

# Determination of Prevalence, Distribution and Etiology of Diabetic Foot Ulcer and the Treatment Modalities

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## ABSTRACT

**Background:** One of the most important and disabling complications of diabetes mellitus (DM) is the diabetic foot ulcers (DFU). They occur more than 15% of diabetic patients during their lifetime. The aim of this study is to Determine of prevalence, distribution and etiology of diabetic foot ulcer and the surgical modalities or outcome at Hospital in Pathanamthitta District , Kerala. **Methods:** Sixty three patients were admitted with diabetic foot ulcers but fifty eight were analyzed having met the inclusion criteria of having complete medical records. Data collected from the patients files included socio demographic parameters of age, sex, type of diabetes mellitus, Wagner's grading of the ulcers, fasting blood glucose on the second day of admission using glucose oxidase method, glycaemic control and type of drugs used, duration of ulcers before presentation to hospital, types of ulcers and risk factors for their development, length of hospital stay, surgical modalities of treatment and ulcer defect cover, patients who had amputations and mortality. **Results:** Diabetic foot ulceration occurred in 58 patients giving a prevalence of 7%. These 58 patients with complete medical records were recruited in the study comprising 36 (62.1%) males and 22 females (37.9%). The Malyali diabetics with ulcers were 37 (63.8%) while Tamil were 13 (22.4%). Seventeen (29.3%) of the DFU patients were illiterate. Age range of patients was 25 – 75 years with mean age of 54.6 ± 14.4 years. The commonest aetiology of DFU in the study was peripheral neuropathy accounting for twenty two (48.2%) cases. **Conclusion:** Peripheral neuropathy as the commonest aetiology of diabetic foot ulceration with other associated risk factors like poor glycemc control which are preventable.

**Keywords:** *Diabetes Mellitus, Diabetic Foot Ulcers (DFU), Amputations, Mortality, Surgical Modalities.*

## INTRODUCTION

The prevalence of both type 1 and 2 DM is increasing. Type 2 DM is responsible for almost 90% of diabetes patients. Obesity, inactivity, family history, age, gestation, high blood pressure, abnormal cholesterol and triglyceride levels and polycystic ovary syndrome play crucial role to get type 2 DM.<sup>[1]</sup> The number of people living with diabetes is growing fast. Diabetic foot infections (DFIs) are one of the most serious chronic complications of DM. One of the most important and disabling complications of diabetes mellitus (DM) is the diabetic foot ulcers (DFU). They occur more than 15% of diabetic patients during their lifetime.<sup>[2,3]</sup> Treatment of diabetic foot ulcers (DFUs) and subsequent infections is difficult. Multidisciplinary approach is needed for the management of DFUs and DFIs. The most dramatic end result of DFUs and DFIs are foot amputation. The number has been reaching one in every 30 second in the world.<sup>[4,5]</sup>

Development of DFU is traditionally believed to result from a combination of oxygen deficiency

caused by peripheral vascular disease, peripheral neuropathy, minor foot traumas, foot deformities, and infection.<sup>[6-8]</sup>

Diabetic foot ulcers generally classified as neuropathic, ischemic or both. Neuropathic DFUs is characterized with the presence of peripheral neuropathy without ischemia while ischemic DFUs is defined with the existence of symptoms related to peripheral artery disease with no peripheral neuropathy. In neuro-ischemic DFUs neuropathy and ischemia coexist.<sup>[9]</sup> Given the DFU's high prevalence, heavy burden, and severe impact on patients' life quality, it is advisable that sufficient heed be paid to prevention of this particular complication of DM. Furthermore, while effective treatment and formulation of prevention guidelines require a thorough understanding of characteristics of DFU patients and their ulcers, there are reports that not only patients' but also physicians' information about these characteristics is inadequate and even the process leading to ulceration and amputation is still not well understood by many healthcare professionals.<sup>[10]</sup> The ulcers may begin with callosities or just blistering for which the patients may ignore as trivial, but these rapidly progress to severe ulceration especially in the presence of poor blood glucose control with infection and eventual gangrene of the limb. The patients may present to the physician/surgeon at any of the stages. But suffice it

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to say that ulcers at stages 3 and above carry poor prognosis and are the ones likely to progress to amputation or even death of the patient. The aetiology of diabetic foot ulceration is multifactorial but the commonest is peripheral neuropathy, accounting for 63% of cause of ulcers.<sup>[11]</sup> Other factors are trauma, vascular ischemia, infection and so on.<sup>[11]</sup> The neuropathy is a result of nerve malfunction caused by accumulation of sorbitol and fructose as a result of hyperglycemia and excessive enzymatic actions of aldose reductase and sorbitol dehydrogenase and consequent decrease in myoinositol necessary for normal function of nerve cells. The vascular ischemia involves the peroneal arteries as a result of vasoconstriction and platelet aggregation with consequent thrombosis. Atheromatous plaques deposition in the vessels further worsen the ischemia. Risk factors associated with development of DFU include: a previous ulceration, previous amputation, cigarette smoking, poor blood glucose control, not wearing shoes, foot deformities like hammertoes, charcot foot and low socioeconomic status.<sup>[12]</sup>

This study is been conducted to determine prevalence, distribution and etiology of diabetic foot ulcer and the treatment modalities in Pathanamthitta District, Kerala

**MATERIALS AND METHODS**

This descriptive, retrospective study was carried out by of consecutive patients admitted at Mount Zion Medical College Hospital Ezhamkulam, Adoor Pathanamthitta Dist, Kerala with diabetic foot ulcers from may 2013 to August 2014. Sixty three patients were admitted with diabetic foot ulcers but fifty eight were analyzed having met the inclusion criteria of having complete medical records. Data collected from the patients files included socio demographic parameters of age, sex, type of diabetes mellitus, Wagner’s grading of the ulcers, fasting blood glucose on the second day of admission using glucose oxidase method, glycaemic control and type of drugs used, duration of ulcers before presentation to hospital, types of ulcers and risk factors for their development, length of hospital stay, surgical modalities of treatment and ulcer defect cover, patients who had amputations and mortality. The study was reviewed and approved by the Ethics Committee of the Mount Zion Medical College Hospital. All data were analyzed anonymously throughout the study. The data was retrieved from the patients files in the plastic, medical and orthopedic clinics; surgical and medical wards; Accident and Emergency and entered into a proforma form. Patients who had diabetes mellitus but have never

had an ulcer or who have healed ulcers were excluded from the study.

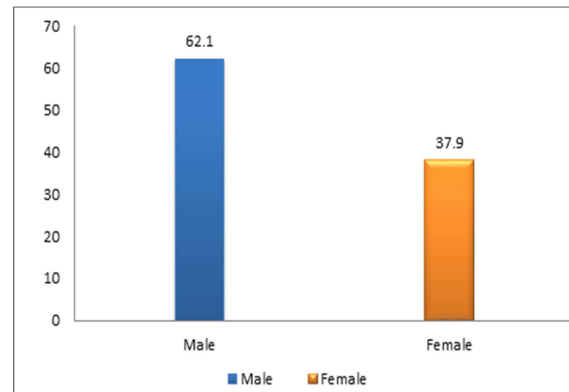
**Statistics Analysis**

SPSS version 19.0 was used for the statistical analysis. Results were expressed as ratios, means, percentages, tables and bar charts. Chisquare was used for comparison of categorical variables and multivariate analysis. P = 0.05 was considered as statistically significant.

**RESULTS**

**Table 1: Socio-demographic characteristics of the patients**

Variables	Frequency	%
AGE		
25-35	4	6.8
36-45	19	32.8
46-55	22	37.9
56-65	9	15.5
65-75	4	6.9
SEX		
Male	36	62.1
Female	22	37.9
ETHNIC GROUP		
Malayali	37	63.8
Tamil	13	22.4
Kannada	6	10.3
Konkanis	2	3.4
EDUCATIONAL STATUS		
Illiterate	17	29.3
Primary	6	10.3
Secondary	26	44.8
Tertiary	9	15.5



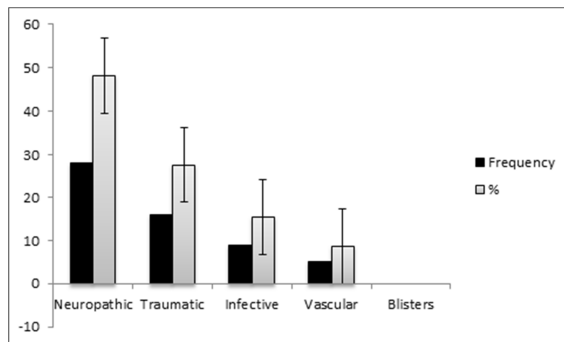
**Figure 1: Gender distribution of patients**

**Table 2: Types of ulcers**

Types Of Ulcer	Frequency	%
Neuropathic	28	48.2
Traumatic	16	27.6
Infective	9	15.5
Vascular	5	8.6
Blisters	0	
TOTAL	58	

## Kavil et al; Diabetic Foot Ulcer

Total number of diabetics treated on admission and in the outpatient department were 826. Diabetic foot ulceration occurred in 58 patients giving a prevalence of 7%. These 58 patients with complete medical records were recruited in the study comprising 36 (62.1%) males and 22 females (37.9%). [Figure 1] the Malyali diabetics with ulcers were 37 (63.8%) while Tamil were 13 (22.4%). Seventeen (29.3%) of the DFU patients were illiterate. [Table 1]. Age range of patients was 25 – 75 years with mean age of  $54.6 \pm 14.4$  years. The commonest aetiology of DFU in the study was peripheral neuropathy accounting for twenty two (48.2%) cases. [Table 2, Figure 2]. Types of diabetes, fasting blood glucose levels on admission and anti-diabetic received were showing in [Table 3]. Additional risk factors for DFU were showing in [Table 4]. Dressing agent used for patients and other supportive therapies were showing in [Table 5]. Surgical treatment given and outcome of treatment were shown in [Table 6].



**Figure 2:** Types of ulcer

**Table 3:** Types of diabetes, fasting blood glucose levels on admission and anti-diabetic received

Number Of Days	Frequency	%
<b>Types Of Diabetes</b>		
Type I	7	12.0
Type II	51	87.9
Total	58	
<b>Fasting Blood Glucose Mmol/L Frequency</b>		
Percent	5	8.6
≤2.4 And Below	8	13.8
2.5-6.5	45	77.6
≥6.6		
<b>Anti-Diabetic Received</b>		
Injection Insulin	38	65.5
Oral Hypoglycaemic	20	34.5

## DISCUSSION

Diabetic foot ulceration occurred in 58 patients giving a prevalence of 7%. These 58 patients with complete medical records were recruited in the study comprising 36 (62.1%) males and 22 females (37.9%). Our study found that the Malyali diabetics

with ulcers were 37 (63.8%) while Tamil were 13 (22.4%). Seventeen (29.3%) of the DFU patients were illiterate. Age range of patients was 25 – 75 years with mean age of  $54.6 \pm 14.4$  years. The commonest aetiology of DFU in the study was peripheral neuropathy accounting for twenty two (48.2%) cases.

Shahi et al. found in their study in North India that risk factor for development of DFU was age above 50 years.<sup>[13]</sup> This was seen in other studies as well. Shahi et al.<sup>[13]</sup> showed that the male sex developed diabetic foot ulcers more frequently (71.13%), probably because they were prone to doing outdoor jobs to raise money for the upkeep of their families. Other studies showed similar male preponderance to diabetic foot ulceration for same reason.<sup>[14]</sup>

**Table 4:** Additional risk factors for DFU

Risk Factor	Frequency	%
None	24	41.4
Poor glycaemic control	15	25.9
Previous ulcer	12	20.6
Previous amputation	2	3.4
Cigarette smoking	1	1.7
Obesity	2	3.4
Hemiplegia	1	1.7
Hyperlipidemia	1	1.7

**Table 5:** Dressing agent used for patients and other supportive therapies

Dressing Agent	Frequency	Percent
Honey only	43	74.1
Antimicrobial + honey	9	15.5
Hydrotherapy + honey	6	10.3

**Table 6:** Surgical treatment given, and outcome of treatment

	Frequency	%
<b>Surgical Treatment</b>		
Serial Debridement	34	58.6
Amputation	17	29.3
Skin Grafting	5	8.6
Discharge Against Medical Advice	2	3.4
<b>Outcome</b>		
Healed Ulcer	28	48.2
Amputation	16	27.6
Death	5	8.6
Discharge Against Medical Advice	9	15.5

Our study showing almost equal gender predisposition to diabetic foot ulceration may be because of the females engagement in more outdoor activities now due to the global economic meltdown in order to raise money to complement the males in taking care of the family. Some studies showed that age was statistically significant in diabetic foot ulcers in patients with long-term diabetes even after glycemic control.<sup>[15-17]</sup> Ekere et al showed that foot ulcers have been reported to occur after a mean

interval of 13 years from the diagnosis of diabetes in Nigerian population.<sup>[17]</sup> Other studies also found that the frequency of having diabetic foot ulcer increased by 8 fold higher in those who were diabetic for more than 10 years.<sup>[18-20]</sup> The possible explanation might be due to the fact that diabetic patients were presumed to be at more risk due of developing long term diabetic-related complications such as peripheral vascular disease, neuropathy, nephropathy and retinopathy which could predispose to the occurrence of foot ulcer. In summary the age range (51-60) years are more at risk of developing foot ulcer than any other age groups.<sup>[20]</sup>

## CONCLUSION

Peripheral neuropathy as the commonest aetiology of diabetic foot ulceration with other associated risk factors like poor glycemic control which are preventable. DFU is most likely to develop in patients with poor DM control; it is inevitable that patient education should be afforded its due attention. To prevent or minimize the risk of developing diabetic foot ulcer, health educators should emphasize on the benefit of weight reduction, blood pressure monitoring and other known predisposing factors.

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