CORRELATES OF POOR GLYCAEMIC CONTROL AMONG DIABETIC PATIENTS WHO ATTENDED TWO DIABETIC CLINICS IN DELHI

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ABSTRACT

The study was carried out to know about the proportion of diabetic patients who have poor glycemic control (HbA1c >7 gm%) and to know the associated factors / correlates of poor glycemic control among diabetic patients. It is a cross-sectional study done by extracting Electronic Medical Records of 300 diabetic patients attending two diabetes clinics in Delhi between June to December 2015. Logistic regression analysis was carried out to predict factors associated with poor glycemic control.Of the total 300 individuals studied, Good Glycaemic control was seen in 80 (26.7%) of the patients. The proportion of individuals with good glycaemic control did not differ significantly by age (p value: 0.334) or gender (p value: 0.166). In univariate analysis, longer duration of disease, fasting and random glucose level in the diabteic range and cardio-metabolic risk (as assessed by TM Sudo-oxipath device) came out to be significantly associated with poor glycemic control. However, on multi-variate analysis, only the blood glucose levels were shown to be significantly associated with glycemic control.The proportion of people suffering from diabetes having poor glycemic control is quite high. There is a need to have stricter glycemic control from both the ends of patients and healthcare providers.

***Keywords*:** Type-2 diabetes, glycemic control, HbA1c.

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INTRODUCTION

Diabetes is a big public health problem that is slowly crippling the health of both developed and developing economies. The worldwide prevalence is 387 million (8.3%), which is predicted to be 592 million by 2035. [1] India has the highest number of diabetics in the world (62 million) and it is predicted that by 2030 the disease might afflict as high as 79.4 million individuals. [2] In 2015, there were over 1 million deaths in India that were attributed to diabetes.[3] These deaths are mainly through the increased risk of cardio-vascular disease (CVD), which is responsible for up to 80 per cent of them. [4] The World Health Organization predicted a 50% increase in deaths from diabetes over next 10 years, and by 2030, diabetes is projected to be the seventh leading cause of death. [5]

Good glycemic control is imperative to keep diabetic complications at bay.Large scale availability and affordability of glucose self monitoring devices has led to widespreaduse of self-monitoring, however despite of this, patients generally do not know their diabetes status and goals. [6,7]In patients with type 2 diabetes previous prospective studies have shown an association between the degree of hyperglycaemia and increased risk of microvascular complications, [8,9] sensory neuropathy, [9,10]myocardial infarction, [8,11,12]stroke, [13] macrovascular mortality, [14-16] and all cause mortality. [15,17-20] United Kingdom Prospective Diabetes Study (UKPDS) study found that each 1% reduction in updated mean HbA_{1c} was associated with reductions in risk of 21% for any end point related to diabetes, 21% for deaths related to diabetes, 14% for myocardial infarction, and 37% for micro vascular complications. [21]

Control of plasma glucose in patients with diabetes can be assessed by measurement of glycated hemoglobin (HbA1c), fasting plasma glucose (FPG), and postprandial plasma glucose (PPG). However, still measurement of HbA1c level remains the gold standard for assessment of glycemic control at follow up. [22]Large randomized clinical trial studies such as Diabetes Control and Complication Trial (DCCT) and the UKPDS indicated that HbA1c >7.0 % is associated with a significantly increased risk of both micro-vascular and macro-vascular complications, regardless of underlying treatment. [23-25]Thus, diabetic patients are expected to keep their HbA1c levels as close to normal levels as possible. Although the benefits of stringent glycemic control are evident, it has been reported that more than 60% of diabetic patients do not reach the recommended glycemic control target. [26]

A large population based study done by Indian Council of Medical Research (ICMR) involving 480 diabetic subjects revealed that good glycemic control was present only in 30-31% of diabetic patients, both in rural and urban areas.[27] A hospital based study done by Kahlon et al in northern part of India, revealed even lesser number of diabetic patients with good glycemic control (13%). [28]A study done in western India gives even a bleaker picture with just 7% of diabetic patients having good glycemic control. [29] A study by Chacko et al from south

India gave a slightly better picture with the proportion of diabetic patients having good glycemic control to be 19.5%. [30]However, studies carried out in developed countries have shown that around 40-60% of diabetic patients under primary care are able to achieve good glycemic control. [31,32] Thus, it becomes more important to know the correlates of good glycemic control in developing countries like India.

Though it is largely known that the glycemic control in diabetic patients is rather poor, there are only few studies from north India that explain the various correlates for poor glycemic control.

MATERIALS & METHODS

It is a cross sectional study involving the Electronic Medical Records (EMRs) of 300 patients with diabetes attending 2 diabetes clinics in Delhi between June-Dec 2015. A convenience sample of 300 was taken as all the patients with complete EMRs were included in the study.

A brief medical history was obtained having information like age, sex, duration of diabetes, family history, physical activity, diet and any other chronic disease. Blood pressure was measured using a standard electronic BP monitor in sitting position. HTN was confirmed by taking 2 readings 15 minutes apart. Height was measured to the nearest millimeter with a wall-mounted Harpenden stadiometer and weight was measured with electronic scales to the nearest 0.1 kg[33]. Body mass index (BMI) was calculated in kg/m^2. The abdominal (waist) circumference was measured at the end of expiration, by wrapping an inelastic tape at the level of the umbilicus [34]. Blood sample was collected the next day after 8 hours of fasting and tested for HbA1c, fasting glucose, triglycerides, HDL-C and low-density lipo-protein cholesterol (LDL-C). Post-prandial blood glucose sample was also collected after 2 hours of breakfast. Blood glucose was measured by Trinder's method and HbA1c was measured by ion exchange chromatography. HbA1c is a measure of the degree to which hemoglobin is glycosylated in erythrocytes, and is expressed as a percentage of total hemoglobin concentration.[35]Poor glycemic control is defined as HbA1c >7%.[36]

The TM-OxiSudoPath test was carried out after 3 hours of fasting. It non-invasively measures more than 30 parameters and out of them, cardio-metabolic risk score was considered to be included as a parameter in the study. The machine uses a pulse oximeter, an automatic oscillometric blood pressure device and galvanic skin response to measure the various body functions.

Clinical and bio-chemical characteristics are expressed as mean and standard deviation. Continuous variables were compared using Student's t-test, and categorical variables were compared using the $\chi 2$ test. SPSS version 18 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. All statistical tests were 2-tailed, and $p<0.05$ was considered significant.

Table 1: Characteristics of the study population (N=300)

Characteristics	N (%)
Age	
<=40 years	52 (17.3)
41-50 years	94 (31.3)
51-60years	77 (25.7)
>60 years	77 (25.7)
Gender	
Male	234 (78)
Female	66 (22)
BMI categories	
Underweight	5 (1.7)
Normal	30 (10)
Overweight	36 (12)
Obese	146 (48.7)
Morbid obesity	83 (27.7)
Hypertension	
No	75 (25)
Yes	225 (75)
Dyslipidaemia	
No	127 (42.3)
Yes	173 (57.7)
Other co-morbidities	
Yes	107 (35.7)
No	193 (64.3)
Oral hypoglycaemic agents intake	
No	12 (4)
Yes	288 (96)
Insulin	
No	242 (80.7)
Yes	58 (19.3)

Figure 1: Age-wise depiction of glycemic control among subjects

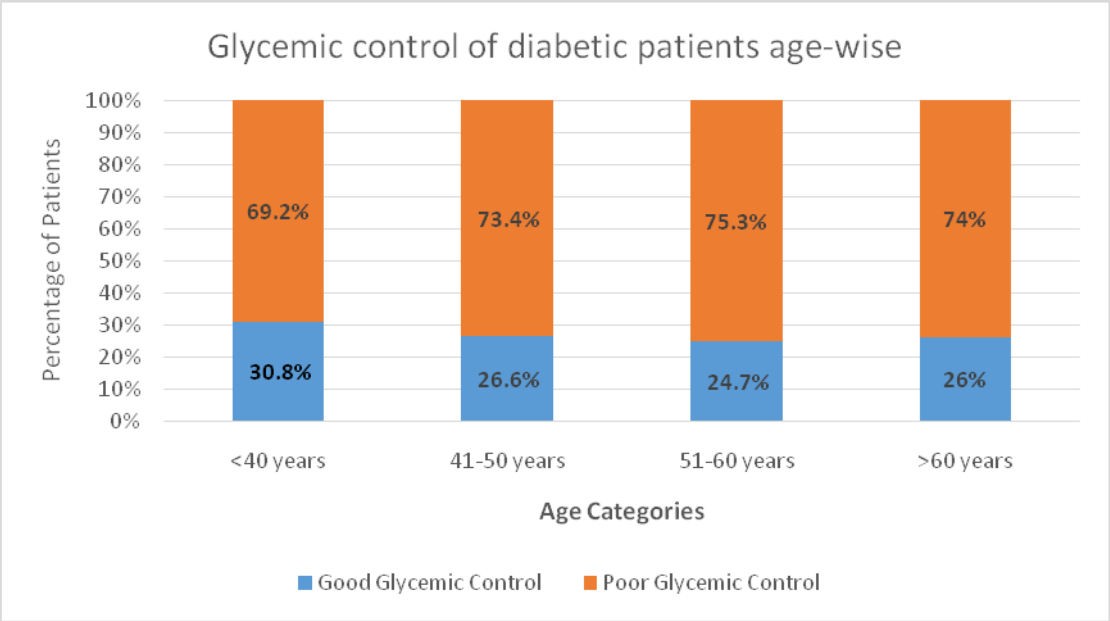

Figure 2: Sex-wise depiction of glycemic control of subjects

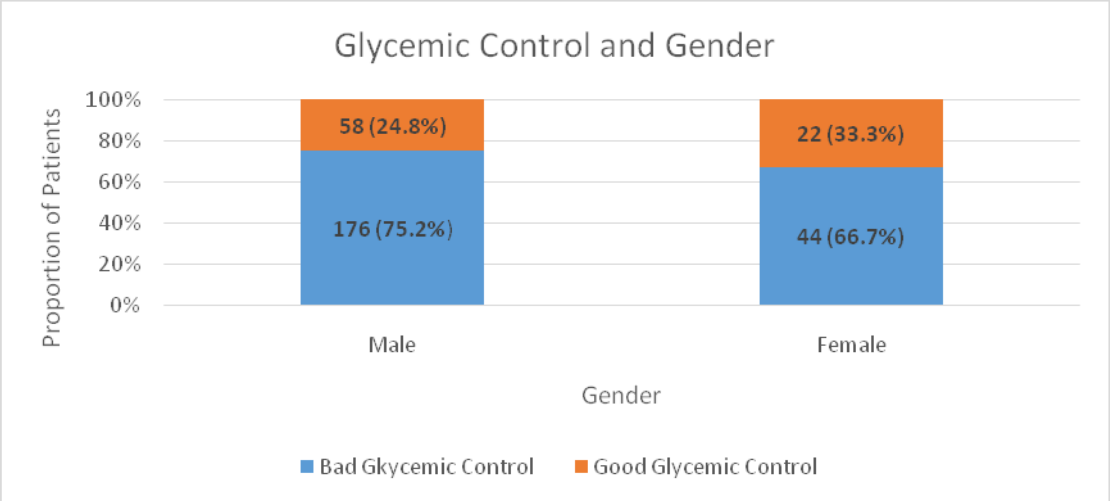

Table no. 2: Univariable analysis for Correlates of Bad Glycaemic Control among subjects

	Bad Glycaemic Control N (%)	Good Glycaemic Control N (%)	Test Statistic	p value
Age				
<=40 years	36 (69.2)	16 (30.8)	5.728	0.334
41-50 years	69 (73.4)	25 (26.6)		
51-60years	58 (75.3)	19 (24.7)		
>60 years	57 (74)	20 (26)		
Gender				
Male	176 (75.2)	58 (24.8)	1.923	0.166
Female	44 (66.7)	22 (33.3)		
Duration of disease*	8.2±7	5.8±6.5	2.748	0.006
BMI*	27.3±4.6	27.3±4.7	-.051	0.959
Fasting Blood Glucose				
Normal	60 (46.9)	68 (53.1)	79.920	<0.001
Diabetic Range	160 (93)	12 (7)		
Random Blood Glucose				
Normal	89 (55.3)	72 (44.7)	57.916	<0.001
Diabetic Range	131 (94.2)	8 (5.8)		
Hypertension				
No	164 (72.9)	61 (27.1)	.091	0.763
Yes	56 (74.7)	19 (25.3)		
Dyslipidaemia				
No	89 (70.1)	38 (29.9)	1.193	0.275
Yes	131 (75.7)	42 (24.3)		
Cardio metabolic Risk				
Present	194 (75.8)	62 (24.2)	5.348	0.021
Absent	26 (59.1)	18 (40.9)		

***Since Duration of disease and BMI were continuous variables, Independent samples t test was used. For all other variables Chi square test was used.**

Table 3: Multivariable analysis (Logistic Regression) for predictors of Bad Glycaemic Control among subjects

Predictor	Reference Category	Odds Ratio	Upper Limit of 95% CI	Lower Limit of 95% CI	p value
Duration of disease	**Not Applicable**	1.044	.996	1.096	.075
Cardio-metabolic Risk					
Absent	**Reference**	-	-	-	-
Present		1.814	.778	4.230	.168
Fasting Blood Glucose					
Normal	**Reference**	-	-	-	-
Diabetic Range		7.741	3.678	16.292	<0.001
Random Blood Glucose					
Normal	**Reference**	-	-	-	-
Diabetic Range		5.228	2.198	12.433	<0.001

RESULTS

The number of subjects included in the study was 300, out of which 234 were males and 66 were females. Only 52 subjects were less than 40 years of age and rest were older. The rest of the characteristics of the study population have been depicted in Table 1. Of the total 300 individuals studied, Good Glycaemic control was seen only in 80 (26.7%) patients. The proportion of individuals with good glycaemic control did not differ significantly by age (p=0.334) or gender (p=0.166) as shown in Figures 1 and 2.

In univariate analysis longer duration of disease, fasting blood glucose in diabetic range (>125 mg%), random blood glucose in the diabetic range (>200 mg%) and positive cardio-metabolic risk were significantly associated (p<0.05) with poor glycemic control(Table 2). All factors that were significant in univariable analysis were included in the multivariable logistic regression model. The R^2 value of the model was 0.440 (i.e. 44% of the variation in the outcome variable is explained by this model). However, on multivariable analysis only fasting blood glucose and random blood glucose came out to be significantly associated with poor glycemic control (Table 3).

DISCUSSION

This study falls in line with the existing research that suggests that poor glycemic control among diabetic patients is largely prevalent in Indian scenerio. The proportion of diabetic patients in the current having good glycemic control (26.7%) is similar to another study in which good control was seen in 30% of patients.[27] However, it is much higher than seen in many studies from different parts of India (7-20%).[28-30] The possible explanation is that in the current study diabetic patients are closely followed up in the specialised diabetic clinic unlike other studies that were largely hospital based. Diabetes is said to be a high-inertia and low urgency disease and that is the reason that motivation is required to make patients follow up on time.

The proportion of individuals with good glycaemic control did not differ significantly by age or gender, the findings are similar to another study.[37] Other factors like duration of disease and BMI were also seen not to be significantly associated with glycemic control. These findings are contradictory to those found in other studies.[30,36,37] The reason is that onset of diabetes is believed to be 4-7 years before clinical diagnosis and complications start developing long before diagnosis.[38] Thus, the disease becomes uncontrolled as soon as the diagnosis is made as undiagnosed diabetes is no benign condition.

The blood glucose levels (both fasting and random) are seen to be significantly associated with glycemic control and predictably so. It has been seen that fasting blood glucose is often as good a predictor of glycemic control as is HbA1c, however same can not be said about random blood glucose.

Knowledge about the disease often leads to improved glycemic control as is evident with many studies.[30,39] A major reason for poor diabetes management that is seen in various parts of the country

is lack of knowledge about diabetes among general public. A study in north India revealed that 70% of diabetics did not know about it's risk factors and 20-40% did not know about their target blood glucose levels.[40] Another study done in western India showed that only 23.8% diabetic patients had good knowledge about diabetes.[41]In another study, only 11.5% of diabetic patients knew about HbA1c.[42]In a study done in east India, 17.5% to 29.3% of the participants were aware of the normal blood sugar level. [43]Another reason for poor glycemic control is lack of systematic primary care provided to diabetic patients. Persons suffering from diabetes require regular follow-up, dietary counseling, timely screening for complications, knowledge about self-managementand motivational support to ensure compliance. Thus a highly motivated primary care physician or specialist is needed to keep diabetes of an individual under control. In Indian healthcare setting a large number of patients visit government hospitals or dispensaries where doctors are overworked and thus they are not able to give sufficient time to the patient. Even a large number of private practitioners too ignore the importance of imparting sufficient knowledge to the patients.

Conclusions & Suggestions:

The proportion of people suffering from diabetes having poor glycemic control is quite high. Irrespective of gender, age, duration of diabetes or insulin therapy-people are equally susceptible of having uncontrolled diabetes. There is a need to improve the knowledge about diabetes and its management among general public and the government and healthcare practitioners need to join hands in imparting the same. More focus should be there to intensively keep the blood sugar levels under control and an integrative approach should be adopted at primary or secondary healthcare level where dieticians, naturopaths and psychologists should be involved to holistically treat a diabetic patient. It is also important that healthcare professionals pay special attention to specific groups, like young diabetic patients or patients with longer duration of diabetes or complications to improve their quality of life.

Limitations of the study:

Since it was a study done on EMRs of patients, so many confounding factors could not be considered like diet, physical exercise and compliance. It was important to know the knowledge level of patients but that too could not be assessed. The sample size could have been larger.

Conflict of interest: None

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