followed by 26.11% had 9-10% whereas minimum 19.44% had 7-8% followed by 23.89% in 89 % at the time of admission.

**Figure 1:** Presentation of various Grades of Diabetic foot ulcer (Based on Wagner's Classification).

Most common risk factor was obesity (61.11%) followed by 49.44% had retinopathy and 40% had bony deformity whereas rarest was arteriopathy in only 6.67% case followed by neuropathy (32.22%). In diabetic foot ulcer patients total vascular diameter and vessel wall thickening was found to increase and vessel

lumen diameter decrease in Doppler study, these changes are included as arteriopathy. 31.11% cases had hypertension followed by diabetic retinopathy in 30% and ischemic heart disease in 22.22% whereas minimum 1.11% had tuberculosis followed by diabetic neuropathy in 10%.

**Table 3:** Prevalence of Risk factors in Diabetic foot ulceration.

Risk factor	Present in No. of cases	%
Bony deformities	72	40
Obesity	110	61.11
Arteriopathy	12	6.67
Neuropathy	58	32.22
Retinopathy	89	49.44
Associated Diseases		
Systemic hypertension	56	31.11
Ischemic Heart Disease	40	22.22
Diabetic Nephropathy	18	10
Pulmonary Tuberculosis	2	1.11
Diabetic Retinopathy	54	30

About 110 patients presented with Diabetic foot ulcers with infection. Pus was sent for culture and sensitivity, of this 74.55% were of single organisms like Klebsiella, E. coli, Proteus, etc. Only 16.36% had mixed organism grown in culture. 70.00% cases were treated by slough excision followed by 13.33% by

antibiotics only, 12.22% by toe disarticulation and 10.56% by fasciotomy whereas minimum 2.22% by incision and drainage and 7.22% by amputation. Some patients were treated by more than one procedure.



Figure 2: Various management Strategies of Diabetic foot lesions

Majority 50% of patients required about 31-40 units of Insulin per day followed by 33.33% required 21 - 30 IU whereas minimum 1.11% need >40 IU per day followed by 0 - 10 IU in 2.78% cases. The average

number of days of hospitalization was  $14 \pm 11.5$  days. Maximum duration was 68 days and minimum were 6 days. In our study mortality rate was 5% and survival rate was 95%.

Table 4: Varying doses of insulin requirement in diabetic foot ulceration.

SIU/day	No. of Cases	%
0 - 10	5	2.78
11 - 20	23	12.78
21 - 30	60	33.33
31 - 40	90	50.00
> 40	2	1.11

## Discussion

In our study, peak Incidence of diabetic foot 33.33% was seen in the Age group of 60- 69years age whereas minimum 5.56% in 20- 39 yr. Mean age was  $29 \pm 15.64$  yr. Similarly, Du F (2022) [6] found that average age of cases was  $60.2 \pm 10.1$  years. Also, Abdissa D et al. (2020) [4] found majority (78%) were from in age group of 40 to 70 years, and the mean age was found to be  $59.91 \pm 10.6$  years. In our study 70% were male and 30% were female. Similarly, Abdissa D et al. (2020) [4] found that 70% were male in their study. In our study, 60% were rural, 50% subjects were in lower socioeconomic group. 52.22% were in 5-10 yr duration of diabetes followed by 41.11% were in <5 yr whereas minimum 1.11% were in >15 yr. Similarly, Abejew et al. (2015) [7] found that the mean duration of diabetic patients was  $6.00 \pm 5.07$  years. Also, Abdissa D et al. (2020) [4] found that the mean duration of diabetes was 9.66 years. In our study, Maximum 70%

cases had foot trauma that was unnoticed whereas 30% had spontaneous development of foot lesion. In Nigeria, the available hospital studies have variously suggested that trauma or complications of traditional bone setting and complications from Diabetes Mellitus are the most common causes of foot ulcers [8].

In our study, 61.11% were obese, on admission 52.78% had random blood sugar level between 201 - 300 mg/dl and 30.56% had HbA1c level more than 10. only 16.67% of patients reported to hospital within 1 week of onset of symptoms. In our study, in our study Most of the patients 55.56% presented with Wagner Grade II type of foot lesions followed by 21.11% in grade IV whereas minimum 1.11% had grade V lesion, Maximum 51.11% patients present with gangrene either foot or toe, followed by 25.56% had cellulitis whereas minimum 4.44% had abscess formation. In earlier studies, Treece et el from City

Hospital, [8] UK in their study of 389 diabetic ulcer patients, 78.4% were of Grade 2 type, 10.8% had Grade 3 type and rest Grade 4. Austria reported 22.7% of cases with Grade 2 type and 38.7% with Grade 3 type. Similarly, Hasbun et al from Mexico Hospital [9] have also reported 23% of their diabetic cases with Grade 2 ulcers and 21% with Grade 3. Our study observations are similar to those of Treece et al and Hasbun et al.

Majority of the patients had either one or more of the risk factors leading to complications in Diabetic foot infections. Most common risk factor was obesity (61.11%) whereas rarest was arteriopathy in only 6.67% case followed by neuropathy (32.22%). Yazdanpanah L (2018) [10] found that 86.7% of patients had neuropathic DFUs, 11.1% of them had ischemic DFUs and 2.2% had neuro-ischemic DFUs. In our study associated comorbidity as 31.11% cases had hypertension followed by diabetic retinopathy in 30% whereas minimum 1.11% had tuberculosis followed by diabetic neuropathy in 10%. Yazdanpanah L (2018) found that the prevalence of diabetic kidney disease (DKD) and diabetic retinopathy (DR) was 86.1% and 90% respectively among the study group.

In our study, about 110 patients presented with Diabetic foot ulcers with infection. Pus was sent for culture and sensitivity, of this 74.55% were of single organisms like Klebsiella, E. coli, Proteus, etc. Only 16.36% had mixed organism grown in culture. Similarly, Du F (2022) found that the prevalence of Gram-positive (GP) bacteria (43.4%) was lower than that of Gram-negative (GN) (52.4%). The most prevalent pathogens isolated were Staphylococcus aureus (17.7%), Escherichia coli (10.9%), Pseudomonas aeruginosa (10.5%), Klebsiella pneumoniae (6.2%), Staphylococcus epidermidis (5.3%), Enterococcus faecalis (4.9%), and fungus (3.7%). The prevalence of polymicrobial infection was 22.8%. The general management and treatment of Diabetic foot ulcers is multidisciplinary. Foot ulceration is a complication caused by diabetes and is invariably infected. The Diabetic state, therefore, needs to be well controlled and infection should be effectively treated. Hence Infection control with appropriate antibiotics becomes a priority. Ulcer care and ulcer surgery is to be considered depending upon the clinical situation and the status of diabetic control. Although a multitude of factors affect the healing of chronic diabetic foot ulcers, daily or more frequent cleaning and dressing are essential

requirements. Regular daily bathing in saline or dilute antiseptic solution offers a better chance of cleaning the ulcers, compared with dressing alone. There are changing perspectives in the local management of Diabetic ulcers which include, apart from new dressings, skin substitutes, growth factors and stem cells.

Despite much efforts towards the treatment of Diabetic foot ulcers, the incidence of lower extremity amputation rate remains about the same. Amputation is a costly outcome and should be prevented as far as possible until otherwise unavoidable. Maximum 70.00% cases were treated by slough excision whereas minimum 2.22% by incision and drainage and amputation was done in 7.22% cases. Some patients were treated by more than one procedure. Majority of patients required about 21-40 units of Insulin per day. The average number of days of hospitalization was 14. In our study mortality rate was 5% and survival rate was 95%. Similarly, Pambe Ab et al from Tanzania [11] has resorted to amputations in 45% of their 288 cases managed in the Muhimbili National Hospital. However, a lower rate of 2.4% amputation was reported by Pound N et al [12] from UK, City Hospital among the 370 patients treated by them which is similar to our observations.

## Conclusion

This study indicates that diabetic foot is a substantial public health issue in India. Foot ulcer among diabetic patients is in increasing trend in India. Majority were old aged rural male with low socioeconomic status with Most common risk factor was obesity and poor diabetic control followed by neuropathy and bony deformity. Early diagnosis and strict control of diabetes and foot care decreases mortality and hospital stay. Therefore, diabetic foot clinical centers are required for foot ulcer screening, identification, and management in urban as well as rural areas. We found out that awareness about diabetes and its complications is poor among the general population hence an urgent need to create awareness among the population regarding diabetes and about the serious consequences of this chronic disorder, through patient education. It was important to learn that diabetic foot amputations are preventable through education interventions, screening high-risk people and offering health care and nurses play an important role in preventing foot ulcers and amputations as they are familiarized with

the basics of foot care for all diabetic patients, particularly high-risk patients. Proper foot self-care and treatment of any pre-ulcerative sign, wearing properly fitting therapeutic footwear were shown to relieve plantar pressure during walking and also help to prevent plantar foot ulcer recurrence. Basics guidelines to patients such as inspecting their shoes before wearing them, keeping their feet clean, caring for their skin and nails and basic physical examination, were also seen to prevent diabetes foot ulcers.

## References

- Rodrigues BT, Vangaveti VN, Malabu UH. (2016). Prevalence and Risk Factors for Diabetic Lower Limb Amputation: A Clinic-Based Case Control Study. *J Diabetes Res*, 5941957.
- Hinchliffe RJ, Brownrigg JR, Andros G, Apelqvist J, Boyko EJ, Fitridge R, Mills JL, Reekers J, Shearman CP, Zierler RE, Schaper NC. (2016). International Working Group on the Diabetic Foot. Effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral artery disease: a systematic review. *Diabetes Metab Res Rev*, 32(S1):136-44.
- Silva JMTS da, Haddad M do CFL, Rossaneis MA, Vannuchi MTO, Marcon SS. (2017). Fatores associados à ulceração nos pés de pessoas com diabetes mellitus residentes em área rural. *Rev Gaúcha Enferm*, 38(3).
- Abdissa D, Adugna T, Gerema U, Dereje D. (2020). Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients on Follow-Up Clinic at Jimma Medical Center, Southwest Ethiopia, 2019: An Institutional-Based Cross-Sectional Study. *J Diabetes Res*, 4106383.
- Tolossa T, Fetensa G, Yilma MT, Abadiga M, Wakuma B, Besho M, Fekadu G, Etafa W. (2020). Postpartum depression and associated factors among postpartum women in Ethiopia: a systematic review and meta-analysis, 2020. *Public Health Rev*, 41:21.
- Du F, Ma J, Gong H, Bista R, Zha P, Ren Y, Gao Y, Chen D, Ran X, Wang C. (2022). Microbial Infection and Antibiotic Susceptibility of Diabetic Foot Ulcer in China: Literature Review. *Front Endocrinol (Lausanne)*, 13:881659.
- Abejew AA, Belay AZ, Kerie MW. (2015). "Diabetic Complications among Adult Diabetic Patients of a Tertiary Hospital in Northeast Ethiopia", *Advances in Public Health*.
- Gough A., M.Clapperton, N. Ronaldo, et al. (1997) Granulocyte - colony -stimulating factor in diabetic foot infection. *Lancet*, 35:855-859.
- Wieman T.J., J.M., Smiell, Y. Su. (1998). Efficacy and Safety of a Topical Gel Formulation of Recombinant Human Platelet - Derived Growth Factor -BB (Becaplermin) in Patients with Chronic Neuropathic Diabetic Ulcers. *Diabetes Care*, 21(5):822-827.
- Yazdanpanah L, Shahbazian H, Nazari I, Arti HR, Ahmadi F, Mohammadianinejad SE, Cheraghian B, Hesam S. (2018). Incidence and Risk Factors of Diabetic Foot Ulcer: A Population-Based Diabetic Foot Cohort (ADFC Study)-Two-Year Follow-Up Study. *Int JEndocrinol*, 7631659.
- Pembe AB, Paulo C, D'mello BS, van Roosmalen J. (2014). Maternal mortality at Muhimbili National Hospital in Dar-es-Salaam, Tanzania in the year 2011. *BMC Pregnancy Childbirth*, 14:320.
- Pound N, Chipchase S, Treece K, Game F, Jeffcoate W. (2005). Ulcer-free survival following management of foot ulcers in diabetes. *Diabet Med*, 22(10):1306-1309.

**Cite this article:** Kumar S, Kumar S, Mali M, Arya H, Abdul H Shah, et.al. (2023). A Clinical Study to Estimate Prevalence of Diabetic Foot Ulceration and its Association with Risk Factors at Tertiary Care Centre. *Journal of Endocrinology and Diabetes Research*, BioRes Scientia Publishers. 1(1):1-6; DOI: 10.59657/2996-3095.brs.23.005

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**Article History:** Received: November 04, 2023 | Accepted: November 24, 2023 | Published: November 30, 2023