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Original Research Article

Clinical Presentation and Management of Diabetic Foot in a Tertiary Care Centre-A Cross-sectional Study

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ABSTRACT

Background
In this study, we wanted to assess various presentations of diabetic foot, evaluate diabetic foot outcomes after non-invasive and invasive treatment modalities, and analyse the percentage of surgical intervention and outcome.

Method
This was a hospital-based cross-sectional study conducted among 80 patients of diabetic foot diseases both male and female attending the General Surgery outpatient department and inpatients at Basaveshwara Medical College Hospital and Research Centre, Chitradurga, from 1st March 2021 to 31st August 2022 after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

Results
Our study involved 80 patients with most of them being males and of age more than 60 years. Most of the patients presented with cellulitis or foot ulcer. Wound debridement was found to be an effective mode of initial management followed by amputation.

Conclusion
The most frequent side effect of diabetes mellitus that surgeons are informed about is diabetic foot infection, which necessitates a multidisciplinary approach to treatment. The most crucial elements in the care of these patients are the efficient control of diabetes and the infection itself, as well as any necessary surgical operations based on the severity of the illness. The limitations of the study are the relatively small number of patients and a short period of study.

Keywords: Diabetic Foot; Foot Ulcer; Debridement; Amputation

INTRODUCTION

The most common cause of mortality from the illness and a pandemic throughout the world is diabetes. In 2017, the estimated number of persons with diabetes was 425 million, or 8.8% of all adults, as reported by the International Diabetes Federation. There are now 72.9 million diabetics in India, and this number is expected to rise to 134.3 million by 2045. [1]

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There are four distinct categories of diabetes:
Type 1 diabetes,
Type 2 diabetes, Gestational diabetes and
A group of other types.

The two most common forms of diabetes are type 1 and type 2, with the latter representing over 90% of all cases. Due to the death of insulin-producing pancreatic beta-cells, type 1 diabetes is pathophysiologically characterized by low levels of insulin. Insulin resistance in peripheral tissues (the liver, the muscle, and the adipose tissue) and beta cell malfunction leading to relative insulin deficit define type 2 diabetes. Infection, ulceration, or tissue damage in the foot due to neuropathy and/or peripheral artery disease in the lower limbs characterize the diabetic foot. [2] There is an increased risk of infection and hospitalization for diabetic patients who develop foot ulcers, with the infection rate reaching over 50% in certain cases. [3,4]. Infections of the diabetic foot (DFIs) are a frequent and potentially dangerous condition among diabetics. Individuals with diabetes mellitus are more likely to develop foot infections owing to the compromised blood flow caused by microvascular illness, which is typically accompanied by a loss of feeling caused by neuropathy. Most often, they result from trauma or the resulting ulceration of skin caused by peripheral neuropathy. In most cases, one or more bacteria are to be blamed for the infection, which then spreads to the surrounding tissue and, in severe cases, to the bone, where it causes osteomyelitis. Having a foot ulcer is a known complication of diabetes mellitus, with a lifetime risk estimated at 15%. More over two-thirds of lower limb amputations [5] may be traced back to ulceration, making it the leading cause of amputation. Introduction of two lower extremity amputations are often used as an indicator of the severity of diabetes and the failure of treatment. According to estimates, those with diabetes have a 15–30 times higher risk of having an amputation than people without the condition. Every 30 seconds, someone has a lower limb or a foot or toe amputated because of diabetes in patients suffering from hyperglycaemia. In India, habits like walking barefoot, lack of knowledge about diabetic foot, poor hygiene, etc. have aggravated the problem. [6] In spite of the prevalence of diabetic foot ulcers, few studies have assessed the internal or external validity of the many categorization systems used to predict ulcer outcomes. The Wagner classification system [7] is now the most popular and extensively used system, while the University of Texas Wound Classification System is another prominent system.[8] Although these algorithms were created based on input from experts across disciplines, their efficacy in forecasting clinical outcomes of diabetic foot infection has not been verified by any studies till date. Infection was not explicitly defined in previously published diabetic foot categorization systems, and when it was, it was only reported as present or absent. If a diabetic patient has developed an infection in his or her feet, the physician will be better equipped to handle a number of critical issues if they can accurately assess the illness's severity. Chronic leg ulcer is due to diabetes-related small-artery disease. [9]

AIMS AND OBJECTIVES

- To study various presentations of diabetic foot in our institution.
- Evaluation of diabetic foot outcomes after non-invasive and invasive treatment modalities.
- To study the percentage of surgical intervention and outcome.

MATERIALS & METHODS

This was a hospital-based cross-sectional study conducted among 80 patients of diabetic foot diseases both male and female attending the General Surgery outpatient department and inpatients at Basaveshwara Medical College Hospital and Research Centre, Chitradurga, from 1st March 2021 to 31st August 2022 after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

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Inclusion Criteria

All outpatients and inpatients with diabetic foot infections in the Department of General Surgery at Basaveshwara Medical College and Hospital, Chitradurga irrespective of the sex of the patients.

Exclusion Criteria

- The study did not include patients with venous ulcers.
- Patients receiving corticosteroids, immunosuppressive medications, radiation therapy, or chemotherapy within a month before study enrolment were not allowed.
- Patients with coagulopathy and on anticoagulant therapy.

Statistical Methods

Data was entered in MS Excel and analysed using SPSS software. Results were resented as tables.

RESULTS

Age of Participants	Total Number of Participants	Percentage
>40	7	8.75%
41-50	12	15%
51-60	16	20%
>60	45	56.25%
Total participants	80	
Age distribution		
Gender of the Study Group	**Total Number of Participants**	**Percentage**
Male	58	72.5%
Female	22	27.5%
Total	80	
Sex distribution		

Table 1: Demographic Distribution

The age distribution of the 80 patients was 26 years for the youngest and 82 years for the oldest. The age group over 60 had the highest number of cases. The patient is 65 years old on an average when presenting. Out of the 80 cases that were examined, 22 were females and 58 were males.

Duration of Diabetes Mellitus	Total Number of Participants	Percentage
Newly Detected	9	11.25%
5 Years or Less	17	21.25%
6 – 10 Years	37	46.25%
11-20 Years	15	18.75%
More than 20 Years	2	2.5%
Total	80	
Duration of Diabetes Mellitus		
Mode of Presentation	**Total Number of Participants**	**Percentage**
Abscess	4	5%
Cellulitis	34	42.5%
Superficial Ulcer	9	11.25%

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Deep Thickness Ulcer	14	17.5%
Gangrene	17	21.25%
Necrotizing Fasciitis	2	2.5%
Total	80	
Nature of Lesion		
Bone Involvement	**Total Number of Participants**	**Percentage**
Yes	13	16.25%
No	67	83.75%
Total	80	
Bone Involvement		
Table 2		

The average duration of diabetes mellitus in our study was 9 years. In our study, cellulitis was the most common presentation (42%), followed by ulcer (29%) which included both superficial ulcer (11%) and deep ulcer (18%), followed by gangrene (21%). Of the 80 cases studied, 13 patients showed bone involvement on x- ray.

Treatment Modality	Total Number of Participants	Percentage
Conservative	14	17.5%
Incision and Drainage	4	5%
Wound Debridement	33	41.25%
Wound Debridement + Split Skin Graft	8	10%
Fasciotomy	8	10%
Disarticulation	2	2.5%
Below Knee Amputation	7	8.75%
Above Knee Amputation	4	5%
Total	80	
Table 3: Treatment Modality		

Forty-five patients had minor operational procedures, including fasciotomy, wound debridement, and incision and drainage. Two patients underwent disarticulation. Seven individuals underwent below-knee amputations, whereas four patients underwent above-knee amputations. 8 patients underwent debridement followed by split skin grafting. Conservative management was done for 14 patients.

Outcome Distribution of the Study Participants	Total Number of Participants	Percentage
Improved	68	85%
Disability	11	13.75%
Death	1	1.25%
Total	80	
Outcome Distribution of the Study Participants		
Duration of Hospital Stay(Days)	**Total Number of Participants**	**Percentage**
1-20	67	83.75%
21-40	11	13.75%
41-60	2	2.5%
>60	0	0%
Total	80	
Duration of Hospital Stay		
Table 4		

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Out of 80 patients in the study, 68 patients improved, 11 patients resulted in disability and 1 patient expired. Average duration of hospital stay was 9 days.

Peripheral Vascular Disease	Total Number of Participants	Percentage
Yes	55	68.75%
No	25	31.25%
Total	80	
Incidence of Peripheral Vascular Disease		
Neuropathy	**Total Number of Participants**	**Percentage**
Yes	54	67.5%
No	26	32.5%
Total	80	
Occurrence of Neuropathy		
Table 5		

DISCUSSION

The most frequent side effect of diabetes mellitus is diabetic foot infection (DFI), which typically does not heal and results in the amputation of the lower leg. Early and effective DFI management can lessen the severity of complications and also improve patients' overall quality of life, especially when a multidisciplinary team approach is used. These strategies include education, blood sugar control, wound debridement, advanced dressing, offloading, advanced therapies, and in some cases, surgery.

Age

Eighty instances were examined, with the youngest patient being 26 years old and the oldest being 82 years old. The age group over 60 had the highest number of cases. The patient is 65 years old on an average when presenting.

The majority of our cases, like that of Madan et al. [10] and Gohel et al, were in the over-60 age range.[11] The mean age of presentation in our study was 65 years, which is also the same in Madan et al.'s study.

Sex

58 of the 80 cases that were examined were male, and 22 were female. In our study, there were more male patients and fewer female patients than in the studies by Madan et al., Griffith and Jeffery, [12] and D G Mote et al.[13] Males are more likely to develop diabetic foot disease than females. This may be related to smoking habits as well as exposure to workplace traumas that mostly affect the insensitive foot.

Duration of Diabetes Mellitus

When compared to the study by Gohel et al the diabetic foot infections were more in the patients with duration of diabetes between 6-10 years, where as in the study by Gohel et al it was with 11-20 years of duration. It is followed by duration less than 5 years or 11-20 years. Whereas in both the studies the foot infections were lesser with duration of diabetes more than 20 years, probably due to education and good glycaemic control and compliance to diabetic medications.

Mode of Presentation

The most frequent presentation in our sample was cellulitis (42%), which was followed by ulcers (29%)-which comprised both deep ulcers (18%) and superficial ulcers (11%)-and gangrene (21%).

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Deep thickness ulcers are more serious and can pierce a tendon, bone, or joint capsule. Superficial ulcers are lesions that only affect the skin and nearby subcutaneous tissue. Of the patients, gangrene was observed in 21.25% and an abscess in 5%. Necrotizing fasciitis affected 2.5% of the patients.

In our analysis, there were less incidence of ulcers and more cases of cellulitis than in the Madan et al study. The gangrene instances and the Gohel et al. studies are similar. There were fewer patients with abscess (5%) in our research than in Gohel et al.'s. These sores are frequently seen in farmers who go barefoot and are susceptible to infections.

Bone Involvement

Compared to the study by Madan et al 30%, proportion of patients in whom bone was involved is less in our study 16.25%. There have been mixed results regarding the sensitivity of plain films in the diagnosis of osteomyelitis. It has to do with how persistent the infection is, and for changes to be shown on conventional radiographs, there must be a minimum of 30 to 50 percent bone loss. The most frequent radiographic manifestations of osteomyelitic alterations include osteopenia, periosteal thickening, cortical erosions, and the production of new bone.

Treatment Modality

Both AKA and BKA are comparable to studies by Madan et al, Md Shakeel.[14] In our study, total proportion of patients who underwent debridement were 51.25% and disarticulation were 2.5%. Patients who underwent grafting in our study were 10% which is same as that of the study by Madan et al, and less compared to the study by Md Shakeel. The proportion of patients who underwent I & D 5% is slightly lower when compared to both the studies.

In our study, we have also included conservative management (17.5%) and fasciotomy (10%) for cellulitis. Offloading, or lowering pressure, is another crucial component of diabetic wound care. Properly fitting shoes, insoles, and socks can lessen foot stress, shock, and shear. Although most patients find it difficult to comply with these modalities, we considered that the most efficient way to relieve pressure was to employ total non-weight bearing, such as utilising crutches or a wheelchair, in our setup. The limb can be saved with appropriate antibiotic use, early presentation, and good diabetes management. Amputation was performed as a life-saving procedure only in cases of gangrene and unchecked infection spread.

Bacteriology of Infections

A diabetic foot infection is typically caused by a polymicrobial organism that includes both gram-positive and gram-negative aerobes and anaerobes. The most often isolated organism is Staphylococci (30%), but this percentage is lower than in studies by Madan et al (32%), Md Shakeel et al (40%), and D G Mote et al (43.3%). In our investigation, staphylococcus is the second most often isolated organism.

Duration of Hospital Stay

The average duration of hospital stay was 9 days in the present study, which is much lower when compared to Gohel et al where it is 17.34 days, and in D G Mote et al., 40% cases required hospital stay for 8-12 weeks.

The severity of the inflammatory response (ESR), recent blood glucose control (HbA1c), BMI, and significant vascular disease (CAD or CVA) at the time of hospital admission all had an impact on the length of hospital stay. In diabetic patients with sepsis, the HbA1c level is an independent predictor of the duration of hospital stay. BMI was associated with immunologic dysfunction, so patients with higher BMI have longer length of hospital stay. [15] The longer stay itself speaks about the cost and health care burden caused by diabetic foot infections.

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Outcome of the Study

Out of 80 patients in the present study, 1 patient expired due to uncontrolled diabetes, uncontrolled infection and septicemic shock. Gohel et al, reported a death rate of 4.5%, higher than our present study 1.25%. Age and renal function were linked to the death risk of individuals with infected diabetic foot ulcers (BUN). According to Lewis et al.'s research, [16] patients with end-stage renal illness and chronic kidney disease had greater death rates than those without such conditions, and these conditions were independent risk factors for the development of diabetic foot ulcers. In our study, 8 patients with PVD who presented with cellulitis were treated conservatively and discharged with cilostazol and ecosprin.

CONCLUSION

As the diabetes mellitus cases are increasing globally, it is becoming a public health problem. From the day of diagnosis of diabetes mellitus, it should be considered as the patient will suffer from diabetic foot, and care to be taken to prevent the huge burden on economy, health system and on society.

The most frequent side effect of diabetes mellitus that surgeons are informed about is diabetic foot infection, which necessitates a multidisciplinary approach to treatment. The most crucial elements in the care of these patients are the efficient control of diabetes and the infection itself, as well as any necessary surgical operations based on the severity of the illness. Males in the fifth and sixth decade belonging to low socioeconomic status with poor diabetic control are more susceptible to diabetic foot infections and increased susceptibility to trauma, smoking and unhygienic living. Agriculturists were affected more because of barefoot walking and working in fields.

Cellulitis was the commonest presentation with staphylococcus aureus being the most common organism isolated in our setup. The majority of foot infections were managed by controlling diabetes, antibiotics, debridement and SSG. Reduction of pressure, or offloading, is another essential aspect of diabetic wound care.

Only in cases of gangrene and unchecked infection spread was amputation performed as a life-saving treatment. To achieve better recovery, every effort must be made to preserve the knee joint. Early detection and effective management of these ulcers can reduce the severity of complications, including preventable amputations.

A team approach must be adopted to manage diabetic foot lesions to achieve good results. Patient education regarding diabetes control, foot care, early reporting of infections is much important and continuing treatment even after leaving the hospital. Knowledge of rehabilitative measures, prosthesis and support must be given to those who have undergone amputations.

Management of diabetic foot ulcers with a multidisciplinary approach resulted in a limb salvage rate that was greater than 90% and a complete healing rate that was greater than 80%.

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