

Original Research

The spectrum of diabetic foot ulcer: A prospective study in a tertiary hospital

¹Sanjeev Gupta, ²Karanbir Singh, ³Imran Yousouf Bhat, ⁴Anitipal Singh Raina

¹Professor, ^{2,3,4}Resident, Department of Orthopaedics, Government Medical College, Jammu, Jammu and Kashmir, India

ABSTRACT:

Introduction: Diabetic foot ulcers are a major cause of morbidity requiring hospitalisation and immediate attention. The present study investigates the prevalence of bacteria isolated from diabetic foot ulcers and the patient outcome. **Methods:** This was a prospective study conducted at a tertiary hospital and included 50 patients attending the orthopaedic clinic and presenting with diabetic foot ulcers. The patients were followed up over a period of one year from June 2019- to May 2020. **Results:** In our study, Staphylococcus aureus was the most common isolate followed by Pseudomonas aeruginosa, Klebsiella pneumonia, Proteus mirabilis. About 80% of patients were treated with debridement, antibiotics and glycemic control, while 18% of patients had progression of disease leading to gangrene requiring amputation, 2% of patients were lost to follow up. **Conclusion:** The treatment of diabetic foot ulcers involves a multidisciplinary team effort. As the infection is usually polymicrobial, culture-specific antibiotics must be used in combination with maintaining good glycemic control and local rest to the part. Once gangrenous changes have set in, the disease will progress therefore an early attempt must be made to salvage the limb and early

Keywords: Diabetic foot, Wagner classification, bacteriology, prevention.

Received: 15 December, 2021

Accepted: 18 January, 2022

Corresponding author: Karanbir Singh, Resident, Department of Orthopaedics, Government Medical College, Jammu, Jammu and Kashmir, India

This article may be cited as: Gupta S, Singh K, Bhat IY, Raina AS. The spectrum of diabetic foot ulcer: A prospective study in a tertiary hospital. J Adv Med Dent Scie Res 2022;10(2):60-64.

INTRODUCTION

Diabetes has become a major health issue worldwide with urbanization and a sedentary lifestyle. Its global prevalence is rising and diabetic foot ulceration is a significant contributor to non-traumatic lower extremity amputation. Peripheral arterial disease increases susceptibility to ischemic ulcers which worsen in patients with diabetes. It is defined as a foot affected by ulceration that is associated with neuropathy and/or peripheral arterial disease of the lower limb in a patient with diabetes. The prevalence of diabetic foot ulceration in the diabetic population is 4–10%; the condition is more frequent in older patients [1–3]. It is estimated that about 5% of all patients with diabetes present with a history of foot ulceration, while the lifetime risk of diabetic patients developing this complication is 15%. Early identification of at-risk patients and aggressive institutions of treatment that may include medical as

well as surgical treatment is key for a successful outcome. This study is postulated to study the microbiological and clinical spectrum in diabetic foot ulcer patients and to evaluate the outcomes of different modalities of treatment.

MATERIALS & METHODS

This is a prospective study conducted in a tertiary care hospital in which fifty patients attending the orthopaedic clinic with diabetic foot ulcers were recruited. After a baseline general examination, the suitable patients were included in the study who were willing for a complete follow-up at our hospital. The patients were admitted and a thorough examination of the ulcer was done. It was classified as per the Wagner classification that divides the diabetic foot ulcer into five classes based on ulcer depth and presence of gangrene.

Grade-0	Skin at risk
Grade-1	Superficial ulcer
Grade-2	Exposed tendon and deep structures
Grade-3	Deep ulcers with abscess or osteomyelitis
Grade-4	Partial gangrene
Grade-5	More extensive Gangrene

Swabs were taken from the wound and sent for culture and antibiotic sensitivity. The following parameters were noted in each patient:-

- A. Duration of diabetes
- B. Previous treatment history
- C. Duration of ulcer
- D. Alcoholic /Smoker status
- E. HbA1c levels.
- F. Wagner's classification

Appropriate treatment depending on the grading of the ulcer and the discretion of the orthopaedician was given to the patient. The patients were followed up for a period of one year after being discharged and at every visit, the size of the ulcer was noted.

RESULTS

Of all the patients, (67%) of the patients were male and (33%) of the patients were females. 78% of these patients were on regular treatment with oral hypoglycemic drugs and 18% of patients were on

erratic treatment and 4% of them were treatment-naive. We had 18% monomicrobial and 82% polymicrobial growth with an average of 1.59 species per specimen. Among 50 patients recruited, 9 patients worsened during the treatment and had to undergo below-knee amputation, 1 patient was lost to follow up and 40 patients were successfully treated with debridement, antibiotics, and in some with use of contact cast. In our study, 24% of patients were classified as Grade I patients and were managed with control of blood sugar, wound dressings and appropriate antibiotics. 44% of the total patients were classified as Grade II and managed with surgical drainage of abscess, control of blood sugar, wound dressings and culture-specific antibiotics. 26% of the patients were classified as Grade III patients were managed with repeated debridements but about 6% of these required ray amputation. 6% of the Wagner Grade IV classified patients required a below-knee amputation.

Table 1 Population Distribution as per Wagner classification

Wagner Classification	Study Population
Grade 0	0
Grade 1	12
Grade 2	22
Grade 3	13
Grade 4	3
Grade 5	0

Table 2 Clinical Features of 50 patients with diabetic foot ulcers.

Duration of diabetes >5 yrs vs <5 yrs	72% vs 18%
Duration of ulcer >4 wks vs <4 wks	65% vs 35%
Alcoholic /Smoker status	67% vs 33%
Comorbidites	72%
HbA1c levels >7.5	89%
Ray Amputation	6%
Below knee Amputation	6%

Table 3 Bacteria isolated from diabetic foot infections of 50 patients

Staphylococcus Aureus	40
Pseudomonas aeruginosa	13
Klebsiella Pneumoniae	9
Proteus Mirabilis	7
E. coli	9
MRSA	4

Figures



Diabetic Foot At presentation



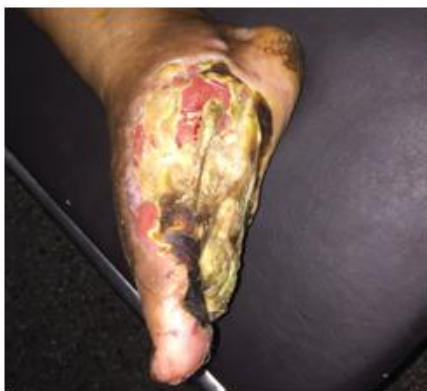
Post Ray Amputation



Diabetic Foot with Osteomyelitis



Below knee amputation was done



Diabetic foot at presentation



Post debridement

DISCUSSION

Treatment of diabetic foot ulcers is usually complex and requires the collective effort of various departments as seen in the study by Sumpio et al. Diabetic foot ulcers are usually the result of trauma preceded by neuropathy as seen in the study of Volmer-Thole M, Frykberg R et al and ischaemia if left untreated it may progress to osteomyelitis leading to gangrenous changes. The infection is most likely to be polymicrobial as seen in the present study and studies by citron d et al and ramakant et al and becomes cumbersome with the presence of resistant organisms, The antibiotics should be broad-spectrum or a combination of antibiotics effective against both gram-positive and gram-negative organisms should be used in conjunction with strict management of glycaemic control and local wound care if any. Early treatment and management of the ulcer, while they are still in their initial stages, is the prerequisite as medical management will suffice and avoids the progression of the disease and thus avoids amputation, this has been shown in studies by Piagessi A et al and Tan J et al^{21,25}. Patients with diabetes must be educated regarding foot care, lifestyle changes, maintaining appropriate weight and good glycemic control and offloading with total contact casting in cases with the presence of an ulcer, the benefits of total contact casting as seen in studies with messenger g and singh n. Though there are many clinical approaches to manage diabetic foot ulcers, still there is no consensus among the best treatment.

CONCLUSION

The treatment of diabetic foot ulcers involves a multidisciplinary dynamic approach that encompasses microbiological evaluation for bacterial isolation & sensitivity along with the decision for the appropriate treatment depending on orthopedicians clinical evaluation and patient presentations. We believe prevention of the formation of ulcers remains the best management with patient education. The government of India under the Ministry of Health and family welfare launched a national programme for the prevention and control of cancer, diabetes, cardiovascular diseases and stroke(NPCDCS) in 2010

for early diagnosis, management and referral and better management of comorbidities associated with diabetes. Recently guidelines are being issued to the States for initiating “population-based screening of common NCDs” utilising the services of the frontline workers and health-workers under the existing primary healthcare system and the practice of yoga is an integral part of the intervention

NO CONFLICT OF INTEREST

We declare no conflict of interest.

NO FUNDING RECEIVED

No funding was received.

REFERENCES

1. Sumpio B, Armstrong D, Lavery L, Andros G. The role of interdisciplinary team approach in the management of the diabetic foot. *Journal of Vascular Surgery*. 2010;51(6):1504-1506.
2. Volmer-Thole M, Lobmann R. Neuropathy and Diabetic Foot Syndrome. *International Journal of Molecular Sciences*. 2016;17(6):917.
3. Frykberg R, Lavery L, Pham H, Harvey C, Harkless L, Veves A. Role of Neuropathy and High Foot Pressures in Diabetic Foot Ulceration. *Diabetes Care*. 1998;21(10):1714-1719.
4. Citron D, Goldstein E, Merriam C, Lipsky B, Abramson M. Bacteriology of Moderate-to-Severe Diabetic Foot Infections and In Vitro Activity of Antimicrobial Agents. *Journal of Clinical Microbiology*. 2007;45(9):2819-2828.
5. Ramakant P, Verma A, Misra R, Prasad K, Chand G, Mishra A et al. Changing microbiological profile of pathogenic bacteria in diabetic foot infections: time for a rethink on which empirical therapy to choose?. *Diabetologia*. 2010;54(1):58-64.
6. Piaggesi A, Schipani E, Campi F, Romanelli M, Baccetti F, Arvia C et al. Conservative surgical approach versus non-surgical management for diabetic neuropathic foot ulcers: a randomized trial. *Diabetic Medicine*. 1998;15(5):412-417.
7. Tan J, Friedman N, Hazelton-Miller C, Flanagan J, File T. Can Aggressive Treatment of Diabetic Foot Infections Reduce the Need for Above-Ankle Amputation?. *Clinical Infectious Diseases*. 1996;23(2):286-291.
8. Messenger G, Masoetsa R, Hussain I. A Narrative Review of the Benefits and Risks of Total Contact

- Casts in the Management of Diabetic Foot Ulcers. *Journal of the American College of Clinical Wound Specialists*. 2017;9(1-3):19-23.
9. Singh N. Preventing Foot Ulcers in Patients With Diabetes. *JAMA*. 2005;293(2):217.
 10. Abbott CA, Carrington AL, Ashe H, North-West Diabetes Foot Care Study et al. The North-West Diabetes Foot Care Study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. *Diabet Med*. 2002;19:377–384. doi:10.1046j.1464-5491.2002.00698.x.
 11. Centers for Disease Control and Prevention Lower extremity disease among persons aged ≥ 40 years with and without diabetes—United States, 1999–2002. *MMWR Morb Mortal Wkly Rep*. 2005;54:1158–1160.
 12. Lauterbach S, Kostev K, Kohlmann T. Prevalence of diabetic foot syndrome and its risk factors in the UK. *J Wound Care*. 2010;19:333–337.
 13. Wagner F. The Diabetic Foot. *Orthopedics*. 1987;10(1):163-172.
 14. Wagner FW. A classification and treatment program for diabetic, neuropathic, and dysvascular foot problems. *Instr Course Lect*. 1979;28(1):143-65.
 15. Mohan V, Pradeepa R. Epidemiology of type 2 diabetes in India. *Indian Journal of Ophthalmology*. 2021;69(11):2932.
 16. Abdulrazak A, Ibrahim Bitar Z, Ayesh Al-Shamali A, Ahmed Mobasher L. Bacteriological study of diabetic foot infections. *Journal of Diabetes and its Complications*. 2005;19(3):138-141.
 17. Pittet D, Wyssa B, Herter-Clavel C, Kursteiner K, Vaucher J, Lew P. Outcome of Diabetic Foot Infections Treated Conservatively. *Archives of Internal Medicine*. 1999;159(8):851.
 18. Eckman M. Foot Infections in Diabetic Patients. *JAMA*. 1995;273(9):712.
 19. Malone J, Snyder M, Anderson G, Bernhard V, Holloway G, Bunt T. Prevention of amputation by diabetic education. *The American Journal of Surgery*. 1989;158(6):520-524.
 20. Lipsky B, Pecoraro R, Ahroni J. Foot Ulceration and Infections in Elderly Diabetics. *Clinics in Geriatric Medicine*. 1990;6(4):747-769.
 21. Edmonds M. Multidisciplinary Care of the Diabetic Foot Patient With Infection. *The International Journal of Lower Extremity Wounds*. 2010;9(1):6-8.
 22. Alexiadou K, Doupis J. Management of Diabetic Foot Ulcers. *Diabetes Therapy*. 2012;3(1).
 23. Pathare, N. A., Bal, A., Talvalkar, G. V., & Antani, D. U. (1998). Diabetic foot infections: a study of microorganisms associated with the different Wagner grades. *Indian journal of pathology & microbiology*, 41(4), 437–441.
 24. Raja N. S. (2007). Microbiology of diabetic foot infections in a teaching hospital in Malaysia: a retrospective study of 194 cases. *Journal of microbiology, immunology, and infection = Wei mian yu gan ran za zhi*, 40(1), 39–44.
 25. Peters B, Jabra-Rizk M, O'May G, Costerton J, Shirliff M. Polymicrobial Interactions: Impact on Pathogenesis and Human Disease. *Clinical Microbiology Reviews*. 2012;25(1):193-213.
 26. Hatipoglu M, Mutluoglu M, Uzun G, Karabacak E, Turhan V, Lipsky B. The microbiologic profile of diabetic foot infections in Turkey: a 20-year systematic review. *European Journal of Clinical Microbiology & Infectious Diseases*. 2014;33(6):871-878.
 27. Lipsky B, Berendt A, Cornia P, Pile J, Peters E, Armstrong D et al. 2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections. *Clinical Infectious Diseases*. 2012;54(12):e132-e173.
 28. Syed Hitam S, Hassan S, Maning N. The Significant Association between Polymicrobial Diabetic Foot Infection and Its Severity and Outcomes. *Malaysian Journal of Medical Sciences*. 2019;26(1):107-114.
 29. National Programme for prevention and control of cancer, diabetes, cardiovascular diseases and stroke (NPCDCS) <https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1048&lid=604>.