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Prevalence, Interpretation and Management of Diabetic Lower Limb Amputation in A Tertiary Care Centre

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ABSTRACT

Background and Objectives: Diabetic foot ulcers are a common and serious complication of diabetes, leading to significant morbidity and, in severe cases, amputation. These ulcers often result from prolonged hyperglycaemia, poor vascular supply, and neuropathy, necessitating prompt and effective management to prevent adverse outcomes. This study was conducted to investigate the prevalence, predictors, and management of diabetic foot ulcers.

Methods: This prospective hospital-based study was conducted over a two-year period at Vinayaga missions kirupananda variyar medical college,Salem. Patients aged 40-80 with diabetic foot ulcers were included, provided they did not have traumatic, vasculitic, or neoplastic ulcers. After obtaining informed consent and ethical clearance, detailed patient histories were recorded, and relevant investigations including complete blood count, X-rays, fasting and postprandial blood sugar levels, lipid profiles, renal function tests, serum albumin, and pus cultures were performed. Data were analyzed using descriptive statistics, and outcomes were assessed in terms of hospital stay duration and recovery speed.

Results: The study included 100 participants, predominantly aged 51-60 years (38%), with a mean age of 56.67 years. The cohort was 55% male and 45% female. Most participants had diabetes for more than 5 years (65%), and the average HbA1c level was 9.8%. Diabetic foot ulcers were present in 28% of patients. Cultured wound samples predominantly showed Staphylococcus (39.28%), followed by Proteus (21.42%).

Conclusion: This study highlights the significant burden of diabetic foot ulcers in the study population, with most cases occurring in older adults with long-standing diabetes. The findings emphasize the importance of early intervention and comprehensive care to improve outcomes and reduce the risk of amputation.

Keywords: *diabetes, peripheral vascular disease, diabetic foot ulcer, amputation.*

1. INTRODUCTION

Diabetes is one of the most common pandemic metabolic conditions, causing enormous physical, psychological, and economic damage in human civilization. It is a major public health problem that has enormous economic and social costs. Diabetic foot ulcer (DFU) is one of the most severe pathophysiological effects of diabetes. [1]. Diabetic patient has a 25% lifetime chance of developing a foot ulcer, with foot ulcers being the most common reason for hospitalisation. Moreover, treating diabetic foot ulcers is costly, accounting for 20% of overall healthcare expenditures for diabetes, which is larger compared to the cost for any other diabetic complication Diabetic foot amputation is a severe and debilitating complication of diabetes mellitus, particularly prevalent in India. [2]

Diabetes is a major global health crisis, causing 1.6 million deaths in 2019. [3] Its adverse metabolic effects lead to foot ulcers, neuropathy, and atherosclerosis. 12-25% of diabetics are prone to developing diabetic foot ulcers (DFUs), a complex cellulitis or osteomyelitis caused by bacterial interaction [4].

India has 77 million diabetes patients, with an estimated 35.7 million by 2045. Diabetes affects 8.9% of the population and causes 1 million deaths annually. [5] Nearly 25% of diabetic patients develop DFU, a growing issue due to lack of awareness, medical infrastructure, and economic limitations.

Peripheral arterial disease (PAD), characterized by reduced blood flow to the lower extremities, is prevalent in Indian diabetic patients and is a significant risk factor for foot ulceration and amputation. [6] Poor glycemic control, characterized by uncontrolled blood glucose levels, can exacerbate the progression of diabetic complications, including neuropathy and PAD, thereby increasing the risk of foot ulceration and amputation .[7]

The prevalence and burden of diabetic foot amputation in India are hindered by limited large-scale epidemiological studies, lack of standardized reporting and data collection methods, and inadequate focus on risk factor identification. Diabetic foot complications in India face challenges such as limited access to specialized care, lack of awareness, and resource constraints. To reduce the burden of amputations, comprehensive strategies like strengthening primary healthcare systems, improving patient education, and promoting multidisciplinary care teams are crucial. Effective management involves a multidisciplinary approach focusing on prevention, early detection, and appropriate treatment strategies. Ongoing efforts to improve access to specialized care and address these challenges are essential for mitigating the impact of this debilitating condition. Thus in this study we intend to identify the predictors and prevalence of diabetic foot amputation and its management in a tertiary care center.

2. MATERIALS AND METHODS

This study was a prospective hospital-based study conducted among patients came with complaints of diabetic foot ulcers and got admitted to the Department of Surgery in Vinayaga missions kirupananda variyar medical college ,Salem . during the study period of 2 years. The study was conducted after obtaining ethical clearance and after obtaining informed consent from the patients. A detailed history got recorded along with necessary investigation as mentioned in the semi structured proforma.

Sample size:100

Inclusion Criteria:

After obtaining consent and if the following criteria were fulfilled they were included in the study:

- Age > 40 years , < 80 years
- History of ulcer
- History of diabetes mellitus

Exclusion Criteria:

- Traumatic ulcers
- Vasculitis ulcer
- Neoplastic ulcers

3. METHODOLOGY

This study was a prospective hospital-based study conducted among patients came with complaints of diabetic foot ulcers and got admitted to the Department of Surgery in Vinayaga missions kirupananda variyar medical college ,Salem. during the study period. The study was conducted after obtaining ethical clearance and after obtaining informed consent from the patients. A detailed history got recorded along with necessary investigation as mentioned in the semi structured proforma.

Investigation / procedures which were done:

- Complete blood picture
- Xray –local part
- FBS,PPBS
- Lipid profile
- Renal function tests
- Sr.albumin
- Pus culture and sensitivity

Study Procedure:

After getting ethical clearance, subjects were recruited. Informed consent was obtained from the caregivers of these patients. A detailed history was recorded and the relevant investigations done were entered in the pre-structured proforma enclosed. Setting in which subjects was recruited from: Patients presenting with these inclusion criteria in the Department of General surgery at Vinayaga missions kirupananda variyar medical college ,Salem

Various diabetic foot ulcer was studied. Investigations like CBC, Xray –local part, FBS, PPBS, Lipid profile, renal function tests, Serum albumin, Pus culture and Sensitivity. We have assessed the risk factors that were associated with diabetic foot ulcer and the factors that influences amputation in those patients.

Statistical Analysis:

Data was collected and entered in Microsoft excel and was exported to SPSS version 21.0 Data was analysed using descriptive statistics such as mean, median, standard deviation, percentages and graphs where ever applicable using respective methods.

4. RESULTS

Table 1: Age and Sex wise distribution of study participants

Age in years	Frequency	Percentage	Mean±S.D
≤40	12	12	56.67±12.97
41-50	19	19	
51-60	38	38	
>60	31	31	
TOTAL	100	100	

In the present study about 38% were in the age group of 51 to 60 years. About 12% were less than 40 years. About 19% were in the age group of 41 to 50 years. About 31% were more than 60 years. Mean age is 56.67 and standard deviation is 12.97. In the present study about 55% were males and 45% were females.

Table 2: Distribution of duration of diabetes mellitus among study participants

Duration of DM in years	Frequency	Percentage
≤5	35	35
>5	65	65
Total	100	100

In the present study about 65% had diabetes for more than 5 years. About 35% had diabetes less than 5 years.

Table 3: Distribution of Variables among study participants

Variables	Mean	SD
Age	56.67	12.97
HBA1C	9.8	2.39
FBS	201.13	62.60
PPBS	256.68	104.69

Table 4: Prevalence of diabetic foot ulcer among study participants

Diabetic foot ulcer	Frequency	Percentage
Yes	28	28
No	72	72
Total	100	100

In the present study prevalence of diabetic foot ulcer is 28%

Table 5: Organisms cultured from wound

Organism	Frequency	Percentage
Staphylococcus	11	39.28
pseudomonas	5	17.85
proteus	6	21.42
Klebsiella	1	3.57
No growth	5	17.85
Total	28	100

In the present study out of 100 patients' organisms were cultured from 28 patients. Among these Majority of the organism cultured was staphylococcus (39.28%)

Table 6: Status of vascular impairment among study participants

Results	frequency	percentage
No vascular impairment	76	76
Vascular impairment	24	24
TOTAL	100	100

About 76% had vascular impairment

Table 7: Grade of ulcer among study participants

Grade	Frequency	Percentage
I	4	14.28
II	10	35.72
III	14	50
Total	28	100

In the present study majority (50%) had grade 3 ulcer. About 35.72% had grade 2 ulcer. Only 14.28% hade grade 1 ulcer

Table 8: Outcome of diabetic foot ulcer among study participants

Outcome	Frequency	Percentage
SSG	2	7.16
Discharge	20	71.42
Amputation	6	21.42
Total	28	100

In the present study about 71% had discharge from their wound. About 21% had amputation. Only 7% went for Split Skin grafting

5. DISCUSSION

This study focused on patients with diabetic foot ulcers admitted to the Department of Surgery at Vinayaga missions kirupananda variyar medical college,Salem. The majority of participants were aged between 51 and 60 years, reflecting a common demographic affected by diabetic complications. The mean age of 56.67 years aligns with the understanding that older adults are more susceptible to diabetes-related issues due to cumulative disease duration and age-related physiological changes. This was corroborated by the study conducted by Akhtar et al., who found that the mean age of the study participants was about 51.58 ± 11.49 years [8].

The slight predominance of males (55%) among the participants is consistent with broader epidemiological trends that often show a higher incidence of diabetic foot complications in men. This is consistent with the study conducted by Dinh et al., who found that nearly 40% of the study subjects had plantar foot ulcerations. They highlighted that women tend to have a lower risk of foot ulceration compared to men, potentially due to factors such as less severe neuropathy, greater joint flexibility, and lower foot pressure [9].

Similarly, a study conducted by Daniele et al. involving 207 individuals with type 2 diabetes, aged between 40 and 75 years, found that males engage in physical exercise on average for a considerably higher number of days than women. This is most likely because men tend to be older, have noticeable sensory alterations, and have more plantar sensitivity [10]. A significant proportion of the participants had diabetes for more than five years. In our study, nearly 60% of the study participants had diabetes for more than 5 years. Chronic diabetes is a well-known risk factor for developing diabetic foot ulcers. Almobarak AO et al. found that nearly 50% of the study subjects had diabetes for more than 10 years. Long-term diabetes can lead to progressive damage to nerves and blood vessels, which increases the risk of ulceration and complications. The findings emphasize the importance of early diabetes management and ongoing monitoring to prevent long-term complications associated with the disease [11].

The study revealed suboptimal glycemic control among participants, with an average HbA1c level of 9.8 ± 2.39% and elevated fasting and postprandial blood glucose levels. Akyuz et al. in their study found that more than half of the study subjects with diabetic foot ulcers had an HbA1c level of about 10% [12]. Kim et al. in their review highlighted that persistent high blood glucose is known to impair wound healing and exacerbate diabetic complications, including neuropathy and poor circulation. These results underscore the need for improved strategies to manage blood glucose levels, such as better patient education, adherence to diabetes medications, and regular monitoring [13].

The study found that 28% of participants had diabetic foot ulcers, and a significant number of these ulcers were classified as Grade III, indicating severe cases. In a study conducted by Hamid et al., Gram-negative bacteria were the predominant organisms isolated, accounting for 58.8% of cultures (n=197). Proteus species (18.8%), E. coli (15.5%), Klebsiella species (14%), and Pseudomonas aeruginosa (10.5%) were the primary isolates. Conversely, Gram-positive bacteria were identified in 41.2% of cultures (n=183), with S. aureus (18.2%), methicillin-resistant S. aureus (MRSA) (8.4%), and E. fecalis (14.6%) being the most common. Effective management of diabetic foot infections requires tailored antibiotic therapy based on culture results to address the specific pathogens involved [14].

Addressing vascular issues through medical or surgical interventions is crucial for improving healing rates and reducing the need for amputations. This emphasizes the importance of a multidisciplinary approach in managing diabetic foot complications.

The results of the study highlight a number of crucial elements of clinical practice for the treatment of diabetic foot ulcers. For the purpose of both avoiding and treating these ulcers, strict diabetic care that improves glycemic control is essential. Regular inspections of the feet and prompt treatment of minor ulcers can help discover and treat them early on, which can stop the ulcer from getting worse and lower the risk of complications and amputations.

6. CONCLUSION

This study underscores the complex factors contributing to diabetic foot ulcers and their management. By focusing on improved glycemic control, early detection and treatment of ulcers, and effective management of vascular and infectious complications, healthcare providers can enhance patient outcomes and identify the predictors and prevalence of diabetic foot amputation and assess its management within a tertiary care center. By pinpointing key risk factors and evaluating current treatment approaches, we seek to enhance understanding and improve outcomes for patients affected by diabetic foot complications.

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