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A clinical study on different methods of treatment of Diabetic Foot Ulcers

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Abstract

***Background**: Diabetes is a lifelong problem, and the incidence of diabetic foot complications increases with age and duration of the disease. Ulceration, infection, gangrene, and amputation are significant complications of the disease. Aim: To study the benefit and outcome of the different treatment modalities for the diabetic foot. To reduce the risk of lower limb complications in people with diabetes. **Methods:** This study was conducted comprising of 100 patients with diabetic foot in the department of general surgery at Prathima Medical College and Hospital, Naganoor, Karimnagar. All patients with diabetes mellitus suffering from foot ulcers and infections are included in the study. **Results:** The commonest presenting lesion was ulcers 44%, followed by gangrene 24% and cellulitis 20%. The commonest site of the lesion was dorsum of the foot 32%, followed by forefoot 28%, and toes 22%. Trivial trauma is the initiating factor in more than half of the cases. More than half of the patients 82% had an infection. The most common microorganism grown from culture was Staphylococcus aureus 30%. 28% of patients were treated with wound debridement, 18% of patients underwent major amputation. **Conclusion:** Diabetic patients at risk for foot lesions must be educated about risk factors. The multidisciplinary team approach diabetic foot disorders have been demonstrated as the optimal method to achieve favorable rates of limb salvage in the high-risk diabetic patient. Infection in a diabetic foot is potentially limb-threatening and always requires urgent diagnostic and therapeutic attention.*

Keywords: *Diabetes, foot ulcers, neuropathy, ischemia.*

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Introduction

Diabetes mellitus is a worldwide problem. The incidence of diabetes mellitus is increasing globally including in India. [1] Patients with diabetes have a 12% to 25% lifetime risk of developing foot ulcers. [2] Charcot foot, which in itself can lead to limb-threatening disorders, is another serious complication of long-standing diabetes. The complications of diabetes foot ulcers result in extensive morbidity, hospitalizations, and mortality. The prevalence of diabetes in adults across the world in the year 1995 was 4% and it is expected to rise to 5.4% by the year 2025. The total number of diabetes cases in the world will increase from 135 million in 1995 to 300 million in 2025. The estimated increase of 42% from 51 to 72 million, in developed countries and a 17% increase, from 84 to 228 million, in the developing countries. The countries with the largest number of people with diabetes will be in the year 2025, India, China, and the U.S. [3]

India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 million by 2030. [4] India presently has the largest number of diabetic patients in the world. In the diabetic patient, the foot is an area for many pathological processes, in which almost all components of the lower extremity involved, from the skin, subcutaneous tissue, muscles, bones, and joints, to blood vessels and nerves. Foot disorders such as ulceration, infection, gangrene, and amputation are a significant complication of the disease, estimated to cost billions of dollars each year. Diabetic foot ulcers occur mostly among elderly people, and elderly diabetics have twice the risk of developing foot ulcers, three times the risk of developing a foot abscess, and four times the risk of developing osteomyelitis. [5] Eighty-five percent of diabetic major amputations begin with a foot ulcer, and the common pathway to amputation involves infection entering the foot and leading to gangrene. Not all foot complications can be prevented, dramatic reductions infrequently have been achieved by taking a multidisciplinary approach to patients. The emulation of the diabetic foot involves careful assimilation of the patient's history and physical findings with the results of necessary diagnostic procedures. Early detection of foot pathology, especially in high-risk patients, can lead to earlier intervention and thereby reduce the potential for hospitalization and amputation. We in the present study tried to determine the causes of diabetes foot ulcers and different treatment modalities of treatment of DFU

Materials and Methods

This prospective study was conducted in the Department of General Surgery, Prathima Institute of Medical Science, Naganoor, Karimnagar. Institutional Ethical Committee clearance was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion Criteria

1. All patients with diabetes mellitus suffering from foot ulcers and infections are
2. included in the study.
3. The age group of the patients: all age groups are included in the study. Patients with a known past-history of diabetes are also included.
4. Patients with the gangrenous foot, complicated by diabetes.

Exclusion Criteria

1. Patients with foot infections without diabetes mellitus are excluded.
2. Patients with gangrene foot of etiology other than infection of foot complicated
3. by diabetes are excluded.
4. Patients whose treatment could not be completed due to non-compliance are excluded.
5. Incidental diagnosis of diabetes on admission.

A pre-designed, Pre-structured standardized questionnaire containing questions regarding clinical history, demographic data, risk factors for limb amputations, and various treatment modalities were used. A complete clinical examination of the patients was performed. The anatomical locations of ulcers were recorded. The type of insulin in use by the patients was also recorded. Investigations were performed which include CBP, FBS, PPBS, HbA1c, LFT, KFT, and culture and sensitivity were also done. complications, treatment, and sequel are studied, analyzed. The available data were recorded in MS Excel spreadsheet and analyzed by SPSS version 19 on Windows format.

Results

Of n=100 cases studied, most of the diabetic patients with foot lesions were in the age group of 61-70 (32%) followed by 51-60 (24%), 31-50 had 24% cases. No cases below 35 years were reported in our study. The youngest has 31 years came with complaints of abscess over the (R) forefoot and the oldest was 80 years admitted for cellulitis of (R) the whole forefoot. 78%

were male patients and 22% of cases of female patients. The ratio of Male: Female is 3.54: 1. Ulcers were found in 44% of cases, 20% of cases were with cellulitis, 16% of cases with abscess, 24% of cases gangrene, and 4% of cases Neuropathic ulcer given in table 1.

Table 1: Showing the clinical presentation of cases in the study

Clinical presentation	*Frequency*		*Percentage*
	Male	*Female*	
Ulcer	35	9	44
Cellulitis	15	5	20
Abscess	6	2	8
Gangrene	19	5	24
Neuropathic ulcer	3	1	4
Total	78	22	100

The most common site of lesion in the diabetic foot was the dorsum of the foot which was in about 32 patients (32%). Then the whole forefoot comprised about 14 cases (28%). The least was heel which was about 4 (4%), patients (table 2).

Table 2: Site of the lesions in the study

Site of lesions	*Frequency*		*Percentage*
	Male	*Female*	
Toes	15	7	22
Heel	3	1	4
Dorsum of foot	26	6	32
Plantar foot	12	6	18
Whole foot	26	2	28
Total	78	22	100

Out of the 100 cases studied 60% not had a history of trauma and 40 patients 40% not had a history of trauma. Most of the patients had diabetes duration for about 6-10 years 28%. One patient had a history of diabetes for only 4 months and 80 years old male patients came with a past history of diabetes with a duration of 24 years (table 3).

Table 3: Duration of diabetes recorded in patients

Duration of DM in years	*Frequency/percentage*
0 – 1	6
2 – 5	16
6 – 10	28
11 – 15	24
16 – 20	20
> 20	6

In the present study 52% of patients presented with neuropathy. Ischemia was seen in 60% of patients and there was an infection in 82% of patients. The above table shows that multiple complications can be presented in a single patient with a diabetic foot. The most common microorganism grown on the culture of pus was staphylococcus aureus in 30% of patients followed by pseudomonas 18%, streptococcus 14%, E-coli 10%, Klebsiella 8%, and Proteus 6%. In 14% of patients, there was no growth seen on culture some cultures yielded more than one type of bacteria (Table 4).

Table 4: Microorganisms isolated from the cases of the study

Microorganisms	*Frequency/percentage*
Staphylococcus aureus	30
Streptococcus	14
Pseudomonas	18
E-Coli	10
Klebsiella	8
Proteus	6
No Growth	14

The most common form of insulin used on admission was H. Actrapid in 62%, patients and H. Mixtard in 28% (table 5). In this study, the minimum stay in the hospital was 10 days and the maximum was 150 days. The most common duration of hospital stay was between 21-40 days (36%). This long duration of hospitalization can be explained by the refractory to the treatment of the

lesions owing to the diminished resistance of the body, hyperglycemia, prepared hormonal mechanisms, and resistance of the organisms to defense antibiotic therapy.

Table 5: type of insulin used by the patients in the study

Type of Insulin used	*Frequency/percentage*
H Actrapid	62
H Mixtard	28
Lente	6
Glargine	4

Out of 100 patients treated 12% of patients were managed conservatively by slough excision and regular dressing with antibiotics with diabetic control. 28% of patients were treated with wound debridement, 16%) patients presented with gangrene of toes and phalanges were M treated with disarticulation. In most of the cases, the limb was salvaged by conservative treatment and minor computations (Table 6).

Table 6: Different operative procedures performed in cases of the study

Operative Procedure	*Frequency/percentage*
Slough excision and regular dressing	12
Wound debridement	28
SSG	10
I & D	6
Fasciotomy	10
Disarticulation	16
Below knee amputation	4
Above-knee amputation	14

In this study minimum stay in the hospital was 10 days and the maximum were 150 days. The most common duration of hospital stay was between 21-40 days (36%). In this series 72% of cases prognosis was good and in 20 (20%) cases it was satisfactory. 2% of patients died of septicemia and 6% cases were discharged against medical advice (Table 7).

Table 7: Prognosis of the cases in the study.

Prognosis	*Frequency/percentage*
Good	72
Satisfactory	20
Expired/Death	2
Discharged against medical advice	6

Discussion

Foot involvement in lesions is a common problem in persons with diabetes mellitus especially if it remains uncontrolled. The high blood sugar levels then cause microvascular complications and following local trauma pressure, and neuropathy leads to various diabetes foot infections. It ranges from simple superficial cellulitis to chronic osteomyelitis. Such infections are difficult to treat because of impaired microcirculation. These individuals can have a combined infection involving bone and soft tissue called fetid foot which is a severe extensive chronic soft tissue and bone infection causing foul exudate. In this study, we found the maximum number of cases were having durations of > 6 years. The mean FBS in this study was 189.5 ± 10.23 mg/dl and the mean HbA1c was 9.4 ± 2.5. In the current study, we found the youngest patient was aged 35 years and the oldest was 79 years. A study by wheel et al; [6] found the youngest patient to be about 32 years and the oldest was 89 years. In this study greater numbers of cases were found in the people suffering diabetes for a longer duration in years. The male to female ratio in this study was 3.5:1. Mayfield JA. [7] had a similar number of cases both males and females in diabetic ulcer foot (DFU). Thurwal K et al;

[8] in a similar study found 78% males and 22% females. It appears that the incidence is more among males in the current study is probably because they are mostly working out-door, which makes them more vulnerable for trauma and sequel. A 24% incidence of gas gangrene was found in this study. Bell et al; [9] in their study found a 24.9% incidence of gas gangrene in their study. In the current study we found 32% of cases of ulcers on the dorsum of the foot and toe was involved in 22% of cases Apelquist et al; [10] Reiber et al; [11] study the common site was toed which was 51% and 52% respectively. In this study, 60% of cases were with a history of trauma and 40% were new-onset ulcers. Mayfield JA [12] found 44% of cases with a history of trauma and 39% new-onset ulcers and 10% due to vascular abnormalities. The most common microorganism isolated in cultures in this study was *Staphylococcus aureus* similar findings were reported by Grayson ML et al; [12] 22% cases. Superficial skin infections, such as cellulitis, are caused by the same organisms as those in healthy hosts, namely, group A streptococci and Staphylococcus aureus. Group B streptococcal cellulitis is uncommon in healthy hosts but not uncommon in patients with diabetes. In diabetic individuals, group B streptococci may cause urinary tract infections and catheter-associated bacteriuria in addition to cellulitis, skin and/or soft-tissue infections, and chronic osteomyelitis. Such infections may be complicated by bacteremia. In the present series, 12% of cases were treated by slough excision and regular U dressing. 14% of cases were treated by wound debridement 10% with SSG, 16% by disarticulation of single or multiple toes at the level of meta-tarsophalengeal joints. I&D and fasciotomy were done in 6% and 10% eases respectively. Below knee amputation was M\H done in 4% cases and above-knee, amputation was done in 14% of cases. The amputation rate in this study was 18% Collen et al; [13] had 38.6% cases with amputation and in Miyajima S et al; [14] 52% underwent amputation. In the present series out of 100 cases studied 66% of cases had a good prognosis. One 2% patient died, and 32% of patient underwent amputation at various levels.

Conclusion

Diabetic patients at risk for foot lesions must be educated about risk factors and the importance of foot care, including the need for self-inspection and surveillance, monitoring foot temperatures, appropriate daily foot hygiene, use of proper footwear, good diabetes control, and prompt recognition and professional treatment of newly discovered lesions will reduce the morbidity and mortality.

Conflict of Interest: *None declared*
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