ORIGINAL ARTICLE

Orthostatic Hypotension and its Relationship with HbA1c Levels in Patients with Diabetes Mellitus

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ABSTRACT

Introduction: For the diagnosis of diabetes mellitus, various tests are available such as FBS (Fasting blood sugar), PPBS (Post Prandial Blood Sugar), Oral Glucose Tolerance Test, Random Plasma Glucose Test, HBA1c, etc, of which HBA1c is considered to be the most standard test.[1,2] As diabetes mellitus can be asymptomatic initially, it can lead to important complications such as neuropathy, nephropathy, retinopathy, cardiovascular diseases, etc if not detected early.[3] Postural blood pressure measurement which diagnoses orthostatic hypotension is a cheap, easy and useful tool to predict HBA1c level even in asymptomatic diabetic patients.

Methods: This is a randomized cross-sectional study of 100 diabetic patients attending Medicine OPD or admitted in our tertiary care hospital of South Gujarat. Pretested proforma was used to collect data after taking informed consent. Investigations including blood pressure measured with a standard Sphygmomanometer at the end of 3 min after standing and HBA1c as mentioned in the proforma was carried out. Final analysis has been done with Open EPI and SPSS software.

Results: 33% of patients of our study population were found with abnormal orthostatic hypotension. Our data shows orthostatic hypotension is directly associated with high HbA1c, longer duration of DM, and higher value of BMI. No correlation was found between age and gender.

Conclusion: Among diabetic patients, high HbA1c, prolong duration of DM and high BMI were associated with abnormal orthostatic hypotension, which can be alarming sign of complications of diabetes mellitus.

Keywords: Orthostatic Hypotension, HbA1C, Glycosylated hemoglobin, Body mass index, Diabetes Mellitus

INTRODUCTION

Diabetes mellitus, one of the most important and common co-morbidity, is associated with phenotype of hyperglycemia. As a multi organ metabolic disorder different vascular and nonvascular complications leads to approximately 10 years shorter life expectancy.[4] Among all complications, diabetic neuropathy is devastating vascular complications. Orthostatic hypotension is one of the signs of cardiac autonomic neuropathy.[5] Systolic BP decreased to at least 20 mmHg or diastolic BP decreased to at least ten mmHg within three minutes of standing is labelled as orthostatic hypotension.

Orthostatic hypotension in patients with diabetes mellitus is associated with increased risk of fall, syncope, cardiovascular events, and sudden cardiac death.[6,7]

There are many factors that affect the development of orthostatic hypotension in patients with diabetes mellitus such as age, duration of diabetes mellitus, glycemic control, BMI etc., out of which glycemic control measured by HbA1c and other variables of diabetes appears to be the most relevent.[1,2]

AIMS AND OBJECTIVES

The study was conducted to determine proportion of OH in diabetic patients and to correlate presence of OH with HbA1c and other variables in diabetic patients.

METHODS

The study was done at Surat Municipal Institute of Medical Education and Research (SMIMER) Hospital, Surat, Gujarat, from year June 2020 to Nov 2021. It was randomized cross sectional study enrolling total 100 OPD and indoor diabetic patients.

Patients with newly detected type 2 diabetes mellitus (having FBG ≥126 mg/dl and/or 2h glucose level after oral glucose tolerance test ≥200 mg/dl and/or HbA1c ≥6.5% and/or random blood sugar ≥200 with sign and symptoms of diabetes); known case of type 2 diabetes mellitus ; age >= 18yrs; patient willing for admission and willing to participate in study and all patient giving informed written consent for study were included in the study. Patients having dehydration; hypovolemia; sepsis; anemia; arrhythmia; patients taking antiarrhythmic drugs and drugs causing arrhythmia or QTc prolongation; CKD pt. on HD; patients intoxicated with alcohol, opioid etc.; cirrhosis; any other pathology other than diabetes causing orthostatic hypotension and pt not willing for hospital admission and not willing to participate in study were excluded.

Approval for this study was taken in institutional ethical committee. Informed written consent of all the participants were taken. All necessary confidentiality of participants were maintained.

Detail history, examination, and investigations as per proforma were done for each participant. Variables like age,

gender, BMI, orthostatic hypotension, and duration of diabetes were also collected. Among glycemic control, HbA1C >8.2 was considered as significant hyperglycemia.

Orthostatic hypotension was taken as inference after measuring blood pressure initially with a standard Sphygmomanometer and was measured again at the end of three minutes after standing. Orthostatic hypotension is defined as a systolic blood pressure decrease of a minimum of 20 mm Hg or a diastolic blood pressure decrease of a minimum of 10 mmHg within three minutes of standing.

Data was entered in MS EXCEL spread sheet and was analyzed with the help of Open EPI and SPSS software. Statistical analysis was done by appropriate statistical method.

RESULT

This study, conducted in a tertiary care hospital in South Gujarat, enrolled 100 diabetic subjects. Proportions of orthostatic hypotension were correlated with diabetes related factors.

Maximum number of patients, that is 59% in study group were in age group of 40-59 years, 4% population were in age group of 20-39 years, 25% population were in age group of 60-70 years and 12% population were in age group of >70 years. The mean age of the patients was 55.3 years with standard deviation of 5.1 year. The table shows that 46% patients were male, 54% patients were female.

Maximum number of patients, that is 39% patients were in group of duration of diabetes <5 years, 36% patients were in group of duration of diabetes 5-10 years and 25% patients were in group of duration of diabetes 11-15 years.

Table 1. Age, Sex Distribution and Duration of Diabetic patients (n=100)

Variables	Case %
Age group	
20-39 yrs.	4
40-59 yrs.	59
60-70 yrs.	25
>70 yrs.	12
Sex	
Male	46
Female	54
Duration of DM	
<5 yrs.	39
5-10 yrs.	36
11-15 yrs.	25
Level of HbA1c	
<8.2 %	34
>8.2 %	66
Body Mass Index (BMI)	
<20 kg/m²	10
20-25 kg/m²	44
>25 kg/m²	46

Table 2. Distribution of diabetic patients according to Significant Orthostatic Hypotension (OH) (n = 100)

Significant Orthostatic Hypotension	Case %
Yes	33
No	67

Maximum number of patients, that is 66% of patients had HbA1c of ≥8.2% and 34% of patients had HbA1c of <8.2%. Above table suggests that 10% of patients had body mass index (BMI) of <20, 44% of patients had body mass index (BMI) of 20 to 25 and 46 % of patients had body mass index (BMI) of >25.

Table suggests that 33% patients out of 100 have significant orthostatic hypotension while orthostatic hypotension in 67% patients out of 100 was found with insignificant hypotension.

Table suggests that 3 patients with less than 8.2 HbA1c were found with significant orthostatic hypotension, while 33 patients with same HbA1c were found with insignificant orthostatic hypotension. 30 patients with more than 8.2 HbA1c were found with significant orthostatic hypotension, while 34 patients with same HbA1c were found with insignificant orthostatic hypotension.

Above table suggests that 9 patients with duration of DM less than 5 years were found with significant orthostatic hypotension, while 30 patients with same duration of DM were found with insignificant orthostatic hypotension. 7 patients with duration of DM 5-10 years were found with significant orthostatic hypotension, while 29 patients with same duration of DM were found with insignificant orthostatic hypotension. 17 patients with duration of DM 10-15 years were found with significant orthostatic hypotension, while 8 patients with same duration of DM were found with insignificant orthostatic hypotension.

Table suggests that 8 patients from age group 30-50 were found with significant orthostatic hypotension, while 20 patients from same age group were found with insignificant orthostatic hypotension. 22 patients from age group 51-70 were found with significant orthostatic hypotension, while 38 patients from same age group were found with insignificant orthostatic hypotension. 3 patients from age group >70 years was found with significant orthostatic hypotension, while 9 patients from same age group were found with insignificant orthostatic hypotension. Application of test of significance (chisquare test) indicates that the p value was >0.05. Thus, orthostatic hypotension was not associated with age group of the patients.

Table suggests that 2 patients with less than 20 BMI (kg/m²) were found with significant orthostatic hypotension, while 8 patients with same BMI (kg/m²) were found with insignificant orthostatic hypotension. 10 patients with 20-25 BMI (kg/m²) were found with significant orthostatic hypotension, while 34 patients with same BMI (kg/m²) were found with insignificant orthostatic hypotension. 21 patients with more than 25 BMI (kg/m²) were found with significant orthostatic hypotension, while 25 patients with same BMI (kg/m²) were found with insignificant orthostatic hypotension.

Table suggests that out of 54 females, 20 were found with significant orthostatic hypotension while 34 were found with insignificant orthostatic hypotension. Out of 46 males, 13 were found with significant orthostatic hypotension while 33 were found with insignificant orthostatic hypotension. Application of chisquare test revealed that the p value was >0.05 indicating that the the orthostatic hypotension was not associated with gender was found insignificant.

Table 3: Association of Clinico-social variables with Orthostatic Hypotension (OH) (n=100)

Variables	Significant OH (%)	Insignificant OH (%)	P value
Age			
30-50	8 (24.24)	20 (29.85)	0.618
51-70	22 (66.67)	38 (56.72)	
>70	3 (9.09)	9 (13.43)	
Gender			
Female	20 (60.6%)	34 (50.74%)	0.352
Male	13 (39.4%)	33 (49.26)	
BMI			
<20	2 (6.06)	8 (11.94)	0.045
20-25	10 (30.30)	34 (50.74)	
>25	21 (63.64)	25 (37.31)	
HBA1c			
≤8.2	3 (9.09)	33 (49.25)	<0.01
>8.2	30 (90.91)	34 (50.75)	
Duration of DM			
<5 years	9 (42.42)	30 (28.36)	<0.001
5-10 years	7 (39.39)	29 (49.25)	
11-15 years	17 (18.18)	8 (22.39)	

DISCUSSION

Diabetes mellitus, one of the most important and commonest comorbidity is associated with phenotype of hyperglycemia. Complex interaction of genetic and environmental factors leads to insulin resistance, increase glucose production and relative insulin deficiency. Ultimately causing hyperglycemia. Poor glycemic control may modulate many biochemical pathway activities such as oxidative stress, aldose-reductase activity, polyol activity and reduced myoinositol content that may cause decreased vasodilatation leading to diminishing blood flow in nerve fibers. There is also autonomic denervation that happens simultaneously with endothelial dysfunction, reduced neuropeptide responses, volume depletion caused by nephropathy and osmotic dieresis, which may induce the development of orthostatic hypotension.

In present study, we screened diabetic patient for presence of significantly abnormal orthostatic hypotension. We correlated significant orthostatic hypotension (OH) with age, gender, HbA1C, duration of diabetes and BMI.

In our study, 33 patients out of 100 were found with significant OH along with mean HbA1c of 9.2 and Std deviation 0.94. 67 patients were found of insignificant OH with mean HbA1c of 8.2 and Std Deviation of 0.84. According to Catarina Budyono study 27.4 % of patients having HbA1c more than 7 were found with significant OH while 72.6 % patients having HbA1c less than 7 were found insignificant OH with P value less than 0.05.[8]

In our Study, 33 patients out of 100 were found with significant OH along with mean duration of DM 8.94 years and Std deviation 4.74. 67 patients were found with insignificant OH with mean duration of DM 6.31 and Std Deviation 3.71. According to Ashok K. Bhuyan study 11 patients out of 100 were found with significant OH along with the Mean duration of diabetes of the patients was 13.14 and Std deviation 6.49.[9]

In our study, 33 patients out of 100 were found with significant OH along with mean age 55.82 years and Std deviation 9.21. 67 patients were found with insignificant OH with mean age 57.90 years and Std Deviation 11.25. According

to Ashok K. Bhuyan study 11 patients out of 100 were found with significant OH along with the Mean age of the patients was 53.3 ± 10.37 years (range: 36–72 year).[9]

In our study, 33 patients out of 100 were found with significant OH along with mean BMI 27.67 and SD 5.12. 67 patients were found with insignificant OH with mean BMI 23.86 and Std deviation 4.09. According to Meghanad Meher and Jayanta Kumar Panda study 73 patients out of 176 were found with significant OH along with Mean BMI 29.79 and Std deviation 2.85.[10]

In our study, out of 33 significant OH 13 are male and 20 are female. Out of total population 46 were male and 54 were female. According to Andrea S. Méndez et al Overall prevalence of in the sample population was 19.3% (170 of 882 participants), with no difference between gender. However, when divided by age and sex groups, the proportion of participants OH+ was similar for women and men <75 years of age but was significantly higher in men than in women ≥75 years.

CONCLUSION

Thirty three percent of patients of our study population were found with abnormal OH. OH is directly associated with high HbA1c, longer duration of DM and higher value of BMI. Gender had no such correlation with OH. Measurement of postural BP should be routine test in diabetic patients as it can detect orthostatic hypotension. OH is a cheap method which can detect early complications of diabetes mellitus.

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