

# Evaluation of Various Prognostic Factors in Diabetic Foot: A Clinical Study

Mohammed Ibrahim

Assistant Professor, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India

## Abstract

**Introduction:** Diabetic foot complications remain major medical, social, economic problems that are seen in all types of diabetes in every country; however, the reported frequencies of amputation and ulceration vary considerably as a consequence of different diagnostic criteria used.

**Aim:** The aim of the study was to study the etiology, presentation, and the management of diabetic foot ulcers to study the prognostic factors of diabetic foot in relation to plan of treatment and to increase the meager awareness of diabetic foot problems.

**Materials and Methods:** In this case study, 50 patients were studied. This study was conducted from September 2017 to November 2019. The protocol for the study was approved both by the Department of General Surgery, Mahatma Gandhi Memorial hospital, Kakatiya Medical College, Warangal.

**Results:** Findings were tabulated according to age and other clinical aspects.

**Conclusion:** Age, gender, duration of diabetes, mode of treatment of diabetes, and tobacco smoking did influence whether or not a diabetic with a foot lesion will have major amputation, an unsatisfactory outcome of primary treatment, prolonged hospital stay or will die. Furthermore, the presence of foot infections alone, microangiopathy (nephropathy, retinopathy), foot ischemia alone or neuropathy alone had no relationship to poor prognostic indices.

**Key words:** Amputation, Diabetes, Foot, Infection, Ulcer

## INTRODUCTION

Diabetic foot complications remain major medical, social, and economic problems that are seen in all types of diabetes in every country; however, the reported frequencies of amputation and ulceration vary considerably as a consequence of different diagnostic criteria used. Among the many chronic complications of diabetes, diabetic foot has remained the most feared complication, with both patients and treating health care professionals sharing the dread in equal measure. Major challenges remain in getting across important messages relating to the diabetic foot:

- a. Foot ulceration is common, affecting up to 25% of patients with diabetes during their lifetime

- b. Over 85% of lower limb amputations are preceded by foot ulcers and diabetes remains the most common cause of non-traumatic amputation
- c. Prevention is the first step towards solving diabetic foot problems. It is estimated that a leg is lost to diabetes somewhere in the world every 30 s; a more important fact is that up to 85% of all amputations in diabetes should be preventable
- d. Reduction in amputations will only be achieved if healthcare.

Professionals from all specialties realize that, as Brand once stated, "pain is God's greatest gift to mankind." It is the loss of pain that permits patients with neuropathy to develop ulcers and continue walking on them despite the presence of often over-whelming infection.

Strategies aimed at preventing foot ulcers are cost-effective and can even be cost saving if increased education and effort are focused on those patients with recognized risk factors for the development of foot problems.

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**Corresponding Author:** Dr. Mohammed Ibrahim, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India.

Diabetes is now the most common cause of Charcot neuroarthropathy another condition that should be preventable.

### Aim and Objectives

The objectives are as follows:

1. To study the etiology, presentation, and the management of diabetic foot ulcers
2. To study the prognostic factors of diabetic foot in relation to plan of treatment
3. To increase the meager awareness of diabetic foot problems
4. To understand the role of various factors involved in the complications arising out of diabetic foot and ascertain their role in the prognosis in relation to the plan of treatment
5. To reduce the risk of lower limb complications in people with diabetes
6. To empower diabetics in better foot care, early problem detection, and in seeking timely help.

## MATERIALS AND METHODS

### Source of Data

Source of data of minimum 50 patients with diabetes mellitus admitted at MGM Hospital surgical ward who have foot manifestations during the period of September 2017 to November 2019.

### Method of Collection of Data

All the patients with diabetes mellitus having foot infections and ulcerations admitted in the surgical ward and also referred from the other specialty departments. The data regarding patient particulars, detailed clinical history, clinical examination, diagnosis, investigations, and surgical procedures are collected in a specially designed case recording format.

### Sample Size

Calculated sample was 50 patients.

### Statistical Methods

My study is a type of prospective study and results are expressed in, Diagrammatic presentation Mean  $\pm$  SD Tests of significance such as "Z", "T", test were applied.

### Inclusion Criteria

All the patients with diabetes mellitus presenting with foot ulcers, infection of foot, and gangrene of foot.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Patients with foot infections without diabetes
2. Patients with ulcer and Gangrene of foot other than diabetic etiology.

## RESULTS

An analysis of 50 cases of diabetic foot ulcer was done. These cases were admitted and treated in Department of General Surgery MGM Hospital, Warangal, during the period of September 2017 to December 2019.

### Age

Age of the 50 patients were studied and ranged from 30 years to 86 years average being 61 years.

### Sex

In the present study, out of 50 cases 34 were males and 16 were females.

Sex	No. of cases	Percentage
Males	34	68
Females	16	32
Total	50	100

### Mode of Clinical Presentation

During our study, out of 50 cases 23 presented with cellulitis, 16 cases with ulcer, four cases with gangrene, and seven cases with abscess.

Mode of presentation	No. of cases	Percentage
Cellulitis	23	46
Ulcer	16	32
Abscess	07	14
Gangrene	04	08
Total	50	100

### Site of Lesion

The most common site of lesion in diabetic foot was sole of the foot which accounted for 40% of all cases.

Site	No. of cases	Percentage
Dorsum	16	32
Toes	14	28
Sole	20	40
Total	50	100

### Duration of Diabetes Mellitus

In our study, 11 cases were freshly detected at the time of admission and 39 patients were known diabetics. In 20 patients, 40% duration was between 1 and 5 years.

Among the 39 known diabetic patients, 16 patients were on regular treatment, 23 patients on irregular treatment, and remaining 11 patients were diagnosed on admission.

### Incidence of Bone Infection

Out of 50 patients, nine patients showed osteomyelitis in X-ray.

So the incidence of osteomyelitis in present study was 18%.

## Treatment

Treatment	No. of cases	Percentage
I and D, Fasciotomy	8	16
Slough excision, regular dressing and SSG	28	56
Tarsal tunnel release	10	20
Disarticulation	2	4
Transmetatarsal amputation	1	2
Below knee amputation	1	2
Total	50	100

Shows treatment received by the patients in my study. Most patients underwent thorough debridement then split skin grafting once the wound becomes healthy.

## Hospital Stay

In my study, average duration of hospital stay was about 31.94 days with minimum being 3 days with maximum being 110 days. The maximum number of patients was in 21–40 days group.

Hospital stay (days)	No. of cases	Percentage
0–20	16	32
21–40	22	44
41–60	06	12
61–80	05	10
81–100	00	00
101–120	01	02
Total	50	100

Table shows the most patients stayed between 21 and 40 days [Tables 1-3].

## DISCUSSION

Foot infections are frequent and serious complication of diabetes mellitus which is a syndrome of metabolic, vascular and neuropathic components which are interrelated. The prevalence of foot infections among diabetics is 12%. About 15% of all diabetics develop foot ulcer in their life time and 50% of non-traumatic amputations are due to diabetes mellitus. About 50% of amputations can be reduced in diabetics by educating about DO'S and DON'TS in diabetics as mentioned before. In my study, total 50 patients studied in the period of September 2017 to November 2019 and discussion of this is as follows.

### Age

Most common age group who presented with diabetic foot in my study was between 51 and 60 years with an average of 60.8 years. In JOS university study,<sup>[1]</sup> it is 63.2 years and in Seattle series it is 64.7 years. Thus, in my study presentation is most common in 5<sup>th</sup> to 6<sup>th</sup> decades. This early presentation may be due to poor glycemic control and good health awareness.

### Sex

In my study, 68% were males and 32% were females. In Seattle study its 67% and in JOS university study its 65%. Male preponderance in my study is may be due to males are more exposed to injuries during their occupational and recreational activities. This is comparable to Diabetic Research Center (2005) Chennai Study At 2005.<sup>[2]</sup>

### Mode of Clinical Presentation

In my study, majority of patients presented with cellulitis (46%), 32% with ulcer, 14% with abscess, and 8% with gangrene. And this is comparable to JOS University<sup>[1]</sup> study in which cellulitis was 50% ulcer 28% abscess 12% and gangrene 10%.

### History of Trauma

In the present study, 76% of patients were presented with history of trauma and it was absent in 24% of remaining patients. This was comparable to Ge *et al.* series in which 77% of patients had history of trauma. Because of sensory neuropathy diabetics will be having insensate foot so they are predisposed to repetitive unrecognized minor trauma and abnormal distribution of pressure on the feet hence emerge as a principle factor in causing foot ulcers.

### Site of Lesion

Out of 50 patients studied, most common site of lesion is was sole of foot (40%).

Site of lesion	Present study %	Apelquist study % <sup>[3]</sup>	Ge <i>et al.</i> series % <sup>[4]</sup>
Sole	40	28	37
Dorsum	32	14	11
Toes	28	51	52

This is comparable only in the sole lesions with the other studies. It is also observed in our study that 60% of diabetic foot occurred among those who walked bare foot and 35% in those wearing only slippers or chappals while only 5% prevalence was observed in those wearing shoes.

### Duration of Diabetes Mellitus

Most of the patients presented between 1 and 5 years and mean age is 3.12 years. It is 14.8 and 11.6 in Manchester, Seattle series and 8.2 in John Hopkins<sup>[5]</sup> study, respectively. This shows that foot complications accrued early in our study most probably due to lack of strict glycemic control.

### Incidence of peripheral vascular disease (PVD) and Neuropathy

Incidence of PVD and neuropathy in the present study was 12% and 20% and both in 36% of patients. When only neuropathy is taken in to consideration, 56% of patient in present series had neuropathy. The incidence of neuropathy

in other series are 39.4% and in Kerala -53.8%. When only PVD is taken in to consideration 48% of patients in the present study had PVD in Manchester series -39% and Walter -24.2%.

The most common lesion is atherosclerosis of tibial arteries leads to decreased blood flow resulting in decreased delivery of oxygen, nutrients and antibiotics to foot hampering the chance of healing. The increased incidence of these complications in our study is probably due to lac of strict glyceemic control.

### Osteomyelitis

In the present study, 18% of the patients had osteomyelitis in the X-ray. Demineralization, periosteal reaction, and bony destruction are classic radiographic triad of osteomyelitis appear only after 30–50% of bone destruction. It is the nidus for infection unless it is controlled wound never going to heal. It is comparable to JOS University study<sup>[1]</sup> (14%) and Manchester series (20%).

### Causative Organism

In the present study, most common organism isolated was *Staphylococcus aureus* (64%), next is *Pseudomonas* (10%), and Str. Pyogenic (10%). These results are comparable with JOS university study.<sup>[1]</sup>

**Table 1: % of patients in different age groups**

Age	No. of cases	Percentage
30–40	03	6
41–50	09	18
51–60	14	28
61–70	11	22
71–80	07	14
81–90	06	12
Total	50	100

**Table 2: Duration of diabetes**

Duration of diabetes in years	No. of cases	Percentage
Newly detected	11	22
<1	04	08
1–5	20	40
6–10	05	10
11–15	07	14
16–20	01	02
>21	02	04
Total	50	100

**Table 3: Incidence of osteomyelitis**

Osteomyelitis	09	18
Normal	41	82
Total	50	100

Infection is the 3<sup>rd</sup> most common factor responsible in the pathogenesis of diabetic foot lesion. When associated with ischemia frequently leads to amputation. this is comparable to JOS University study<sup>[1]</sup> and Seattle study in which *S. aureus* was the most common organism.

### Necessity of Strict Glyceemic Control

In the present study, all 50 patients treated with insulin. Insulin requirement was more initially and as the infection is under control the requirement became less and less. Among 50 patients only 12% had hemoglobin A1c (HbA1c) level <7 mg% and they have shorter hospital stay indicating that strict glyceemic control is necessary for faster healing of wounds and decrease the incidence of amputation. Compared to Manchester University study, foot complications such as neuropathy and vasculopathy, appeared early in the course of diabetes mellitus in our study. This is mainly due to lack of strict glyceemic control in our patients and tells us the necessity of strict glyceemic control to reduce the foot complications.

### Hospital Stay

Hospital stay was related to type, extent, severity of disease, and effective short- and long-term glyceemic control. In the present study, average duration of hospital stay was 34.64 days. Stay for non-healing wounds are 28.4 days and for neuropathy it was 16 days. Causes for long hospital stay were uncontrolled diabetes, life-threatening infections, malnutrition, and multiple medical comorbidities.

### Foot Care

Patient education in foot care, prophylactic skin and nail care, and footwear reduces the risk for foot ulcers and lower extremity amputation by 25% in those patients with no specific risk factor.

Prescription footwear accommodating deformity and decreasing pressure and shear forces applied to skin overlying bone prominence, keep individuals ambulatory, and protect them from ulcer formation.<sup>[6]</sup> In the present study, all patients educated regarding DOS AND DONTs. All are advised to wear MCR slippers selected patients referred to foot clinic Manager Jain hospital Bangalore, as this facility is not available in our hospital.

### CONCLUSION

This study comprised 50 cases of diabetic foot patients with emphasis on surgical management and its complications over a period of 1 year. After analysis of the data the following are the conclusions.

The highest number of patients was seen in the age group of 51–60 years (28%). Youngest patient was 30 years old

and the oldest 88 years. Males are more vulnerable to trauma and almost 3 times more affected than females because of their occupation and recreational activities. History of trivial trauma of some kind was the most common initiating factor in nearly half of the cases.

The most common presenting lesion was Cellulitis 46%, ulcer 32%, abscess 14%, and Gangrene 8%. Duration of diabetes varied from 1 year to 25 years and few patients were diagnosed post admission. Only 12% had HbA1c level <7 mg% and they have shorter hospital stay indicating that strict glycemic control is necessary for faster healing of wounds and decrease the incidence of amputation.

HbA1c level <7 mg% in only 12% of patient indicates poor compliance of patient regarding long term glycemic control. Commonest microorganism isolated in our hospital was *S. aureus*. Conservative treatment consisting of control of diabetes with Plain/Lente insulin along with appropriate oral/IV antibiotics was effective in some cases. Wound debridement, slough excision followed by dressing with Povidone/magnesium sulfate/plemin/saline resulted in healing in some cases.

Tarsal tunnel release in selected neuropathic patients resulted in improved neuropathic symptoms. Split skin grafts, disarticulation, transmetatarsal amputation, and below knee were the other modes treatment.

## SUMMARY

Foot ulceration in diabetic patients is a resource consuming, disabling morbidity that often is the first step towards lower extremity amputation. Prevention is the best treatment. The hallmark of diabetic foot problem in our populations is gross infection, and major contributing factors for late presentation include bare foot gait, attempts at home

surgery, trust in faith healers and undetected diabetes.<sup>[7]</sup> Diabetic patients have always suffered from complications affecting the lower limbs. Foot infection and the subsequent amputation of a lower extremity are the most common cause of hospitalization among diabetic patients.<sup>[8]</sup> It is more common in male agriculturists. Most common in middle aged males. Most commonly presents as cellulitis are non-healing ulcer over plantar aspect of foot common precipitating factor is trivial trauma. Neuropathy, ischemia and infections are the most common cause of foot lesions. *S. aureus* is the most common organism isolated from foot lesions.

Early thorough surgical debridement is helpful. Saline with Oxum gave good results. Tarsal tunnel release gave good results with symptoms of neuropathy and ulcer recurrence and patients were followed up for 6 months. Later they lossed follow-up. Education regarding foot care plays a key role in the prevention of recurrence.

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