

Observational Study to Compare the Predisposing Factor in Diabetic Foot Patients in our Centre

Ravindra Singh¹, Pradeep Rathore², Mukesh Kumar Dhurvey³, Brijesh Singh Kirar⁴

¹MS (General Surgery), Department of Surgery, G.R. Medical College & JAH, Gwalior (M.P.)

²PG Resident, General Surgery, Department of Surgery, G.R. Medical College & JAH, Gwalior (M.P.)

³MS (General Surgery), Department of Surgery Resident GRMC, Gwalior

⁴Senior Resident, Department of Surgery, G.R. Medical College & JAH, Gwalior (M.P.)

Received: 20-04-2023 / Revised: 11-05-2023 / Accepted: 30-05-2023

Corresponding author: Dr. Brijesh Singh Kirar

Conflict of interest: Nil

Abstract:

Introduction: Diabetes is a major global health issue, DFU is one of the complications of diabetes associated with severe morbidity, mortality, and reduced quality of life and socioeconomic implication. The incidence of DFU continues to raise Diabetic foot osteomyelitis is the consequence of a soft tissue infection that extends into the bone in diabetic individuals, affecting the cortex first followed by marrow. In all DFUs chronic wounds, recurrent ulcers with clinical findings of inflammation, bone involvement should be suspected. Any bone can be affected by osteomyelitis, but most commonly the forefoot (90%), followed by the midfoot (5%) and the hindfoot (5%).

Methods: This study was conducted on 75 consecutive patients admitted in various surgery units in Department of General Surgery, J.A. Group of Hospitals, G.R. Medical College, Gwalior during period February 2019 – august 2020. Well, and informed consent from the patient was taken before enrolling them in the study.

Result: The commonest presenting age group among Diabetic foot patients is 51-60 with a mean age of 56.6 ± 11.6 years. The male and female ratio was approximately 1.6: 1. Diabetic foot is more common in men due to their increased susceptibility to trauma. More risk of developing Diabetic foot with increasing duration of diabetes and, more among in uncontrolled diabetic patient and family history of diabetes mellitus.

Conclusion: Diabetic patients at risk for foot complication must be educated about risk factors and the importance of foot care, including the need for self-inspection and surveillance, monitoring foot temperatures, daily foot hygiene, use of proper footwear, good diabetes control, and prompt recognition and early professional treatment of newly discovered lesions.

Keywords: Diabetic foot, Gangrene, Off-loading, DFU.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Diabetic foot ulcers were first described in the 19th century. De Calvi in 1852 and Thomas Hodgkin in 1854 describe an association between diabetes and gangrene of the foot[3,4]. At that time, foot ulcers were treated by prolonged bed rest and the wound recurred when the patient was mobilized.

The unique anatomy of the foot is among the reasons that infection is potentially so serious in this location. The structure of various compartments, tendon sheaths, and neurovascular bundles tend to favor the proximal spread of infection. The deep plantar space of the foot is divided into medial, central, and lateral compartments. Because rigid fascia and bony structures bound these compartments, edema associated with acute infection may rapidly elevate the compartment pressure causing ischemic necrosis of the confined tissue, infection may spread from one compartment to another at their proximal calcaneal convergence or by direct perforation of septa.

Hyperglycaemia influences the development of complications of diabetes through the

1. Polyol Pathway: This process is termed hyperglycemia-induced pseudo-hypoxia[5]

2. Glycation Of Proteins [6]

Involvement of the blood vessels by atherosclerosis, leading to ischemia is a significant factor in infrapopliteal peripheral vascular disease (PVD) and is the most common causative factor for limb ulceration, gangrene, impaired wound healing, and ultimately amputation[7].

Vascular insufficiency and impaired neutrophil function are the major factors predisposing diabetic patients to foot ulcers and infections. Repetitive minor trauma to an insensitive neuropathic foot, faulty wound healing, exacerbated by abnormal biomechanics or ill-fitting shoes, causes

areas of increased plantar pressure to develop calluses that predispose to ulcer development. Deep to the callus and clinically occult, an ulcer forms insidiously. Direct extension of infected ulcers or soft tissue infection leads to osteomyelitis. These infections are usually polymicrobial and involve both anaerobic and aerobic pathogens.

Peripheral neuropathy is the most common microvascular complication in 60% of diabetics. The incidence of neuropathy increases with the duration of the disease and episodes of hyperglycemia both. Peripheral neuropathy makes the patient to unrecognized trauma, which potentiates the risk of bacterial invasion and infection.

Aims and Objectives-

Observational study To compare the predisposing factor of Diabetic foot Ulcer in our centre

Material and Methods

Sample Size- A minimum of 75 Patients

Type of study: Observational study (Prospective)

Source of data: Patients diagnosed with attending the Outpatient department and getting admitted to Department of surgery, J.A. Group of hospitals, Gwalior.

Inclusion Criteria :

1. All patients with foot ulcer were admitted to the department of general surgery of G.R. Medical College in the above mention period.
2. Duration of ulcer ≥ 2 weeks
3. Ulcer width >2 cm and depth >3 mm with or without gangrene

Exclusion Criteria

1. Non-diabetic patients with foot ulcers.
2. Presence of peripheral vascular disease (<0.6 ABI)
3. Patients who have diabetes with superficial ulcer (width $<2\text{cm}^2$ and depth $<3\text{mm}$).

Statistical Analysis

All Statistical calculations were done with the help of Chi-Square test with degree of significance $<0.5\%$ with SPSS software version 22.0

Results were tabulated and represented by suitable graphs and compared with other similar studies.

Observation & Results

Following observations were made:-

Table 1: Age Distribution

Age Group	Frequency	Percentage %
<20 yrs	0	0
21- 30 yrs	1	1.33%
31-40 yrs	3	4%
41 -50 yrs	13	17.33%
51-60 yrs	26	34.67%
61-70 yrs	24	32%
>70 yrs	8	10.67%
Total	75	100

In our study out of 75 cases, most of the DFO cases observed were in the 51-60 years age group with a mean age of 58.95 & a standard deviation of ± 10.87 . the youngest patient was 25 years of age presenting with gangrenous right forefoot and the oldest was 88 years of age presenting with left forefoot deep tissue infection.

Table 2: Sex Distribution

Gender	Frequency	Percentage
Male	46	61.33%
Female	29	38.66%
Total	75	100

During our study, a total of 75 patients were selected for the study of diabetic foot. There was a marked male predominance in diabetic foot lesions. Out of 75 cases, 46 (61.33%) were male and 29 (38.66%) were female. Therefore male: female ratio was 1.6:1.

Table 3: Duration of Diabetes

Duration Of Diabetes	No. Of Patients	Percentage
<10 years	57	76%
>10 years	18	24%
Total	75	100

In our study out of 75 DFO patients 57 (76%) presented with <10 years history of DM on admission and 24% had >10 years duration of diabetes mellites.

Table 4: Family History of Diabetes Mellitus in Study Population

Family History Of Dm	Frequency	Percentage
Yes	39	52%
No	36	48%
Total	75	100

In our study 39 (52%) patients out of 75 gave a positive family history of diabetes

Table 5: Treatment History for Dm in Study Population

Drug	Frequency	Percentage
No Drug	13	17.33%
Regular Oral Hypoglycemic	37	49.33%
Irregular Oral Hypoglycemic	16	21.33%
Insulin	4	5.33%
Insulin With Oral Hypoglycemic	5	6.66%
Total	75	100

In our study out of 75 patients 29(38.66%) patients presented with severe form foot complications.

Table 6: History of Trauma

H/O Trauma	Frequency	Percentage
Yes	47	62.67%
No	28	37.33%
Total	75	100

In our study out of 75 cases, 47(62.67%) patients presented with a history of some kind of trauma before the development of foot complications.

Table 7: Addiction and Personal Habits (Alcoholic/Tobacco/Smoking)

History Of Addiction (Smoking/Alcoholic/ Tobacco Chewing)	Frequency	Percentage
Yes	42	56%
No	33	44%
TOTAL	75	100

In our study out of 75,42(56%) patients presented with a history of some kind of addiction either of alcohol, smoking, or tobacco.

Discussion

The analysis of this study and comparison with other studies is as follows:

Table 9: Age

Age	Didier Pittet et.al.	Abubaker et.al.	Present study
Mean age (years)+ standard deviation	68±12.5	56.6±11.6	58.95±10.87

Most diabetic foot patients were in the 51-60 age group with mean age 58.95±10.87 Abubaker et.al.[9]. in their study also found the commonest age group 51-60 with mean age 56.6±11.6 comparable to our study.

Table 10: Male and Female Ratio

Ratio	Abubaker et.al.[9]	Didier Pittet et.al.[8]	Present study
Male: female	3:1	0.9:1	1.6:1

The present study had Male: Female ratio as 1.6:1. Abubaker et.al. in their study also reported male preponderance. The incidence is more among males probably as they are mostly working outdoor, which

makes them more vulnerable for trauma and sequel.

Duration of Diabetes

In a study by Didier Pittet et. Al[8]. most cases had a history of 10-20 years duration

of diabetes. In our study 76% of patients presented with DFO with a history of diabetes <10 years of duration. Most of the patients were from rural area in our study and had foot complications early because of barefoot walking practice coupled with poor foot hygiene, and lack of patient education about the disease

Status of Diabetes

In diabetics with well controlled blood sugar levels and good compliance to anti diabetic drug intake, presented with less severe form of disease, less relapses as compared to patients with uncontrolled glycemic status with poor drug compliance.

Family History of Diabetes

In our study 39(52%) patients presented with a family history of diabetes. M. Vishwanath et al[10] found series of familial aggregation of disease in India and other Asian population. In India nearly 75% of type II patients have family history of diabetes in first degree relatives. The familial aggregate of diabetics was highly

prevalent in first degree relatives compared to second generation in Asian Indians. The risk of offspring developing diabetic foot complications is higher with familial history of Diabetes mellites.

Addiction and Personal Habits

Tobacco increases local hypoxia and is detrimental to wound healing as nicotine is a potent vasoconstrictor agent. Smoke also contains a high level of carbon monoxide which binds to hemoglobin forming carboxyhemoglobin. It has a higher affinity for O₂ and decreases O₂ delivery to hypoxic tissue. Alcohol is known to cause atherosclerosis which further aggravates, ischemia thereby delaying wound healing[11].

In our study 75 out of 42(56%) patients were addicted to either alcohol, tobacco, or smoking and these patients showing delayed healing. It indicates that in patients using either mode of addiction prognosis is poor.

Table 11: History of Trauma

History of trauma	Jennifer. A. May field et al,	Present study
Yes	44%	63%
No	66%	37

In this study out of 75 cases, 47 (63%) had a history of foot trauma before the onset of the lesion. In Jennifer. A. May Field et al[12]., 44% percentage of cases had prior history of trauma.

Conclusion

- The commonest presenting age group among DFO patients is 51-60 with a mean age of 56.6±11.6 years.
- The male and female ratio was approximately 1.6: 1. DFO is more common in men due to their increased susceptibility to trauma.
- More risk of developing DFO with increasing duration of diabetes and, more among in uncontrolled diabetic patient and family history of diabetes mellitus.

- Diabetic patients at risk for foot complication must be educated about risk factors and the importance of foot care, including the need for self-inspection and surveillance, monitoring foot temperatures, daily foot hygiene, use of proper footwear, good diabetes control, and prompt recognition and early professional treatment of newly discovered lesions.

- Trivial trauma (before diabetic foot lesion) is the initiating factor in more than half of the cases.

Reference

1. D. C. Jupiter, J. C. Thorud, C. J. Buckley, and N. Shibuya, "The impact of foot ulceration and amputation on mortality in diabetic patients. I: from

- ulceration to death, a systematic review,” *International Wound Journal*, vol. 13, no. 5, pp. 892–903, 2016.
2. N. C. Schaper, J. J. van Netten, J. Apelqvist, B. A. Lipsky, K. Bakker, and on behalf of the International Working Group on the Diabetic Foot (IWGDF), “Prevention and management of foot problems in diabetes: a summary guidance for daily practice 2015, based on the IWGDF guidance documents,” *Diabetes/Metabolism Research and Reviews*, vol. 32, pp. 7–15, 2016.
 3. Marchal de Calvi A: Des rapports de la gangrène et de la glycosurie [Reports of gangrene and glycosuria]. *Gaz Hôp Civ Mil* 1852; 25: 178.
 4. Hodgkin T: On diabetes. *Assoc Med J* 1854; 2: 916
 5. Bareford D, Jennings PE, Stone PC, Baar S, Barnett AH, Stuart J. Effects of hyperglycaemia and sorbitol accumulation on erythrocyte deformability in diabetes mellitus. *J ClinPathol*. 1986 Jul; 39(7): 722–727.
 6. Nawale RB, Mourya VK, Bhise SB. Non-enzymatic glycation of proteins: a cause for complications in diabetes. *Indian J BiochemBiophys*. 2006 Dec;43(6):337-44.
 7. Ikem R, Ikem I, Adebayo O, Soyoye D. An assessment of peripheral vascular disease in patients with diabetic foot ulcer. *Foot (Edinb)*. 2010 Dec;20(4):114-7.
 8. Didier Pittet, MD, MS; Blaise Wyssa, MD; Catherine Herter-Clavel, MD; et al. Outcome of Diabetic Foot Infections Treated Conservatively A Retrospective Cohort Study With Long-term Follow-up. *Arch Intern Med*. 1999;159(8):851-856.
 9. Abubakr H Widadalla , Seif Eldin I Mahadi, Mohamed A Shawer, Shadad M Mahmoud, A E Abdelmageed, Mohamed Elmakki Ahmed. Diabetic foot infections with osteomyelitis: efficacy of combined surgical and medical treatment. *Diabet Foot Ankle*. 2012;3.
 10. M Viswanathan, My 40-year journey in diabetes research. *Perspect Clin Res*. 2018 Jul-Sep; 9(3): 113–122.
 11. E.Shokry Abd-Allah, Sabah A. Hagrass, S. S.Mohamed. Diabetic Foot Among Elderly: Risk Factors and Foot Care Practices *American Journal of Nursing Science* Volume 5, Issue 1, February 2016, Pages: 22-29.
 12. Mayfield, Jennifer, A., et al 1996: "A foot risk classification system to predict diabetic amputation in Pima Indians". *Diabetes care* 1996 July, 704- 709.