ORIGINAL ARTICLE

Correlation of HBA1c and duration of diabetes mellitus with grades of diabetic foot.

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ABSTRACT… Objective: To find the correlation of HbA 1c and duration of diabetes mellitus with grades of diabetic foot according to Wagner classification. **Study Design:** Cross-sectional study. **Setting:** Bahawal Victoria Hospital Bahawalpur. **Period:** May 2020 to April 2021. **Material & Methods:** 100 patients of 25-65 years of age with diabetic foot who presented in OPD or emergency department were included in study. Wounds of the diabetic foot were graded according to Wagner classification. HbA1c (Glycosylated haemoglobin) level was measured and duration of diabetes mellitus was calculated. SPSS Version 20 was used to analyze the data. Correlation of HbA1c and duration of diabetes mellitus with grades of diabetic foot was calculated and the chi- square test was applied, and results were considered significant where p value was ≤ 0.05. **Results:** The mean age was 51.46 ± 10.51. There were 70 male patients and 30 female patients. Mean value of HbA1c was 8.31±2.02. Neuropathy (52%) was the most common among risk factors for diabetic foot. Correlation between level of HbA1c and grades of diabetic foot was not significant (p value of 0.346). There was significant correlation between duration of disease and Wagner grades (p value was 0.003). **Conclusion:** Severity of diabetic foot is not correlated with HbA1c level but it is significantly related with duration of DM. Peripheral neuropathy is the main risk factor for diabetic foot.

Key words: Diabetic Foot, Diabetes Mellitus (DM), Glycosylated Haemoglobin (Hba1c), Wagner Classification.

INTRODUCTION

Diabetes mellitus (DM) has high prevalence and high complications rate worldwide.[1] This disease is also very common in Pakistan where 10.91% patients are prediabetic and 16.98% have type 2 diabetes. The disease is more common in patients in their 6th decades.[2] Diabetic foot is a common and notorious complication of diabetes mellitus. The incidence of diabetic foot is 25% and prevalence of diabetic foot in patients of diabetes mellitus is 4-10%.[3] Most of the patients (about 85%) present as diabetic foot in surgical outdoor.[4] Incidence of diabetic foot ulcers in the forefoot, midfoot and hind foot is 59%, 25%, and 16% respectively.[5] Ischaemia secondary to macro vascular disease and micro vascular dysfunction, peripheral sensorimotor neuropathy (PSN) and immunosuppression due to excess of sugar are the causative factor in diabetic foot.[6] Infection can spread rapidly along the tissue planes and patients can present with cellulitis, abscess, ulcers, osteomyelitis and gangrene and later amputation may be required to save the life.[7] Wagner classified the diabetic foot on the basis of depth of ulcer and extent of gangrene.[8] Glycosylated haemoglobin (HbA1c) reflects blood glucose control in the previous two to three months. Poor glycaemic control is associated with serious complications. The risk of lower extremity ulcer and lower extremity amputation increases by 1.6 times and by 1.5 times respectively after each 2% increase in the level of HbA1c increases.[9]

Studies have been done on correlation of HbA1c and diabetic foot. But data relating to correlation of duration of diabetes mellitus and HbA1c with grades of diabetic foot is lacking in literature. Aim of our study is to determine the correlation of HbA1c and duration of diabetes mellitus with different grades of diabetic foot according to

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Wagner classification simultaneously.

The rationale of our study is that either elevated HbA1c or some other risk factor relating to duration of DM are associated with high grades of diabetic foot.

MATERIAL & METHODS

This cross-sectional study was done in Bahawal Victoria Hospital Bahawalpur from 1st May 2020 to 30th April 2021 after the approval from Institutional Ethical Review Board (approval letter NO.423). 100 patients of diabetic foot who presented in OPD or emergency department were included in study. Patients of ages between 25-65 years, either gender, of a diagnosed diabetic foot were included. Patients with ulcers after trauma, venous ulcer (varicose veins) Buerger's disease, and peripheral vascular disease were excluded from study. Data was entered on a proforma in which name age, sex, duration of diabetes mellitus, foot grades, findings on x-ray foot, HbA1c level and complications were entered. Grading of the diabetic foot was performed as shown in Table-I.

SPSS Version 20 was used to analyze the data. Mean and the standard deviation of age, male to female ratio, mean and standard deviation of HbA1c were calculated. Patients were grouped according to age ranges, HbA1c ranges, duration of diabetes mellitus in years and grades of diabetic foot. Frequency of other risk factors (foot abnormalities, neuropathy, nephropathy, hypertension and cardiovascular disease) of foot ulcers was also calculated. Correlation of HbA1c and duration of diabetes mellitus with Wagner classification was also calculated, the chi- square test was applied, and results were considered significant where p value was ≤ 0.05.

RESULTS

The mean age of the patients was 51.46 ± 10.51. Of the total 100 patients, 8 (8%) patients were in age 25-35 years, 20 (20%) patients in age 36-45 years, and 38 (38%) patients in age 46-55 years and 34(34%) patients in age 56-65 years. There were 70 male patients and 30 female patients with male to female ratio of 2.33:1. Minimum HbA1c level was 5.6 and maximum was 13.40 with mean value of 8.31±2.02. According to HbA1c level, there were 41(41%) patients who had HbA1c level between 6.5 -7.5%, 22(22%) patients between 7.6-8.5%, 10(10%) patients between 8.6-9.5% and 27 (27%) patients >9.5%. There were 60(60%) patients in which duration of diabetes mellitus was less than 7 years, 25(25%) patients 8-15 years and 15(15%) patients >16 years. According to Wagner Classification, there were 3(3%) patients who had grade 1 foot, 47(47%) patients grade 2 foot, 17(17%) patients grade 3 foot, 18(18%) patients grade 4 foot and 15(15%) patients grade 5 foot. In our study neuropathy was present in 52(52%) patients, nephropathy in 21(21%), foot abnormalities in 19(19%), cardiovascular disease in 5(5%) and hypertension in 3(3%) patients as risk factors. There was no significant correlation between level of HbA1c and grades of diabetic foot as shown in Table-II.

Out of 15 patients who had diabetes mellitus for > 16 years, 5 patients developed whole full foot gangrene whereas out of 60 patients who have diabetes mellitus less than 7 years, 4 patients developed whole foot gangrene. Longer the duration of diabetes mellitus, higher will be the grade of diabetic foot as shown in Table-III. There is significant correlation between duration of disease and Wagner grades.

Grades	Leision
0	No open lesions; may have deformity or cellulitis
1	Superficial diabetic ulcer (partial or full thickness)
2	Ulcer extension to the ligament, tendon, joint capsule, or deep fascia without abscess or osteomyelitis
3	Deep ulcer with abscess, osteomyelitis, or joint sepsis
4	Gangrene localized to the portion of the forefoot or heel
5	Extensive gangrenous involvement of the entire foot
Table-I. Wagner classification.	

Parameter	Wagner classification					Total
HbA 1c	Grade 1 Superficial ulcer	Grade 2 Deep ulcer	Grade 3 osteomylitis	Grade 4 Fore foot gangrene	Grade 5 Whole foot gangrene	
6.5-7.5%	0	21	6	10	4	41
7.6-8.5%	1	12	2	3	4	22
8.6-9.5%	0	3	1	2	4	10
>9.5%	2	11	8	3	3	27
Total	3	47	17	18	15	100

Table-II. Correlation of HBa1c with Wagner classification.

Duration of DM	WAGNER GRADE					Total	P-Value
	Grade 1	Grade 2	Grade3	Grade 4	Grade5		
	Superficial ulcer	Deep ulcer	Osteomylitis	Fore foot gangrene	Whole foot gangrene		
<7 years	1	36	11	8	4	60	0.003
8-15 years	0	7	6	6	6	25	
>16 years	2	4	0	4	5	15	
Total	3	47	17	18	15	100	

Table-III. Correlation of duration of diabetes mellitus and wagner classification.

DISCUSSION

Diabetes mellitus (DM) has high prevalence and high complications rate worldwide.[1] This disease is also very common in Pakistan where 10.91% patients are prediabetic and 16.98% have type 2 diabetes.[2] Diabetic foot is a serious complication. The incidence of diabetic foot is 25% in diabetic patients and prevalence of diabetic foot in patients of diabetes mellitus is 4-10%.[3] In our study the diabetic foot was most common in patients between 46-65 years (72%). Similar results were found in a study conducted by Ansar S et al, in which most of the patients were between 40-60 years.[10] In an another study by Jeyaraman et al., it is observed that age (with a median age of 64 years) is correlated with occurrence of DFUs due to increased risk for angiopathy.[11] In our study, male were more commonly affected than female (2.33:1). This is in accordance with a study conducted by Jan, Y.-K.; Liao, F et al.[12] In another study conducted by Farooque U et al,[13] males are more frequently affected by diabetic foot than females. Glycosylated Hemoglobin A1c (HbA1c) shows sugar control for the last two to three months.[14] In our study 41 patients whose HbA1c level was between 6.5-7.5%, 21(51.21%) patients out of them developed grade 2 ulcer

and 27 patients whose HbA1c level was more than 9.5%, 11(40.74%) patients developed grade 2 ulcer. There was no significant correlation between HbA1c level and grades of diabetic foot. Some studies showed a statistically significant correlation between HbA1c and Wagner grades of diabetic foot.[15] And some studies found a statistically insignificant correlation.[16] According to Sarinnapakorn et al.[17] there is no correlation among HbA1c level, fasting plasma glucose and diabetic foot. In our study it was found that there a was significant correlation between the duration of diabetes and Wagners grades of diabetic foot. 4(6.6%) patients out of 60 whose duration of diabetes was less than 7 years developed grade 5 diabetic foot whereas 5(33.33%) patients out of 15 whose duration of diabetes was more than 16 year developed grade 5 diabetic foot. According to Al-Rubean et al., diabetes duration was significantly associated with DFU (diabetic foot ulcer) where duration of diabetes mellitus in 88.99% of patients was more than 10 year.[18] Similar results were reported by Syauta D et al. that there is a significant correlations between diabetes duration and degree of diabetic foot ulcers according to Wagner's classification.[19] In our study it was found that peripheral neuropathy

was the most common risk factor which was 52%. According to a study by A. J. Boulton, L. Vileikyte, G approximately 50% of diabetics had DPN (diabetic peripheral neuropathy) at the time of presentation as diabetic foot, which is mostly of moderate severity.[20]

Our study had several limitations including small sample size and limited duration of time. However this will encourage others to conduct a larger study on correlation of HbA1c and duration of diabetes mellitus with grades of diabetic foot.

CONCLUSION
Severity of diabetic foot is not correlated with HbA1c level but it is significantly related with duration of DM. Peripheral neuropathy is the main risk factor for diabetic foot. By increasing awareness about peripheral neuropathy in public, incidence of diabetic foot can be reduced.
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