

## Study the Level of Glycosylated Haemoglobin in Lower Limb Diabetic Ulcer in Tertiary Care Hospital

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Conflict of interest: Nil

### Abstract:

**Background:** Diabetic patients are at increased risk for developing foot ulcers, which, if left untreated, can lead to neuropathy and vascular insufficiency, both of which can have devastating effects on the patient's quality of life.

**Objective:** To study relationship between HbA1c levels and lower limb diabetic ulcer.

**Methodology:** The present prospective study was carried out at Department of Surgery of tertiary care centre during November 2021 to October 2022. A total of 50 patients with diagnosed type II DM and diagnosed diabetic foot ulcers were included in the study. Data was collected at presentation using proper history, thorough examination of patient, limb and ulcer, HbA1c assessment as well as duplex arterial sonography of lower limb. Grading of ulcer was done by Wagner Classification.

**Results:** The mean age among the distribution of cases was 56.29 ±10.92 years with male dominance. (64%) The maximum numbers of cases had Grade 3 diabetic ulcer (42%) The relation of grade of diabetic foot ulcer and HbA1c shows HbA1c has a linear relationship with the grades of Wagner classification of diabetic foot

**Conclusion:** The HbA1c can be used as a screening tool in the high-risk diabetic patients for the diabetic foot to predict its occurrence.

**Keywords:** Glycosylated Hemoglobin, Diabetic Ulcer, Lower Limb.

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### Introduction

The prevalence of type 2 diabetes mellitus (T2DM) is rapidly increasing, making it a major public health concern that has obvious repercussions for people's health and healthcare systems. [1] International Diabetes Federation (IDF) data and statistical analysis show that 425 million adults worldwide have diabetes mellitus (DM), with this number expected to rise to 629 million by 2045. [2]

It is well-known that diabetic patients are at increased risk for developing foot ulcers, which, if left untreated, can lead to neuropathy and vascular insufficiency, both of which can have devastating effects on the patient's quality of life. [3,4]

One of the long-term complications of Type 2 diabetes is foot infections, as 1-4% of people with Type 2 diabetes each year develop a foot ulcer, which can lead to gangrene and lower extremity amputation. [5]

People with diabetes have a 25-fold higher risk of amputation of the lower extremities than the general population. [5,6] Researchers from the Global Lower Extremity Amputation Study Group

found that diabetes was a factor in 25–90% of amputation cases.[7]The aim of this study was to check the level of HbA1c in patients with lower limb diabetic ulcer in a tertiary care hospital.

### Objectives:

To study relationship between HbA1c levels and lower limb diabetic ulcer.

### Methodology:

The present study was a cross-sectional study. The study was carried out at Department of Surgery of tertiary care centre during November 2021 to October 2022. A total of 50 patients with diagnosed type II DM and diagnosed diabetic foot ulcers were included in the study. Patients with malignancy, CKD, pregnancy, traumatic ulcers, and vascular disorders were excluded. The study was conducted after obtaining clearance from the Ethical Committee of the institute. Data was collected at presentation using proper history, thorough examination of patient, limb and ulcer, HbA1c assessment as well as duplex arterial sonography of lower limb. Grading of ulcer was done by Wagner

Classification. [8] Data was summarized in percentages and proportions. The comparison between qualitative data was determined by

applying chi-square or Fischer exact test. P-value less than 0.05 were considered significant.

#### Results:

**Table 1: Demographic variables among patients:**

Variables		No. of Patients (n=50)	Percentage
Age group (years)	<40	02	01.00
	41-50	13	26.00
	51-60	23	46.00
	>60	12	24.00
Gender	Male	32	64.00
	Female	18	36.00
Duration of Diabetes Mellitus (Years)	<1	06	12.00
	1-5	12	24.00
	6-10	28	56.00
	>10	04	08.00

Most of the patients with diabetic ulcer were in age group 51-60 years (46%) with mean age of  $56.29 \pm 10.92$  years with male dominance. (64%) The majority of patients have duration of diabetes 6-10 years (56%) with mean of  $7.83 \pm 3.52$  years (Table 1)

**Table 2: Distribution of patients according to HbA1c:**

HbA1c (%)	Frequency (n=50)	Percentage
<6.5	00	00
6.5-7.5	03	06.00
7.6-8.5	31	62.00
8.6-9.5	12	24.00
>9.5	04	08.00

The majority of patients had HbA1c in 7.6-8.5 % range (62%) with mean of  $8.42 \pm 2.87\%$  (Table 2)

**Table 3: Distribution of patients according to grades of Wagner classification:**

Grades of Wagner classification	Frequency (n=50)	Percentage
Grade 1	06	12.00
Grade 2	11	22.00
Grade 3	21	42.00
Grade 4	09	18.00
Grade 5	03	06.00
Total	50	100

The maximum numbers of cases had Grade 3 diabetic ulcer (42%), followed by Grade 2 (22%) (Table 3)

**Table 4: Relation of grade of diabetic foot ulcer and HbA1c:**

Grades of foot ulcer by Wagner classification	HbA1c (%)			Total
	6.5-7.5	7.6-8.5	>8.5	
Grade 1	03	03	00	06
Grade 2	00	09	02	11
Grade 3	00	16	05	21
Grade 4	00	03	06	09
Grade 5	00	00	03	03
Total	03	31	16	50

( $P < 0.0001$  highly significant)

The relation of grade of diabetic foot ulcer and HbA1c shows as the levels of HbA1c increase the grade of ulcer increases with statistically significant difference. ( $P < 0.05$ )

#### Discussion

Diabetic foot syndrome is a complex and heterogeneous disorder which affects 1 out of 7 patients with diabetes at least once in their lifetime with relevant consequences both on lower limb and general morbidity. [9]

Presently there is no absolute way to prevent the development of this disastrous disease; however a good glycemic control has been proven to retard the progression of complications like neuropathy, angiopathy, foot infections etc.

The present cross-sectional study was conducted to study relationship between HbA1c levels and lower limb diabetic ulcer. In the present study most of the patients with diabetic ulcer were in age group 51-60 years (46%) with mean age of  $56.29 \pm 10.92$  years with male dominance. (64%) Similar findings were observed in study by Kumar B et al [10] on correlate the level of glycosylated haemoglobin with wound healing in diabetic foot patients with mean age of presentation was 53.4 years and 70% females.

Christman AL et al [11] in a study on haemoglobin A1C is a predictor of healing rate in diabetic wounds observed mean age of 55.3 years with 71.1% of males. This finding was similar to present study. Most patients have duration of diabetes 6-10 years (56%) with mean of  $7.83 \pm 3.52$  years. Kumar B et al [10] observed the average duration of diabetes mellitus was 4.5 years, which was of relatively shorter duration than present study. Shahi et al [12] in their study over prevalence of diabetic foot ulcer and associated risk factors in North India, found mean duration of diabetes to develop foot ulcers 11.5 years.

In the present study, the majority of patients had HbA1c in 7.6-8.5 % range (62%) with mean of  $8.42 \pm 2.87\%$  (Table 2) Kumar B et al [10] observed mean value of 6.6 of HbA1c among diabetic patients. HbA1c reflects glycemic control over past 2-3 months and its role in management of diabetes is well established. [13] In ADVANCE trial, a target 6.5 HbA1c value was found to drastically reduce the macro and microvascular complications. [14]

In the present study, the maximum numbers of cases had Grade 3 diabetic ulcer (42%), followed by Grade 2 (22%) The relation of grade of diabetic foot ulcer and HbA1c shows as the levels of HbA1c increase the grade of ulcer increases with statistically significant difference. ( $P < 0.05$ ) Similar findings were observed in study by Kumar B et al [10] on correlate the level of glycosylated haemoglobin with wound healing in diabetic foot patients with significant association with good healing of diabetic ulcer among low levels of HbA1c.

Christman AL et al [11] in a study on hemoglobin A1C is a predictor of healing rate in diabetic wounds found similar inverse association between grades of ulcer and rate of healing. Zubair M et al [15] in a study on glycosylated hemoglobin in diabetic foot and its correlation with clinical

variables in a North Indian tertiary care hospital observed significant association while s Ozenc et al. [16] found a statistically insignificant correlation.

### Conclusion

The study concludes that diabetic patients are prone for diabetic foot those with older age, male gender, longer duration of DM, raised HbA1c.

The HbA1c can be used as a screening tool in the high-risk diabetic patients for the diabetic foot to predict its occurrence, as HbA1c has a linear relationship with the grades of Wagner classification of diabetic foot. This can help decrease the incidence of the diabetic foot and its related complications.

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