



## **Clinical Profile and Outcome of Diabetic Foot Ulcer in Tertiary Care Hospital**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** The goal of this study was to estimate the disease burden of diabetic foot ulcer (DFU) admissions in a tertiary care hospital in a developing country in terms of clinical profile and outcome.

**Method:** In this descriptive study, the data were collected from the medical record of diabetic patients with foot ulcer who were treated in Saveetha medical college and hospital between the period of February to November 2020. The demographic characteristic, type of foot lesion, etiology, isolated microorganism, treatment, and outcome were reviewed.

**Results:** There were 180 admissions with diabetic foot problems involving 100 patients. All of the patients had type 2 diabetes, and there was no gender bias. The average age was 50, and diabetes control was poor. The majority of patients had no knowledge what had caused their symptoms. In 56 % of cases, ulcers were neuropathic, 25% were neuro ischemic, and a smaller fraction were pure ischemia. More than 70% of ulcers were Wagner grade 3 or higher, with infection occurring in nearly every patient. Gram-negative bacteria were the most prevalent isolates from culture. A total of 30 lower extremity amputations (LEAs) were performed at various levels of the foot.

**Conclusion:** Diabetic foot problems are a source of morbidity, a reason for LEA surgery, and a cause of death in people who have diabetes mellitus.

*Keywords: Diabetic foot ulcer; clinical profile; outcomes.*

## 1. INTRODUCTION

Diabetes is one of the most prevalent chronic diseases: according to research, 285 million individuals globally have diabetes, with that number expected to grow to 439 million by 2030 [1]. A significant change in the population is expected to result in an increase in the prevalence of diabetes chronic complications, particularly those of the lower limb, such as diabetic foot [2]. The yearly population-based incidence of a diabetic foot ulcer (DFU) is estimated to be between 1.0 and 4.1 percent. The lifetime incidence rate might be as high as 25% [3]. There will always be a percentage of ulcers that require hospitalization, despite the best efforts of conservative management [4,5]. Surgical debridement, excision of the distal osseous and soft tissue structure, and endovascular surgery may be required in certain instances [6,7,8,9].

Diabetic foot issues can be life or limb threatening, but they haven't received the same amount of attention as other diabetes complications [10]. Until far, descriptive data on demographic and clinical variables in diabetic foot ulcers among Indian patients have been scarce, despite the fact that we are all aware of their clinical significance.

## 2. METHODS

This study is a retrospective study reviewing the medical records of diabetic patients who were admitted in Saveetha medical college with foot problems. The study was conducted between the period of February to November 2020. Sampling technique was non-probability with total sampling [11].

## 3. TREATMENT SETTING

DFU is a general term for lesions that develop in a diabetic patient's foot, specifically in the anatomical area below the malleoli [12]. DFU patients with increasing infection, septicemia, gangrenous tissue needing amputation, complicated wound care, or intercurrent illness were admitted to the hospital. By integrating first-line medical treatment, revascularization if needed, surgical management, and second-line limited lower extremity amputation (LEA) surgery, the strategies were required to optimize limb salvage rate and healing time. An endocrinologist or surgeon will take the lead as a physician in charge and treat the patients in close proximity.

On admission, immediate insulin treatment was given to manage hyperglycemia. For pressure relief of ulcers, all patients were encouraged to stay in bed or use crutches, and casts were only given to those who could afford them.

When there were clinical symptoms of infection, antibiotics were given. Local treatment (debridement, dressing) was used to treat those with a superficial skin ulcer, whereas abscess collection was incised and drained. All contaminated lesions were promptly debrided.

Limited bone excision was used to treat osteomyelitis without peripheral arterial disease (PAD). When severe PAD was present, angiography was followed by revascularization as soon as the patient's overall state had improved. Amputations at various degrees were used to cure gangrene. LEA was also indicated in life-threatening situations involving highly infected ischemic limbs.

## 4. DATA ANALYSIS

A structured questionnaire was created to collect various components of the following information in Saveetha medical college: (1) demographic data, (2) diabetes history, (3) laboratory results, (4) microbiological profile, (5) treatment, and (6) Complications. After decontamination and debridement, specimens of the foot lesions were collected for gram stain, aerobic and anaerobic culture, and antibiotic susceptibility testing. Radiographs of the affected foot(s) were done to look for bone anomalies. The diagnosis of osteomyelitis was made after a radiological examination.

The ulcers were also staged, and only the Wagner technique [13] was employed in this study because it is the most widely used method in our center. The prevalence of PAD and peripheral neuropathy was noted in the details of current and previous foot disease. The type of foot lesion was established using the clinical data and classified as neuropathic, ischemic, neuroischemic, or unclassified.

## 5. PATIENT MANAGEMENT AND OUTCOME

Patients were assessed and treated using the Wagner grading, which took into account the severity of the infection as well as the presence of PAD at the time of presentation. The length of

stay in the hospital was calculated from the time of admission to the time of discharge. The following were used to categorize patient outcomes:

- conservative wound care with extensive wound healing (incorporating strict bed rest, intravenous antibiotics)
- skin transplant with or without dressing operative procedure: surgical debridement and/or incision drainage followed by wound care, with or without skin grafting; osteotomy; Lower extremity amputation.
- passing away in the hospital as a result of a diabetic foot

Most patients required multiple dressing changes and wound toileting after surgery. Patients were discharged after demonstrating good clinical evidence of wound healing, including the absence of sepsis and necrotic tissue. With regular out-patient clinic attendance, post-discharge treatment ensured proper off-loading and domiciliary support.

## 6. RESULTS

There were 180 admissions with diabetic foot problems involving 100 patients; these involves 56 males and 44 females. The reason for admission included uncontrolled foot infection,

cardiovascular events, hyperglycemic emergencies, worsening renal function, acute critical limb ischemia, hypoglycemic event, and others.

## 7. CLINICAL CHARACTERISTICS OF PATIENTS

The patients had type 2 diabetes and varied in age from 30 to 75 years old. Diabetes lasted an average of five years. None of the individuals were diagnosed with type 1 diabetes. Common precipitating events of ulcer, which are shown in Fig. 1 including minor trauma, walking barefoot and ill-fitting shoes. It was found that 20% of patients could not remember the initiating events of the wound. In this study, 73 patients were in Wagner high grade, i.e., Wagner grade  $\geq 3$  (Table 2). Foot ulcers in 56 patients were pure neuropathic, 19 patients had ischemic-type, while 25 had neuro-ischemic origin.

## 8. BACTERIOLOGIC PATTERN

A total of 80 specimens were cultured which yielded 45 positive cultures. Gram-negative bacilli represented the majority (70.8 percent) of the positive-cultured specimens, with *Escherichia coli* being the most prevalent isolate. Anaerobic bacteria comprised 3% of the total number of isolates. *Pepto streptococcus* species was the most commonly isolated anaerobe.

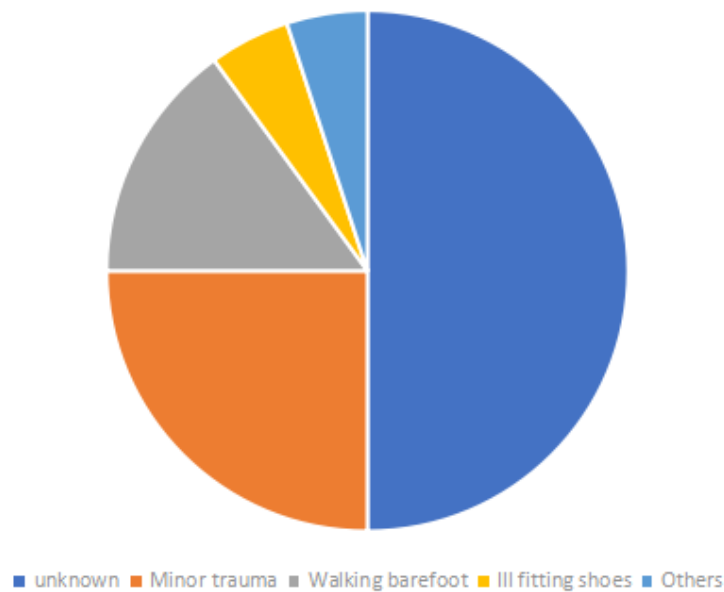


Fig. 1. Precipitating events preceding the ulcer

**Table 1. Distribution of foot lesion in accordance with Wagner grading system**

Grade	Sign	N
0	No ulcer in a high-risk foot	0
1	Superficial ulcer involving the full skin thickness	2
2	Deep ulcers penetrating to ligaments/muscle, but No bone involvement or abscess formation	22
3	Deep ulcer with cellulitis or abscess formation, often osteomyelitis	40
4	Localized gangrene	33
5	Extensive gangrenes involving the whole foot	3

**Table 2. Surgical intervention by Wagner grade**

Wagner grading	0	1	3	4	5	6	Total
Type of surgical intervention							
Conservative management	0	1	2	5	0	0	8
Daily wound care	0	1	2	5	0	0	8
Debridement	0	2	22	14	4	0	42
Skin grafting	0	3	5	0	0	0	08
Incision/Drainage	0	6	1	12	0	0	12
Lower extremity Amputation	0	0	10	20	0	0	30

## 9. SURGICAL MANAGEMENT AND LOWER EXTREMITY AMPUTATION

Fig. 1 shows the management strategies for patients classified according to the Wagner classification. Because the majority of ulcers were Wagner grades 3 and 4, the most common surgical techniques were debridement and abscess incision and drainage. Arterial bypass surgery, specifically femoro-popliteal bypass is other surgical management of diabetic foot ulcer. Primary angioplasty was performed in patients with Peripheral artery disease. The overall amputation rate was 30% ( $n = 30$ ) and specific.

## 10. DISCUSSION

According to Abbott et al. [14], more than 2% of diabetic individuals develop new foot ulcers each year. In hospital-based study of people with diabetes, the prevalence of DFU ranged from 4 % to 20.4% [15,16]. Diabetic foot problems, according to certain experts [17,18], account for 23–50 % of diabetic patients' hospital bed occupancies. Our study showed a 11% prevalence rate of DFU among consecutive, unselected diabetic patients admitted to Saveetha Medical College's largest medical inpatients service. These patients are at a higher risk of developing non-healing ulcers, foot infections, and LEA, which is said to be more

common in patients from low socioeconomic groups who have inadequate hygiene conditions [19].

The proportions of both sexes, as well as middle-aged people, were similar in our study (mean age 50 years). They presented to the hospital four weeks after the ulcers had grown due to a lack of knowledge on the nature of the disease [20-22]. The persistence of ulcers > 30 days was associated with the development of a wound infection in research by Lavery et al. [23]. Infection was found in nearly all of the patients in our study, and Gram-negative bacteria were the most often detected. The most common anaerobic isolates were *Pepto streptococcus* spp., which is consistent with earlier bacteriologic studies from Singapore [24] or other tertiary care hospitals in India [25].

In the Seattle Diabetic Foot Study, Boyko et al. [26] discovered that the average duration of diabetes was 13.2 years, compared to 4.4 years in this study. Furthermore, some of the patients in our study (12.3 %) had undiagnosed diabetes when they reported with foot problems. According to Thewjitcharoen et al. [27], almost 56.8% of DFU patients had only neuropathy, while another 29.3% developed neuroischemic ulcers (56% and 25%, respectively, in our study).

Pure ischemic ulcers, are found in a lower percentage of cases (19% in our study).

A quarter of our patients had no knowledge what has caused their ulcers. Perhaps the prevalence of neuropathy, as well as a lack of foot care, is the primary cause of their lesions progressing prior to presentation. According to other studies, the most prevalent cause of foot ulceration is inadequate footwear [14,16] or spontaneous blisters [27,28]. A previous DFU history is shown to enhance the probability of future lesions [14] and is associated with a comparable risk of LEA as first ulceration [29]. The recurrence of foot ulcers in 35.4 %of patients indicated that they needed more personal foot care education. This finding is significant because foot ulceration can be avoided with proper education, routine foot care, and attention to footwear [19,30].

Another factor that causes ulcer recurrence is previous partial amputation. [30]. Even partial amputation of the great toe causes foot abnormalities that enhance the incidence of re-ulceration [31]. In this investigation, the authors discovered that the most common level of LEA was at the level of the toes (27.3%). Plasters, immobilization, therapeutic shoes have been found to speed ulcer healing, reduce ulcer recurrence, and reduce LEA. In the future, this method could be used as part of the initial therapy of foot ulcers [32]. Patients with Wagner grades 3, 4, and 5 illness accounted for 76 percent of cases, as shown in Table 2. This is due to the fact that the majority of our patients who presented late with a deep ulcer, osteomyelitis, and severe gangrene of the foot.

Finally, in this tertiary care hospital-based retrospective investigation, LEA incidence and mortality may be more related to patient attitudes and health-care organization systems than to an inadequate resource [33-35]. Diabetic foot problems are one of the avoidable and treatable complications of diabetes [19], and the current situation should motivate us to do more in this area. Our ultimate goal should be to make excellent preventative foot care and education programs available, particularly in basic and secondary health care settings.

## 11. CONCLUSION

Diabetic foot diseases are prevalent among diabetics and can cause major health issues in developing countries. They affect both men and women equally. The current study emphasizes

the importance of patients with DFU at tertiary care hospitals in the Thandalam area, where diabetes is poorly controlled, there is also little awareness of foot care, and there is a delay in seeking treatment, all of which worsens tissue destruction. Once admitted to the hospital, many patients do not receive timely and adequate care. Finally, LEA is a prevalent complication of DFU admitted to our hospital, as well as a leading cause of death.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

The ethical approval of the hospital authority was acquired prior to the start of the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Shaw JE, Sicree RA, ZimmetPZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract.* 2010;87:4–8. DOI:10.1016/j.diabres.2009.10.007 [PubMed] [CrossRef] [Google Scholar]
2. van Dieren S, Beulens JWJ, van der Schouw YT, et al. The global burden of diabetes and its complications: an emerging pandemic. *Eur J Cardiovasc PrevRehabil.* 2010;17(Suppl. 1):S3–S8. DOI:10.1097/01.hjr.0000368191.86614.5a [PubMed] [CrossRef] [Google Scholar]
3. Reiber GE. Epidemiology of foot ulcers and amputation in the diabetic foot In: Bowker J, Pfeifer M, editors. *The diabetic foot.* St. Louis: Mosby. 2001;12–32. [Google Scholar]
4. Indonesian Society of Endocrinology Consensus on the management and prevention of type 2 diabetes mellitus in Indonesia. Jakarta: Indonesian Society of Endocrinology; 2006. [Google Scholar]
5. Worster A, Haines T. Advanced statistics: understanding medical record review (MRR) studies. *AcadEmerg Med.* 2004;11:187–192. DOI:10.1111/j.1553-2712.2004.tb01433.x [PubMed] [CrossRef] [Google Scholar]

6. Adam DJ, Raptis S, Fitridge RA. Trends in the presentation and surgical management of the acute diabetic foot. *Eur J VascEndovasc Surg.* 2006;31:151–156. DOI:10.1016/j.ejvs.2005.05.039 [PubMed] [CrossRef] [Google Scholar]
7. El-Maadawy G, Sabry A, Mohi Elden H, et al. Different procedures in management of diabetic foot infections. *Trends Med Res.* 2010;5:16–30. DOI:10.3923/tmr.2010.16.30 [CrossRef] [Google Scholar]
8. Decroli E, Karimi J, Manaf A, et al. Profilulkusdiabetik pada penderitawatinap di bagianpenyakitdalam RSUP Dr. M. Djamil Padang. *Maj KedoktIndones.* 2008;58:3–7. [Google Scholar]
9. Yusuf S, Okuwa M, Irwan M, et al. Prevalence and risk factor of diabetic foot ulcers in a regional hospital, eastern Indonesia. *Open J Nurs.* 2016;6:1–10. DOI:10.4236/ojn.2016.61001 [CrossRef] [Google Scholar]
10. Waspadji S. Kaki diabetik: kaitannyadenganneuropatidiabetik In: Djokomoeljanto R, DarmonoSuhartono T, editors. *Kaki diabetik: patogenesis dan penatalaksanaan.* Semarang: Diponegoro University Press. 1996;E1–E23. [Google Scholar]
11. Madiyono B, Moeslichan S, Sastroasmoro S, et al. Perkiraanbesarsampel In: Sastroasmoro S, Ismael S, editors. *Dasardasarmetodologipenelitianklinis.* 3rd ed. Jakarta: CV SagungSeto. 2008;302–331. [Google Scholar]
12. Pemayun TGD, Naibaho RM, Novitasari D, et al. Risk factors for lower extremity amputation in patients with diabetic foot ulcers: a hospital-based case-control study. *Diabetic Foot Ankle.* 2015;6:29629. DOI:10.3402/dfa.v6.29629 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
13. Wagner FW, Jr. The diabetic foot. *Orthopedics.* 1987;10:163–172. [PubMed] [Google Scholar]
14. Abbott CA, Carrington AL, Ashe H, 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:10.1046/j.1464-5491.2002.00698.x [PubMed] [CrossRef] [Google Scholar]
15. Bouter KP, Storm AJ, de Groot AJ, et al. The diabetic foot in Dutch hospital: epidemiological features and clinical outcome. *Eur J Med.* 1993;2:215–218. [PubMed] [Google Scholar]
16. Benotmane A, Mohammedi F, Ayad F, et al. Diabetic foot lesions: etiologic and prognostic factors. *Diabetes Metab (Paris).* 2000;26:113–117. [PubMed] [Google Scholar]
17. Smith DM, Weinberger M, Katz BP. Predicting nonelective hospitalization: a model based on risk factors associated with diabetes mellitus. *J Gen Intern Med.* 1987;2:168–173. DOI:10.1007/BF02596146 [PubMed] [CrossRef] [Google Scholar]
18. Waugh NR. Amputations in diabetic patients – a review of rates, relative risks and resource use. *Comm Med.* 1988;10:279–288. DOI:10.1093/oxfordjournals.pubmed.a042420 [PubMed] [CrossRef] [Google Scholar]
19. Abbas ZG. Reducing diabetic limb amputations in developing countries. *Expert Rev Endocrinol Metab.* 2015;10:425–434. DOI:10.1586/17446651.2015.1058151 [PubMed] [CrossRef] [Google Scholar]
20. Sutanegara D, Darmono, Budhiarta AAG. The epidemiology and management of diabetes mellitus in Indonesia. *Diabetes Res Clin Pract.* 2000;50(Suppl. 2):S9–S16. DOI:10.1016/S0168-8227(00)00173-X [PubMed] [CrossRef] [Google Scholar]
21. Hartemann-Heutier A, Ha Van G, Danan JP, et al. Outcome of severe diabetic foot ulcers after standardized management in a specialized unit. *Diabetes Metab (Paris).* 2002;28:477–484. [PubMed] [Google Scholar]
22. Ozkara A, Delibasi T, Selcoki Y, et al. The major clinical outcomes of diabetic foot infections: one center experience. *Cent Eur J Med.* 2008;3:464–469. DOI:10.2478/s11536-008-0018-x [CrossRef] [Google Scholar]
23. Lavery LA, Armstrong DG, Wunderlich RP, et al. Risk factors for foot infections in individuals with diabetes. *Diabetes Care.* 2006;29:1288–1293. DOI:10.2337/dc05-2425 [PubMed] [CrossRef] [Google Scholar]
24. Ng LSY, Kwang LL, Yeow CS, et al. Anaerobic culture of diabetic foot infections: organisms and antimicrobial

- susceptibilities. *Ann Acad Med Singapore*. 2008;37:936–939. [PubMed] [Google Scholar]
25. Chopdekar KA, Joshi AA, Shivram S, et al. Bacteriological analysis of diabetic foot infection. *Bombay Hosp J*. 2011;53:706–711. [Google Scholar]
26. Boyko EJ, Ahroni JH, Stensel V, et al. A prospective study of risk factors for diabetic foot ulcer. The Seattle Diabetic Foot Study. *Diabetes Care*. 1999;22:1036–1042. DOI:10.2337/diacare.22.7.1036 [PubMed] [CrossRef] [Google Scholar]
27. Thewjitcharoen Y, Krittiyawong S, Porramatikul S, et al. Outcomes of hospitalized diabetic foot patients in a multidisciplinary team setting: thailand's experience. *J Clin Transl Endocrinol*. 2014;1:187–191. DOI:10.1016/j.jcte.2014.10.002 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
28. Ogbera OA, Osa E, Edo A, et al. Common clinical features of diabetic foot ulcers: perspectives from a developing nation. *Int J Low Extrem Wounds*. 2008;7:93–98. DOI:10.1177/1534734608318236 [PubMed] [CrossRef] [Google Scholar]
29. Larsson J, Agardh CD, Apelqvist J, et al. Long-term prognosis after healed amputation in patients with diabetes. *Clin OrthopRelat Res*. 1998;350:149–158. DOI:10.1097/00003086-199805000-00021 [PubMed] [CrossRef] [Google Scholar]
30. Van Netten JJ, Price PE, Lavey LA, et al. On behalf of the international working group on the diabetic foot (IWGDF). Prevention of foot ulcers in the at-risk patient with diabetes: a systematic review. *Diabetes Metab Res Rev*. 2016; 32(Suppl. 1):84–98. DOI:10.1002/dmrr.2701 [PubMed] [CrossRef] [Google Scholar]
31. Izumi Y, Satterfield K, Lee S, et al. Risk of reamputation in diabetic patients stratified by limb and level of amputation: a 10-year observation. *Diabetes Care*. 2006;29:566–570. DOI:10.2337/diacare.29.03.06.dc05-1992 [PubMed] [CrossRef] [Google Scholar]
32. Laborde JM. Tendon lengthening for neuropathic foot problems. *Orthopedics*. 2010;33:319–326. DOI:10.3928/01477447-20100329-26 [PubMed] [CrossRef] [Google Scholar]
33. Winkley K, Stahl D, Chalder T, et al. Risk factors associated with adverse outcomes in a population-based prospective cohort study of people with their first diabetic foot ulcer. *J Diabetes Compl*. 2007;21:341–349. DOI:10.1016/j.jdiacomp.2007.09.004 [PubMed] [CrossRef] [Google Scholar]
34. Peters EJG, Armstrong DG, Lavery LA. Risk factors for recurrent diabetic foot ulcers: site matters. *Diabetes Care*. 2007;30:2077–2079. DOI:10.2337/dc07-0445 [PubMed] [CrossRef] [Google Scholar]
35. Akhter JM, Khan IA, Shahpurkar VV, et al. Evaluation of the diabetic foot according to Wagner's classification in a rural teaching hospital. *Br J Diabetes Vasc Dis*. 2011;11:74–79. DOI:10.1177/1474651411406372 [CrossRef] [Google Scholar]

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