Original Article

Glycemic Control in Type 2 Diabetes Mellitus and its Association with Duration of Diabetes & Glycosylated Hemoglobin A1

Medicine

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ABSTRACT

Objective: The aim of present study was to evaluate glycemic control in type 2 diabetes mellitus (DM) subjects and its association with the duration of diabetes & glycosylated Hemoglobin A1 (HbA1c).

Subjects and Methods: A descriptive study, comprising of 571 diagnosed cases of type 2 DM were studied at the Diabetic clinic of Isra University/ consultant private clinics over a year period. Diabetic subjects were divided as; controlled diabetics (Group I. HbA1c ≤7%) and uncontrolled diabetics (Group II. HbA1c >7%). The data was recorded on a proforma. Blood glucose was measured by glucose oxidase method & HbA1c on automated clinical chemistry analyzer. The student`s t-test and chi-square were used for the quantitative and qualitative data respectively. Spearman`s correlations was used for a linear correlation of HbA1c with the duration of DM and random blood sugar (RBS). The data was analyzed on SPSS version 16.0 for windows. P-value at ≤ 0.05 was taken statistically significant.

Results: The mean age was noted as 45.8±7.4 & 43.2±9.0 years (p=0.001) & male to female ratio of 2:1 & 0.9:1 in both groups respectively. RBS was elevated in 169 (66%) and 211 (66.9%) in both groups respectively (p=0.74). Poor glycemic control was observed in 315 (55.1%) of subjects. Of 571 T2DM, 256 (44.8%) were having HbA1c <7% (Group I.) and 315 (55.2%) HbA1c ≥7% (Group II). The HbA1c values as high as ≥13.1% was noted in 73 (12.7%). A highly significant difference was observed in HbA1c (p=0.0001) between groups. Significant correlation of HbA1c was found with duration of DM (r=0.65, p=0.0001) but not with the RBS (r=0.038, p=0.36)

Conclusion: We report poor glycemic control as indicated by glycosylated Hb A in type 2 diabetics. Public campaigns be attempted on regular basis to make diabetics aware of glycemic control.

Key Words: Glycemic control, Diabetes mellitus, Glycosylated Hb A1

INTRODUCTION

The number of people with type 2 Diabetes mellitus (T2DM) is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity.[1] This epidemic of DM is particularly relevant to Pakistan.[2] The WHO has estimated that in 2030, half of 333 million people living with DM will be from Asia. According to International Diabetes Federation (IDF), the number of diabetics older than twenty is going to rise from 285 million in 2010 to 439 million in 2030.[3] The Pakistan occupies sixth position regarding diabetes burden in whole world.[1] According to an estimate of Shera, et al[4]. there are 15% Pakistani's with diagnosed DM and millions more which remain undiagnosed/unaware of having DM.[4, 5] Self care is critical to outcomes of T2DM. Monitoring of blood glucose levels in T2DM is critical in preventing the long term complications. Blood glucose in T2DM subjects should be monitored by the patient himself and this has been termed as self monitoring of blood glucose level (SMBG). Glycemic control in T2DM subjects is related to dietary modifications, regular exercise and regular drug intake.[2]

The glycosylated hemoglobin A (HbA1c) is a validated criterion of glycemic control in T2DM subjects. The HbA1c is primarily a treatment tracking test reflecting average blood glucose levels over the preceding 90 days approximately.[6] Every percent point drop in HbA1c from 8 to 7% reduces the risk of microvascular complications of eyes, kidney and nerve diseases by 40%, therefore the American Diabetes Association has set the goal for HbA1c below 7%.[7] The Isra university hospital is more than 600 bedded tertiary care hospital, where hundreds of patients visit Diabetic OPD per week. The self monitoring of blood glucose level is widely recommended as a component of diabetes management, but there is substantial controversy about this costly practice, especially for patients with T2DM.[2] As most of our patients belong to the surrounding villages who are less privileged, with scarce health facilities, education and financial support, hence we planned to conduct a study about glycemic control in our tertiary care hospital.

SUBJECTS AND METHODS

A descriptive case study was conducted on diagnosed cases of T2DM attending the Diabetic OPD of Isra

University hospital, and consultant private clinics, Hyderabad. A total 571 patients were enrolled over one year period from June to August 2011 to July 2012. T2DM were divided into two groups; Group I. controlled diabetics (HbA1c ≤7%) and Group II. Uncontrolled diabetics (HbA1c >7%). The patients were selected through non-probability purposive sampling according to inclusion and exclusion criteria. The diagnosed cases of T2DM, of ages 30-60 years were included in the study. The T2DM subjects having associated systemic diseases like chronic liver disease, chronic kidney disease, chronic lung disease, and secondary diabetes mellitus were excluded from the study. Verbal consent was taken from the subjects. A complete biodata was taken from the willing participants. This was followed by enquiry about medical history related to T2DM, duration, antidiabetic drugs, habit of drug intake, frequency of blood glucose checking and education level were recorded on a structured proforma. The body mass index (BMI) was calculated from the weight and height by the following formula; BMI= Weight (kg)/Height (m^2). Diabetes mellitus was defined as Random blood sugar (RBS) level of ≥200 mg/dl or fasting blood glucose level of ≥ 126mg/dl[7]. Hb A1C was used as an indicator of glycemic control. The HbA1c was performed in laboratory certified and standardized to the DCCT assay. The HbA1c was measured by TTAB (tetradecyltrimethylammonium bromide) on automated clinical chemistry analyzer (Hitachi 902, Roche diagnostics, USA). The glycemic status was defined as controlled diabetics with HbA1c ≤7% and uncontrolled diabetics with HbA1c >7%.[8] Hypertension was defined as systolic blood pressure≥140 mmHg or diastolic blood pressure ≥90 mmHg.[9] The blood samples were drawn through a venepuncture under aseptic condition using standard methods of blood sampling by trained paramedic person. The data was recorded on a pre-structured proforma. The student`s t-test (independent samples t-test) and chi-square were used for the quantitative and qualitative data respectively. Continous variables were presented as mean±SD and categorical data as frequencies and percentages. A linear correlation of HbA1c with the duration of DM and RBS using Spearman`s correlations was analyzed using bivariate analysis. The data was analyzed on SPSS version 16.0 for windows. P-value at ≤ 0.05 was taken statistically significant.

RESULTS

Of 571 T2DM, 256 (44.8%) were having HbA1c <7% (Group I.) and 315 (55.1%) were having HbA1c ≥7% (Group II). The demographic characteristics are shown in table. I. The mean age in Groups I & II subjects was noted as 45.8±7.4 & 43.2±9.0 years respectively (p=0.001). The male to female ratio in Groups I & II was found as 2:1 & 0.9:1 respectively.

Table No.1: Demographic data of study population (n=571)

	Group I (HbA1c ≤7%) (n=256)	Group II (HbA1c >7%) (n=315)
Age		
· 30-39.9 years	69	54
· 40-49.9 years	168	99
· 50-59.9 years	79	150
· ≥ 60 years	18	12
Male	173	153
Female	83	162
Marital status		
· Married	173	253
· Single	70	50
· Widows/others	13	12
Education		
· Uneducated	87	93
· Primary	23	21
· Middle	60	53
· Matric	52	78
· Intermediate	29	27
· Graduate	05	43

Table No.2: Characteristics of study population (n=571)

|	Group I (Hb A1c ≤7%) (n=256)	Group II (Hb A1c >7%) (n=315)	p-value *
Age (years)	45.8±7.4	43.2±9.0	0.001
BMI (kg/m^2)	26.1±3.4	25.9±2.2	0.26
Duration of DM (years)	6.61±4.46	18.5±8.0	0.001
Systolic BP (mmHg)	131.7±18.1	130±19.1	0.27
Diastolic BP (mmHg)	74.9±11.2	73.6±11.7	0.17
RBS (mg/dl)	245±118	248±119.6	0.74
HbA1c (%)	6.5±0.43	9.9±1.7	0.0001

*p-vale at the 0.01 level (2-tailed).

Majority of subjects were married; 426 (74.6%). Education level of study population is shown in table. I. Obesity (BMI ≥24.9 kg/m^2) and hypertension was found in 123 (21.5%) & 234 (40.9%) diabetics respectively in both groups. Random blood sugar (RBS) was elevated in 169 (66%) and 211 (66.9%) in both groups respectively, without any significant difference. (p=0.74) (Table. II). The HbA1c values as high as ≥13.1% was noted in 73 (12.7%). A highly significant difference was observed in Groups I and II regarding HbA1c (p=0.0001). Poor glycemic control was observed in 315 (55.1%) of subjects. Most of subjects were taking sulfonylureas, metformin and both in 371(64.9%), 126 (22%) and 71(12.4%) respectively. Only three cases (0.5%) of Insulin therapy were noted in Group II subjects. Drug non-compliance was noted in majority of cases of both groups; 134 (52 %) vs.167 (53%) respectively. Significant correlation of HbA1c

was found with duration of DM (r=0.65, p=0.0001) but not with the RBS (r=0.038, p=0.36) (Table. III) (Graph. I). Frequency of blood glucose checking in both groups was noted as weekly, monthly and not known in 67 (25.3%), 123 (48%) and 66 (25.7%) vs.98 (31%), 176 (55.8%), 41(13%) respectively.

Table No.3: Correlation of Duration of DM & Random blood sugar with HbA1c

		HbA1c
Duration of DM	Spearman's rho	0.65[**]
	p-value	0.0001
	N	571
RBS	Spearman's rho	0.038
	p-value	0.36[**]
	N	571

[**]. Correlation is significant at the 0.01 level (2-tailed).
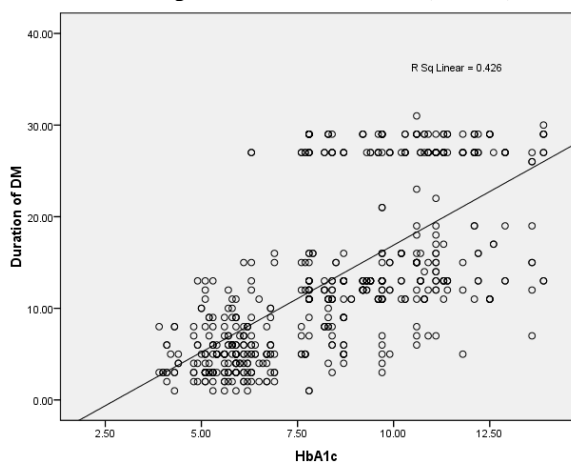
Graph No.1: Spearman`s correlation of HbA1c & duration of DM

DISCUSSION

Our study clearly shows that most of our T2DM subjects were having poor glycemic control as indicated by HbA1c levels ($\geq$ 7%), found in 55.1%. Our study population belonged to the poor social class with prevailing illiteracy (table. I). The RBS was found elevated in 71.9% and HbA1c as high as 13.5% was noted in 73 (12.7%). Our findings are comparable to studies reported from Pakistan.[10,11,12] Our results are comparable to a recent study, comprising of diabetics of upper social class, has reported poor glycemic control in 56% of diabetics.[11] Self care is critical to outcome of diabetes complications and includes compliance to medication, dietary restrictions and regular exercise.[13] If any of these are compromised, the target glycemic control many not be achieved.[14,15] Studies of the diabetic population in Pakistan showed that more than two-thirds of investigated samples had poor glycemic control.[16,17,18] Reasons for these outcomes have never been investigated.[2] The Diabetes Control and Complications Trial (DCCT) in 1993, conclusively showed that intensive glucose control delays the onset

and progression of retinal, neural and nephropathic complications by 35% to more than 70%. In fact, it demonstrated that *any* sustained lowering of blood glucose was beneficial, irrespective of previous glycemic control.[21] When comparing the demographics of study population to recently published results of treated type 2 diabetics in Pakistan, the mean age, higher male percentage, and drug non-compliance is comparable.[10,11] However socioeconomic status and knowledge of glycemic control of our diabetics is contrary to a recent study.[11] The findings suggest the need for more intensive efforts to bring the HbA1c of patients within a permissible range. The fact that the youngest patients had majority with acceptable values is particularly encouraging as they are the ones at the greatest risk for developing subsequent complications because of their greater life expectancy. This is particularly important as adolescents with poorer HbA1c values have been shown to maintain them even as adults.[22] The ADVANCE study in 2008 has demonstrated that lowering the glycated Hb value to <6.5% leads to a 10% relative reduction in the risk for major micro and macro vascular events.[23] This is reasonable target for many but not all patients; more intensive treatment to bring the target HbA1c within the normal range may increase the mortality but nonetheless, maintains its beneficial effects.[24] According to the Asian Diabetes Association report in Pakistan, there were 5.2 million people with T2DM and is predicted to rise to 13.9 million by the year 2030.[11] The Pakistan National Diabetes Survey (PNDS) reported that for each diagnosed case of DM, there are 2 cases of undiagnosed DM and 3 cases of impaired glucose tolerance approximately.[19,20] The current rising burden of newly diagnosed DM subjects is underreported from the Pakistan. When the diabetics are even unaware of their ailment how they can be aware of glycemic control? This is highly alarming situation in T2DM subjects. Glycemic control is basic in the prevention of complications of T2DM.[10] The results of 30 academic medical centers form USA indicated that many patients with T2DM are not achieving target goal of <7% for HbA1c.[10] The reports from USA[10] are disappointing and our socioeconomic status and health delivery system is obsolete and indicates a worst situation of poor glycemic control which remains unreported and underreported.

Our study has many limitations. First, the cross sectional study design is not without limitations as the cause effect relationship is not established. Second, most of our patients belonged to poor social class with poor drug compliance because of non-affordability. Lastly, findings can not be generalized to other settings until further studies are conducted.

CONCLUSION

We report poor glycemic control as indicated by glycosylated Hb A1 in majority of type 2 Diabetic subjects. Public campaigns should be attempted on

regular basis to make diabetics aware of glycemic control and its relationship with Diabetes related complications.

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