

## **A Hospital-Based Study to Examine Socio-Demographic, Behavioural, and Clinical Risk Factors for Diabetic Foot and Patient Response to Therapy**

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### **Abstract**

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

**Methods:** A prospective study was conducted in the Department of General Surgery, Government Medical College, Bettiah, Bihar, India for 12 months. 100 patients were included in the study. All patients who presented to surgical outpatient department or were admitted via emergency to the surgical wards with signs and symptoms of diabetic foot during the 12 months period were included. The study was conducted after obtaining approval from institutional ethics committee.

**Results:** Out of 100 patients in study, 42 (42%) were in the age group of 51-60 years followed by 26 (26%) in the age group 61-70 years. There was a male preponderance in the study with 70 (70%) patients out of 100 being males. Majority of the study subjects were literate with overall literacy rate being 60%. 96% study subjects belonged to low class. Among the 100 patients, 25 (25%) were unmarried showing lack of support and care and rest (75%) were married. Labourers accounted for 35% of study participants, farmers constituted 30%, businessmen 17% and others 18% of study subjects. Among the 100 study participants, 44 (44%) either smoked or chewed tobacco and 36 (36%) consumed alcohol. Majority (90%) of the patients were sedentary, 5% performed light physical activity while the remaining 5% performed moderate physical activity. 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 75% 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 glycemic 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:** Diabetic foot, Socio-demographic factors, Wagner's classification

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## Introduction

Diabetes mellitus (DM) is a major public health problem worldwide and is considered one of the main global health emergencies of the 21st century. [1] The prevalence of DM is increasing in both developed and developing countries, recent estimates indicate that there were 463 million adults living with diabetes in 2019 which is projected to increase to 642 million in 2040. [2,3]

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. [4] 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. [5] 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. [6] The mortality rate in patients with DFU is also high and is approximately twice that of the patients without ulceration. [7]

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. [8] 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. [9] Every 20 seconds a lower limb is lost to diabetes in the world and it is the most common cause of non-traumatic lower limb amputation. [10] It is estimated that approximately 45,000 lower limbs are amputated every year in India and the vast majority of these are probably preventable.

[9] 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. [11] Regular comprehensive foot examination, patient education on foot care like simple hygienic practices, provision of appropriate footwear, and prompt treatment of minor injuries and a multi-disciplinary team approach can decrease ulcer occurrence by 50% and amputations by up to 85%. [12,13]

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

## Materials and Methods

A prospective study was conducted in the Department of General Surgery, Government Medical College, Bettiah, Bihar, India for 12 months. 100 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 12 months period were included.

## Method of collection of data

100 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, behavioural 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 colour 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:

##### A. Conservative management

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

##### B. 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	5	5
41-50	10	10
51-60	42	42
61-70	26	26
71-80	14	14
81-90	3	3

<b>Gender</b>		
Male	70	70
Female	30	30
<b>Literacy</b>		
Illiterate	40	40
Literate	60	60
<b>Socioeconomic status</b>		
High	0	0
Middle	4	4
Low	96	96
<b>Marital status</b>		
Married	75	75
Unmarried	25	25
<b>Occupation</b>		
Laborer	35	35
Farmers	30	30
Businessmen	17	17
Others	18	18

Out of 100 patients in this study, 42 (42%) were in the age group of 51-60 years followed by 26 (26%) in the age group 61-70 years. There was a male preponderance with 70 (70%) patients out of 100 being males. Majority of the study subjects were literate with overall literacy rate being 60%. 96% study subjects belonged to low

class. Among the 100 patients, 25 (25%) were unmarried showing lack of support and care and rest (75%) were married. Labourers accounted for 35% of study participants, farmers constituted 30%, businessmen 17% and others 18% of study subjects.

**Table 2: Behavioural factors**

<b>Variables</b>	<b>Number of patients</b>	<b>Percentage(%)</b>
<b>Smoking/tobaccochewing</b>	44	44
<b>Alcohol use</b>	36	36
<b>Physical activity</b>		
<b>Sedentary</b>	90	90
<b>Light</b>	5	5
<b>Moderate</b>	5	5

Among the 100 study participants, 44 (44%) either smoked or chewed tobacco and 36 (36%) consumed alcohol. Majority (90%) of the patients were sedentary, 5% performed light physical activity while the remaining 5% performed moderate physical activity.

**Table 3: Clinical Parameters**

<b>Variables</b>	<b>Number of patients</b>	<b>Percentage(%)</b>
<b>Duration of diabetes (years)</b>		
0-5	0	0
5-10	10	10
>10	90	90
<b>Family history of diabetes</b>		
Present	80	80
Absent	20	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)	92	92
Obese ( $\geq 30$ )	8	8
<b>Co-morbidities</b>		
Hypertension	75	75
Ischemic heart disease	60	60
Hypercholesterolemia	70	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  $\geq 30$ ). Hypertension was present in 75% of study participants, ischemic heart disease in 60% and hypercholesterolemia in 70%.

**Table 4: Clinical presentation**

<b>Variables</b>	<b>No. of patients</b>	<b>Percentage(%)</b>
<b>Mode of presentation</b>		
Skin changes	100	100
Gangrene	20	20
Discharge with foul smell	80	80
Ulcer	100	100
<b>Site of lesion</b>		
Toes	60	60
Dorsum of foot	13	13
Plantar	17	17
Multiple ulcer	5	5
Lateral aspect of foot	1	1
Dorsum and toes	3	3
Whole foot	1	1
<b>Ulcer category (Wagner's classification)</b>		
Grade 0	0	0
Grade 1	15	15
Grade 2	20	20
Grade 3	22	22
Grade 4	40	40
Grade 5	3	3
<b>History of trauma</b>		
Present	82	82
Absent	18	18
<b>Pathology</b>		
Neuropathy	84	84
Peripheral vascular disease (Vasculopathy)	42	42
Both	20	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 (20%). History of trauma was present in 82 (82%) 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. [14] 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. [15] 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". [16] Diabetic foot syndrome is defined as a group of syndromes in which neuropathy, ischemia and infection lead to tissue breakdown, and possible amputation. It is essential to identify the "foot at risk", through careful inspection and physical examination of the foot followed by neurological and vascular tests.

Out of 100 patients in this study, 42 (42%) were in the age group of 51-60 years followed by 26 (26%) in the age group 61-70 years. This observation is similar to the findings of study by Al-Mahroos et al. [17] There was a male preponderance in this study with 70 (70%) patients out of 100 being males. This is similar to the observation in a study done by Navarro-Peternella et al. [18] Among the 100 study participants, 44 (44%) either smoked or chewed tobacco and 36 (36%) consumed alcohol. Majority (90%) of the patients were sedentary, 5% performed light

physical activity while the remaining 5% performed moderate physical activity. Similar findings were observed by Navarro-Peternella et al. [18] Tobacco use and sedentary life style have been identified as a risk factor for diabetic foot in various studies. [19]

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). Longer duration of diabetes was reported as a risk factor for diabetic foot by Shahi et al. [19] 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. [20,21] 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. This was similar to the study of Apelquist et al. [22] 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. [23] History of trauma was present in 82 (82%) of study participants which was comparable to the findings of study by Reiber et al. [24] 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. [25,26]

### 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. Tobacco use, sedentary life style, longer duration of diabetes, family history of

diabetes, higher body mass index and uncontrolled diabetes are the behavioural and clinical risk factors for diabetic foot. Peripheral neuropathy is also an important factor in the development of foot lesions. Hence it is essential to educate all the diabetic patients at risk about good glycemic control, risk factors, proper foot care, periodic foot examination and neurological examination of lower limbs, prompt treatment of foot lesions and regular follow-up. It can therefore be concluded that screening for foot complications should start at the time of diagnosis of diabetes and integrated with sustainable patient education at primary care level by training of health care providers at primary care level.

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