

## A Prospective Assessment of the Clinic-Demographic Profile and Risk Factors of Diabetic Foot

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### Abstract

**Aim:** The objective of the present study was to assess association between socio-demographic, behavioural and clinical risk factors and diabetic foot and response of patients to various treatment modalities.

**Methods:** A prospective study was conducted in the General Surgery Department of Bhagwan Mahavir institute of medical science, Pawapuri, Nalanda, Bihar, India for 7 months. 50 patients were included in the study. All patients who presented to surgical outpatient department or were admitted to the surgical wards with signs and symptoms of diabetic foot during the 7 months period were included.

**Results:** Out of 50 patients in our study, 20 (40%) were in the age group of 51-60 years followed by 13 (26%) in the age group 61-70 years. There was a male preponderance in our study with 36 (72%) patients out of 50. Majority of the study subjects were literate with overall literacy rate being 60%. 96% study subjects belonged to low class. Among the 50 patients, 13 (26%) were unmarried showing lack of support and care and rest (74%) were married. Labourers accounted for 34% of study participants, farmers constituted 30%, businessmen 18% and others 18% of study subjects. Most of the participants had type II diabetes for >10 years. 80% of study participants had family history of diabetes. 92% of study participants were overweight (BMI 25-29.9) and remaining 8% were obese (BMI  $\geq$ 30). Hypertension was present in 72% of study participants, ischemic heart disease in 60% and hypercholesterolemia in 70%.

**Conclusion:** Diabetic foot is a common complication of long-standing diabetes. Several socio-demographic factors like advancing age, low socio-economic status, lack of family support, occupations involving risk of trauma to foot contribute to the risk of developing diabetic foot in diabetics. Hence it is essential to educate all the diabetic patients at risk about good glycaemic control, risk factors, proper foot care, periodic foot examination and neurological examination of lower limbs, prompt treatment of foot lesions and regular follow-up.

**Keywords:** Diabetes foot, Socio-demographic factors, Wagner's classification.

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### Introduction

Diabetes mellitus is a major public health problem with rising prevalence worldwide and in the year 2015 around 415 million people were known to have diabetes. This estimate is expected to increase to 642 million of the population by 2040. [1] Further, it is the 6th leading cause of death [2], attributing to 5 million deaths globally in 2015. According to recent estimates, 69.2 million people are affected with diabetes in India. [1]

Along with the raising prevalence of diabetes, an increase in its complications is also expected. Diabetes along with its complications is expected to result in increasing morbidity, mortality and

health expenditure due to the requirement of specialized care. [3] Diabetic foot is one of the most significant and devastating complication of diabetes and is defined as a group of syndromes in which neuropathy, ischemia and infection lead to tissue breakdown, and possible amputation. [4] Around 15% of diabetic patients will develop foot ulcers in their life time and this is known to precede amputation in 85% of the cases. [5] Every 20 s a lower limb is lost to diabetes in the world and it is the most common cause of non-traumatic lower limb amputation. [6] It is estimated that approximately 45,000 lower limbs are amputated every year in India and the vast majority of these

are probably preventable. [5] Prevention of diabetic foot ulceration is critical in order to reduce the associated high morbidity and mortality rates, and the danger of amputation. A number of contributory factors work together to cause foot ulceration in patients with diabetes. These include peripheral neuropathy; mechanical stress and peripheral vascular disease. [7]

As the prevalence of diabetes increases, the prevalence of long-term diabetes-related complications is also likely to increase. Diabetic foot ulcer (DFU) is a common and major complication of diabetes, representing a major healthcare burden with significant morbidity. [8] Diabetic foot is defined as the presence of infection, ulceration and/or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral arterial disease (PAD) in the lower limb in patients with diabetes. [9] It is a significant cause of morbidity and can lead to prolonged hospital stays, which is evidenced by the fact that ~20% of diabetes-related hospitalisations are related to DFU. [10] The mortality rate in patients with DFU is also high and is approximately twice that of the patients without ulceration. [11]

The objective of the present study was to assess association between socio-demographic, behavioural and clinical risk factors and diabetic foot and response of patients to various treatment

### Materials and Methods

A prospective study was conducted in the General Surgery Department of Bhagwan Mahavir institute of medical science, Pawapuri, Nalanda, Bihar, India for 7 months. 50 patients were included in the study. All patients who presented to surgical outpatient department or were admitted to the surgical wards with signs and symptoms of diabetic foot during the 7 months period were included.

### Method of collection of data

Fifty patients of diabetic foot were selected randomly and studied in detail after obtaining written informed consent. Data was collected by meticulous history, clinical examination, routine investigations, appropriate radiological investigation and relevant special investigations. A predesigned proforma was used to collect socio-demographic data such as age, sex, socio-economic status, literacy, occupation behavioral factors such as tobacco and alcohol use, physical activity and clinical data such as duration and type of diabetes, body mass index, current diabetic treatment, ulcer site and discharge. Further these patients were clinically examined thoroughly and the findings were recorded. Vascular and neurological examination was performed to detect peripheral vascular disease and neuropathy. Ulcer discharge

was sent for culture and sensitivity and appropriate antibiotics were selected accordingly. Radiological investigation was done to detect osteomyelitis. The details of management of each patient and the response to treatment were recorded.

### Inclusion criteria

Patients with signs and symptoms of diabetic foot of all age groups and both the sexes were included in study.

### Exclusion criteria

Foot ulcers, swelling and discoloration of toes due to non-diabetic causes were excluded from the study.

### Categorization of diabetic foot

Diabetic foot ulcers were categorized by Wagner's classification as follows- Grade 0- No obvious ulcer, but skin changes like hyperkeratosis, Grade 1-Localized, superficial ulcer, Grade 2-Deep ulcer to bone, ligament, or joint, Grade 3-Deep abscess, osteomyelitis, Grade 4-Gangrene of toes, forefoot and Grade 5-Gangrene of entire foot.

### Investigations

#### Routine investigations

It included-complete blood counts (CBC), blood sugar test: Fasting blood sugar and random blood sugar, HbA1c test, Urine analysis: albumin, sugar, microscopy and renal function tests.

#### Radiological investigation

It included X-ray foot and arterial doppler of lower limbs.

#### Specific investigation

Culture and sensitivity test of the ulcer discharge.

#### Treatment

The participants were treated with one or more of the following modalities of treatment:

#### Conservative management

Insulin/oral hypoglycaemic drugs/both-depending on the blood sugar levels, appropriate antibiotics for infected ulcers and foot care.

#### Surgical management

Depending on the degree of foot lesions- Incision and drainage of foot abscess, wound debridement, disarticulation, Amputation-1. Ray's amputation,

2. Trans-metatarsal,
3. Below knee and
4. Above knee.

Statistical analysis

Data was analysed by descriptive statistics and results presented as frequency and percentages appropriately.

## Results

**Table 1: Socio-demographic factors**

Variables	Number of patients	Percentage(%)
<b>Age (years)</b>		
31-40	2	4
41-50	5	10
51-60	20	40
61-70	13	26
71-80	6	12
81-90	4	8
<b>Gender</b>		
Male	36	72
Female	14	28
<b>Literacy</b>		
Illiterate	20	40
Literate	30	60
<b>Socioeconomic status</b>		
High	0	0
Middle	2	4
Low	48	96
<b>Marital status</b>		
Married	37	74
Unmarried	13	26
<b>Occupation</b>		
Laborer	17	34
Farmers	15	30
Businessmen	9	18
Others	9	18

Out of 50 patients in our study, 20 (40%) were in the age group of 51-60 years followed by 13 (26%) in the age group 61-70 years. There was a male preponderance in our study with 36 (72%) patients out of 50. Majority of the study subjects were literate with overall literacy rate being 60%. 96%

study subjects belonged to low class. Among the 50 patients, 13 (26%) were unmarried showing lack of support and care and rest (74%) were married. Labourers accounted for 34% of study participants, farmers constituted 30%, businessmen 18% and others 18% of study subjects.

**Table 2: Behavioral factors**

Variables	Number of patients	Percentage(%)
<b>Smoking/tobaccochewing</b>	22	44
<b>Alcohol use</b>	18	36
<b>Physical activity</b>		
Sedentary	45	90
Light	2	4
Moderate	3	6

Among the 50 study participants, 22 (44%) either smoked or chewed tobacco and 18 (36%) consumed alcohol. Majority (90%) of the patients were sedentary, 4% performed light physical activity while the remaining 6% performed moderate physical activity.

**Table 3: Clinical Parameters**

Variables	Number of patients	Percentage (%)
<b>Duration of diabetes (years)</b>		
0-5	0	0
5-10	5	10
>10	45	90
<b>Family history of diabetes</b>		
Present	40	80
Absent	10	20
<b>BMI (kg/m<sup>2</sup>)</b>		
Underweight (<18.5)	0	0
Normal (18.5-24.9)	0	0
Overweight (25-29.9)	45	90
Obese (≥30)	5	10
<b>Co-morbidities</b>		
Hypertension	36	72
Ischemic heart disease	30	60
Hypercholesterolemia	35	70

Most of the participants had type II diabetes for >10 years. 80% of study participants had family history of diabetes. 92% of study participants were overweight (BMI 25-29.9) and remaining 8% were obese (BMI ≥30). Hypertension was present in 72% of study participants, ischemic heart disease in 60% and hypercholesterolemia in 70%.

**Table 4: Clinical presentation**

Variables	No. of patients	Percentage(%)
<b>Mode of presentation</b>		
Skin changes	50	100
Gangrene	10	20
Discharge with foul smell	40	80
Ulcer	50	100
<b>Site of lesion</b>		
Toes	30	60
Dorsum of foot	6	12
Plantar	8	16
Multiple ulcer	2	4
Lateral aspect of foot	1	2
Dorsum and toes	2	4
Whole foot	1	2
<b>Ulcer category (Wagner's classification)</b>		
Grade 0	0	0
Grade 1	8	16
Grade 2	10	20
Grade 3	11	22
Grade 4	20	40
Grade 5	1	2
<b>History of trauma</b>		
Present	40	80
Absent	10	20
<b>Pathology</b>		
Neuropathy	42	84
Peripheral vascular disease (Vasculopathy)	21	42
Both	10	20

All study participants had skin changes showing discolouration on the foot and 20% of them showed gangrenous change. Ulcer was present in all study subjects and it was associated with foul smelling discharge in 80% of them. Toes were the

commonest site of lesion seen in 60% of study participants followed by plantar aspect in 17%. Majority (40%) of study participants had Grade 4 ulcer followed by Grade 3 ulcer (22%). History of trauma was present in 40 (80%) of study

participants. Neuropathy was present in 84% of study participants while peripheral vascular disease was seen in 42% and 20% had both these phenomena.

### Discussion

Diabetes mellitus is the commonest chronic non-communicable disease in India which affects nearly 7% of adults. [12] The triad of foot ulceration, sepsis, and amputation are the most feared complications of diabetes. Chronic non-healing ulcers of the foot are known to increase the morbidity of these patients. The most significant and devastating complication of diabetes is believed to be diabetic foot and it is estimated that 15% of all diabetics have a lifetime risk of developing it. [13] The WHO definition of diabetic foot is "the foot of patients with diabetes which develops ulceration, infection and / or deep tissues destruction, accompanied by neurological abnormalities and various grades of peripheral vascular disease in the lower limb". [14] It is essential to identify the "foot at risk", through careful inspection and physical examination of the foot followed by neuropathy and vascular tests.

Out of 50 patients in our study, 20 (40%) were in the age group of 51-60 years followed by 13 (26%) in the age group 61-70 years. Majority of the study subjects were literate with overall literacy rate being 60%. 96% study subjects belonged to low class. Among the 50 patients, 13 (26%) were unmarried showing lack of support and care and rest (74%) were married. Labourers accounted for 34% of study participants, farmers constituted 30%, businessmen 18% and others 18% of study subjects. This observation is similar to the findings of study by Al-Mahroos et al. [15] There was a male preponderance in our study with 36 (72%) patients out of 50. This is similar to the observation in a study done by Navarro-peternella et al. [16] Among the 50 study participants, 22 (44%) either smoked or chewed tobacco and 18 (36%) consumed alcohol. Majority (90%) of the patients were sedentary, 4% performed light physical activity while the remaining 6% performed moderate physical activity. Similar findings were observed by Navarro-peternella et al. [16]

Most of the participants had type II diabetes for >10 years. 80% of study participants had family history of diabetes. 92% of study participants were overweight (BMI 25-29.9) and remaining 8% were obese (BMI  $\geq$ 30). Hypertension was present in 72% of study participants, ischemic heart disease in 60% and hypercholesterolemia in 70%. Longer duration of diabetes was reported as a risk factor for diabetic foot by Shahi et al. [17] Majority of participants were overweight (90%) and rest were obese in our study. Elevated BMI was associated with higher risk of developing diabetic foot in

studies by Zantour et al and Sohn et al. [18,19] All study participants had skin changes showing discolouration on the foot and 20% of them showed gangrenous change. Ulcer was present in all study subjects and it was associated with foul smelling discharge in 80% of them. Toes were the commonest site of lesion seen in 60% of study participants followed by plantar aspect in 17%. History of trauma was present in 40 (80%) of study participants. Neuropathy was present in 84% of study participants while peripheral vascular disease was seen in 42% and 20% had both these phenomena. This was similar to the study of Apelquist et al. [20] Majority (40%) of study participants had Grade 4 ulcer followed by Grade 3 ulcer (20%) which was similar to the study by Mehraj et al. [21] History of trauma was present in 82 (82%) of study participants which was comparable to the findings of study by Reiber et al. [22] Neuropathy was present in 84% of study participants while peripheral vascular disease was seen in 42% and 20% had both these phenomena. Similar findings were reported by Khan et al. [23]

### Conclusion

Long-term diabetes often causes diabetic foot. Age, poor socioeconomic level, lack of family support, and employment with foot trauma increase the incidence of diabetic foot among diabetics. Diabetic foot risk factors include smoking, sedentary lifestyle, longer diabetes duration, family history of diabetes, higher body mass index, and uncontrolled diabetes. Peripheral neuropathy also causes foot lesions. Thus, diabetic patients at risk must be educated about appropriate glucose control, risk factors, correct foot care, periodic foot examination and neurological assessment of lower limbs, quick treatment of foot lesions, and frequent follow-up. Thus, screening for foot problems should begin at diabetes diagnosis and be linked with sustainable patient education at primary care level through primary care provider training.

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