



ORIGINAL RESEARCH PAPER

General Surgery

MANAGEMENT OF DIABETIC FOOT ULCERS AND RELATED COMPLICATIONS: A PROSPECTIVE OBSERVATIONAL STUDY

KEY WORDS: Diabetes, Ulcer, SINBAD score, Amputation

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ABSTRACT

Introduction Foot ulceration and its complications are one of the major complications attributing to the hospital admission, with overall prevalence of about 4 -10% and even higher in geriatric population (5-10%). With the lifetime risk of 15%, it contributes as a major factor of morbidity and not infrequently leading to severe adverse outcomes, such as amputation and life threatening sepsis. The study was aimed at analyzing the prevalence of diabetic foot infection, its complications and outcomes of different treatment modalities available in a tertiary care center. **Material and Methods** A prospective observational study of 12 month duration was conducted among 100 patients having a history of diabetes and diagnosed with diabetic foot ulcer undergoing treatment in the surgery department of a tertiary care center in Jammu. The period of study was Feb 2022 to Feb 2023. Prior to the study an informed written consent and approval of the ethics committee was obtained. **Results** The incidence of diabetic foot ulcers peaks at the 5th decade of life with the mean age in our study being 53.17±10.2 years. A predominance in the male population (m:f ratio=2.57:1) and higher risk in the lower socio-economic strata was also noticed. The most common presenting complaint being ulcer (96%) and discharge (67%). Culture positivity was seen in 80% of the patients with Staph. Aureus being the most common causative organism. The main stray of treatment involved debridement and amputation (31%) followed by Split thickness skin grafting (30%). No adverse events were noted during the course of study. **Conclusion** Being a menace in developing countries, diabetes mellitus, a disease with life threatening and physically incapacitating consequences which not only increases the patient morbidity but also substantially increases the economic burden. Provision of precise counseling and a multidisciplinary line of action can lessen the complication and amputation rate, and is therefore recommended, along with the incorporation of diabetic foot management guidelines into the routine practice and teaching.

INTRODUCTION

High prevalence of diabetes and its related complications in the era of metabolic diseases makes its comprehensive knowledge and understanding quite imperative⁽¹⁾. Even with the increased awareness about the disease and easy availability of the healthcare services it still remains as one of the major cause of patient morbidity and hospitalization due to the various complications associated which are secondary to diabetes.

As per the WHO, diabetes is a chronic disease which has two main pathways, when not enough insulin is produced by the pancreas as per the body needs or ineffective utilization/uptake of insulin by the cells, mainly characterized as Type 1 (Insulin dependent) or Type 2 (Insulin independent) Diabetes mellitus, respectively. Globally, it has become a pandemic on its own, affecting more than 425 million people worldwide and it is estimated that 72.9 million people in India have diabetes and is expected rise to 135 million by the year 2045.⁽²⁾

The three most common consequences attributed to diabetes are foot ulcers, infection and ischemia. Diabetic Foot Ulcer (DFU) being the most frequent and ever-growing consequence of diabetes mellitus requiring hospitalization, is characterized by a soft tissue infection just under the malleoli which may extend deep into the bone and is the most frequent cause of lower extremity amputation, which in itself is one of the most dreaded complication of the disease.⁽³⁾ With a five-year survival of about 50% post amputation, the long-term outcomes have often been grave for such patients.

With lifetime risk of 15% of foot ulcer development in diabetic diaspora, over 2/3rd of the affected population undergoes lower limb amputation, with ulceration as the initial presentation⁽⁴⁾ A 15 to 30 fold increase risk has been observed in the diabetics when compared to non-diabetic patients. Globally, a lower limb amputation (complete or partial) takes

place every 30 seconds.⁽⁵⁾ The study was aimed at ascertaining the etiology, various clinical profile, complications and outcome of the different treatment modalities used in its treatment.

MATERIAL AND METHODS

This is a prospective observational study which included hundred cases admitted and treated (from March 2022 to May 2022) in ASCOMS and Hospital, Jammu. A detailed history of the patients including the demographics was taken after an informed consent. All concomitant medical conditions and previous history of surgeries were noted with a special emphasis on arterial or venous disorders and compromised immune system. The site is ischemia, neuropathy, bacterial infection and depth (SINBAD) score classification was performed after examining the DFU.

The treatment modalities used were conservative management⁽⁶⁾, split skin grafting and amputation^(7,8), depending upon the severity and clinical condition of the patient.

RESULTS

A total of 100 patients were included in the current study. The age distribution of the patients was between 30 years and 80 years. Mean age of patients was 53.17±10.2 years and the male:female ratio was 2.57:1. The incidence of diabetic foot ulcer peaked at the 5th decade of life. Among the patients about 75% belonged to low socioeconomic class. (Table 1).

Table 1: Sociodemographic variables of the patients (n=100) (%)

Sociodemographic variables of the patients (n=100) (%)		
Age group (years)	No. of patients (%)	
31-35	6	
35-40	10	
40-45	8	

45-50	15	
50-55	23	53.17± 10.2 years
55-60	18	
60-65	8	
65-70	4	
70-75	5	
75-80	1	
Sex		
Male	72	
Female	28	
Socioeconomic Class		
Lower Class	30	
Upper-Lower Class	45	
Lower-Middle Class	20	
Upper-Middle Class	3	
Upper Class	2	

With the mean duration of diabetes being 13.7±5.77 years, the maximum duration among the study population was seen at 5-10 years. An RBS of 200 mg/dl was noticed in more than 92% of patients with a mean level of 314.57 mg/dl. With the majority of the study population having an HbA1c level between 8-10 mmols/mol (57%) only 13% of the patients HbA1c levels greater than 10 mmols/mol. While 8.4 mmols/mol was the mean HbA1c in our study (Table 2). A positive family history of diabetes was present in 70% of the patients and hypertension being the chief comorbidity in about 40% patients. With alcohol use and smoking being the most common risk factors at 65% and 40% respectively.

Table 2: Diabetic profile of the patients (n=100) (%)

Diabetic profile of the patients (n=100)%	
Duration	
<5 years	16
5-10 years	38
11-15 years	22
16-20 years	15
>20 years	10
RBS levels on admission (mg/dl)	
<200	8
200-300	43
>300	49
HbA1C levels (mmols/mol)	
6-8	30
8-10	57
>10	13

Among the participants of the study forefoot was the most common ulcer site (46%). With regards to the grading grade 3 DFUs (32%) were predominant, followed by great 2 (23%), grade 6 (19%) and grade 1 (18%) according to SINBAD score. About 80% of the cases had superadded infection, with Staphylococcus aureus as the most common organism isolated on culture (Figure 1), and 92% presented with ulcers larger than 2 cm² in area. The depth of the ulcer was restricted to the skin and subcutaneous tissue in about 63% cases and reached the muscle, tendon and deeper tissues in about 37% cases (Table 3).

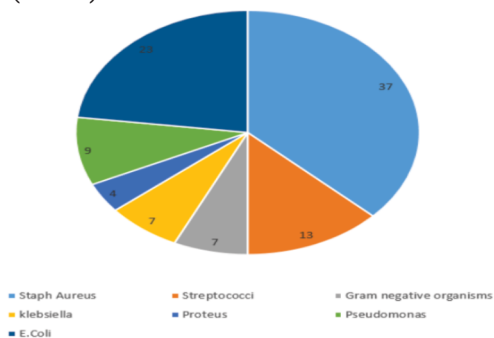


Figure 1: Causative Organisms and their prevalence

Table 3: Characteristics of the ulcer (n=100) %

Characteristics of the ulcer (n=100) %	
Foot ulcer site	
Forefoot	46
Midfoot	7
Hindfoot	43
Ischemia	42
Neuropathy	39
Bacterial Infection	80
Ulcer area	
<1 cm	0
1-2cm	8
>2cm	92
Ulcer depth	
Confined to Subcutaneous tissue	63
Reaching muscle, tendon or deeper	37
SINBAD score	
Grade 1	18
Grade 2	23
Grade 3	32
Grade 4	3
Grade 5	5
Grade 6	19

All the management options and their outcomes have been shown in table 3. The most commonly performed procedure was debridement and amputation (Toes/Trans-metatarsal) in about 31% of patients as majority of ulcers were grade 3 according to Sinbad score. Split thickness skin grafting was done in 30% patients followed by conservative management at 21%, slough excision in 15% and below knee amputation was seen only in 3% cases (Figure 2).

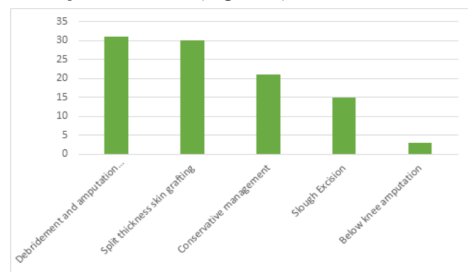


Figure 2: Treatment modalities used and their percentage

DISCUSSION

Diabetic foot is the most common consequence of diabetes mellitus and is one of the prevalent causes of hospital admission in India, owing to various socio cultural habits such as lack of proper knowledge, barefoot walking and low socio-economic status, often leads to increased morbidity and lower limb amputation. However, with the current available modalities such as active blood sugar management, effective dressing and wound care, it can be efficaciously managed. Moreover, with the use of multidisciplinary team effort with active intervention and surgical care, the severity of the problem can be diminished to a great extent leading to an enhanced quality of life and health for the patient.

The findings of a study with regards to age distribution were completely or partially concordant with the previous studies by Seth et al.⁽⁹⁾ Madan et al.⁽¹⁰⁾ and Rooh-ul-Muqim et al.⁽¹¹⁾ With maximum number of patients belonging to them age group between 50 to 60 years. The age distribution in our study ranged from 32 years being the youngest patient and 78 years being the oldest. At 53.17± 10.2 years, the mean age of the presenting population is comparable to that of the previously conducted studies. The higher incidence in geriatric population and mean age being in the latter half of life can be directly associated with the prevalence of diabetes, as it is higher in older patients. Studies by mote et al.⁽¹²⁾ and Gohel et al.⁽¹³⁾ have reported a that the affected population had a male predominance which is consistent with our findings as our

male to female ratio stood at 2.57:1. The higher prevalence in males can be due to the higher incidence of workplace acquired injuries and higher outdoor activities. The most affected socioeconomic class in our study was the lower-upper class with 45% of the cases, even lower class stood at 30% while the upper class constituted only 2% of the cases which is in coherence with the findings of Gohel et al.⁽¹³⁾. In our study the mean duration of diabetes was 13.7±5.77 years; Kumar and Gupta⁽¹⁴⁾ reported a higher number of patients with 1-5 years of diabetic history, this variation can be attributed to the difference in geographic and social factors. Forefoot (46%) was the most commonly seen location of the ulcer in our studied population with hindfoot closely following (43%), these observations are in similar to the ones made by Yosuf et al.⁽¹⁵⁾, who also reported forefoot as the most common site.

With regards to the ischemia, clinically evident reduced blood flow was seen in 42% of the patients, while sensation loss was observed in 39% of the patients. Our findings are consistent with Chalya et al.⁽¹⁶⁾ who reported ischemia at 57.4% and neuropathy in 30.8% patients. Diabetic foot infections were noted in 80% of the cases, typically these are polymicrobial in nature, but the most common organism in our study was Staph. Aureus. A sterile culture was noted in 20% of the patients, Jasmine et al.⁽¹⁷⁾ had also reported similar outcomes.

At 92%, the ulcers larger than 2 cm² were the most common entity and only 8% patients had ulcers between 1-2 cm², with a mean ulcer size of 26.7 cm². A study reported by Seth et al.⁽⁹⁾, with a mean ulcer size of 14.85 cm², partially comparable to our results.

Grade 3 DFUs were the most common in our study according to the SINBAD score, in consistence with the study reported by Venkataramana et al.⁽¹⁸⁾. With Debridement and amputation being the main stray of management in our setting (31%) and split thickness grafting was performed in 30% of the patients with a limb salvage. Only 21% patients qualified for conservative management. These findings are partially comparable to the findings of Kharbhari et al.⁽¹⁹⁾ The sample size being the only limitation of this study.

CONCLUSION

Being a menace in developing countries, diabetes mellitus, a disease with life threatening and physically incapacitating consequences which not only increases the patient morbidity but also substantially increases the economic burden. With the widespread and easily accessible modalities, early screening, adequate assessment and treatment, the burden of the disease can be drastically reduced. SINBAD score being easy to use can be utilized for effective screening for patients at risk for surgical intervention. Provision of precise counseling and a multidisciplinary line of action can also lessen the complication and amputation rate, and is therefore recommended, along with the incorporation of diabetic foot management guidelines into the routine practice and teaching.

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