International Journal of General
Medicine and Pharmacy (IJGMP)
ISSN(P): 2319-3999; ISSN(E): 2319-4006
Vol. 8, Issue 2, Feb – Mar 2019; 1-6

International Academy of Science,
Engineering and Technology
Connecting Researchers; Nurturing Innovations

CORRELATION OF HBA1C IN ASSOCIATION WITH DIFFERENTCOMPLICATIONS OF DIABETES

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ABSTRACT

Aims

This present research paper attempt to know the correlation between HbA1c in association with various Complications of diabetes.

Methods

A retrospective cross-sectional study was conducted at Department of Medicine, BGS Global Institute of Medical Science, Bengaluru during the year 2016-2018. A total of 120 patients were considered for the study (defined sample size calculated with marginal error 20% and level of significance alpha is 0.05). All patients were meet inclusion and exclusion criteria. Exclusion criteria; terminal illness, patients who are suffering from chronic illness and ICS (ICS) etc. The HbA1c parameter was collected at different time intervals, complications, drug adherence, adverse drug reaction, duration of diabetes, diabetes-associated illness and co morbidity and mortality data were collected from the structural data sets. The collected data was analyzed by using R-programming language-open source software. The multiple logistic regression was employed to test the hypothetical results

Results

As per the resulted findings, the mean duration of diabetes was 12.85 with SD 3.26 Years. The duration of diabetes <5 (7.50%) years a smaller proportion will not be any global changes for theincidence of diabetes & associated complications when compared with an increased duration between 6-10 years (18.33%);11-15 years (26.67%) and >=16(47.50%). Increased perpetuation was found to be strongly associated with diabetes complication at the onset of mean age 53.21years $p<0.01$. The cardiovascular disease (CVD) (5.00%), coronary heart disease (CHD) (3.33%), Ischemic stroke (2.50%) and diabetes microvascular complications (6.67%) were found to be statistically significant $p<0.01$ with elevated reference rage of HbA_1c 6.85-7.00 mmol/L, the overall incidence of diabetes complications was 17.50%.

Conclusions

The present study concludes that the HbA1c target of >7.0 mmol/L might be too high for some patients and geometrically progressed diabetes-associated complications, in HbA1c levels should be approached cautiously

KEYWORDS: *HbA1c, CHD, CVD, Glycated Hemoglobin, RBC*

Article History

***Received:** 14 Dec 2018 | **Revised:** 01 Feb 2019 | **Accepted:** 07 Feb 2019*

INTRODUCTION

Glycation is the non-enzymatic addition of sugar to amino groups of proteins. While virtually any protein in the body can be glycated, for convenience and ease of obtaining a sample, glycated Hb is measured in the blood obtained form a patients [(1)].In patients withdiabetics mellitus, the glycated Hb value is used to determine the degree of glycemic control and to make decisions regarding therapy [(2, 3)]. In addition to, the concentration of glycated Hb predicted the progression of diabetic microvascular complications. This has been clearly documented by many authors. In past literature revealed that glycated hb is one of the predictors for diabetic associated complications [(5, 6, 7, 8)]. More recent evidence indicates that glycated hemoglobin also predicts 'CVD' in patients with type I diabetes [(6)]. Measurement of glycated hemoglobin is thus essential components in the management of patients with diabetes. There are several forms of glycated hemoglobin. These include hemoglobin A_1c (HbA_1c), HbA1a, HbA_1b, and HbA_1c and total glycated hemoglobin. The American diabetes association recommends that Hb A_1c should be measured at leastwise a years in person with diabetes [(1,2).] Elevated HbA_1c has also been regarded as an independent risk factor for CHD and stroke in subjects with or without disbetes. The valuable information provided by a single HbA_1c test has rendered it as reliable biomarkers for the diagnosis and prognosis of diabetes. This present research paper attempt to know the correlation between HbA1c in association with different Complications on a retrospective basis.

METHODOLOGY

A retrospective cross-sectional study was conducted during 2016-2018 at Department of Medicine, BGS medical College, and Research Institute. A total of 120 patients were considered for the study with a defined sample size of marginal error 20% and level of significance alpha is 0.05. All patients were meet inclusion and exclusion criteria. Exclusion criteria; terminal illness, patients who are suffering from immune compromised patients (ICS) *etc*. Study consent obtained from all the patients. Demographic profile, hematological and serological parameters were collected from the patients records systematically. A HbA1c parameter was collected at different intervals, complications, drug adherence, adverse drug reaction, duration of diabetes, diabetes-associated illness and co-morbidity and mortality data were collected from the structural data sets. Collected data were analyzed by using R-programming open source software. Multivariate logistic regression and chi-square test was employed to test the hypothetical results.

RESULTS

Table 1: Correlation between HB A1C and Diabetic Complication-A Retrospective Study

Parameters	No (%)	P-value
Gender		
Male	**66(55.0%)**	**0.00**
Female	**54(45.0%)**	**0.00**
Mean Age (Yrs)	**48.63±1.25**	**0.00**
Region		
Rural	**31(%)**	**0.13**

Table 1: Contd.,		
Urban	**89(%)**	**0.00**
FBG(mmol/L)	**189±20.86**	**0.00**
Cholesterol (mmol/L)	**158.22±2.55**	**0.00**
TG(mmol/L)	**456.22±1.23**	**0.00**
LDL (mmol/L)	**156.33±3.56**	**0.00**
Duration of Diabetics		
1-5 Yrs	**9(7.50%)**	**0.22**
6-10 Yrs	**22(18.33%)**	**0.00**
11-15 Yrs	**32(26.67%)**	**0.00**
>=16 Yrs	**57(47.50%)**	**0.00**
Risk increase at higher versus lower HbA1c	**6.89±0.88**	**0.00**
Complications		
a)cardiovascular disease (CVD)	**6(5.00%)**	0.00
b)coronary heart disease (CHD)	**4(3.33%)**	0.11
c) Ischemic stroke	**3(2.50%)**	0.23
diabetes micro vascular complications	**8(6.67%)**	0.00
Total	**21(17.50%)**	

The hematological characteristics are presented in Table 1, as per the resulted findings, the male, and female comprises 66(55.0%) and 54(45.0%) with sex ratio 1:1. The mean age of the cases was 48.63±1.25 years, patients were partially distributed with a proportion of rural and urban 31% and 89% respectively. The gender was found to be statistically significant for the incidence of an increased level of HbA_1c, if the FBG is uncontrollable conditions $p<0.01$. A greater proportion of cases had diagnosis diabetes microvascular complications as compared with Hb A_1c >9.0%, it was found to be statistically significant $p<0.01$ with an increased level of HbA1c.The FBG ($P<0.01$) average numerals was 189.00±20.86 mmol/L; Cholesterol (mmol/L) was 158.22±2.55 mmol/L; TG(mmol/L) was 456.22±1.23 mmol/L; LDL (mmol/L) was 156.33±3.56 mmol/L were found to be statistically significant $p<0.01$ for the advent of various diabetes-associated complications. The duration <5 (7.50%) years a smaller proportion will not change the incidence of numerals as compared with increased duration between 6-10 years (18.33%);11-15 years (26.67%)and >=16(47.50%) were found to be strongly associated with diabetes complication at the onset of mean age 53.21years $p<0.01$ cardiovascular disease (CVD) (5.00%), coronary heart disease (CHD) (3.33%), Ischemic stroke(2.50%) and diabetes micro-vascular complications(6.67%), the overall incidence of diabetes complications was 17.50% table (2)

Table 2: Correlation between HB A1C with a Complication with Respect to Different Groups

Parameters	**Group 1 (HbA1c ≤6%),**	**Group 2 (HbA1c >6%–9%),**	**Group 3 (HbA1c >9%).**
Male	**22(18.33%)**	**13(10.83%)**	**10(8.33%)**
Female	**18(15.00%)**	**22(18.33%)**	**15(12.50%)**
CVD	**0(0.00%)**	**2(1.67%)**	**4(3.33%)**
CHD	**0(0.00%)**	**1(0.83%)**	**3(2.50%)**
Ischemic stroke	**1(0.83%)**	**0(0.00%)**	**2(1.67%)**
Micro vascular	**2(1.67%)**	**4(3.33%)**	**2(1.67%)**

The multiple imputation analysis has categorized into three groups viz., Group 1 (HbA1c ≤6%), Group 2 (HbA1c >6%–9%) and Group 3 (HbA1c >9%). In case of group 1 the male comprises 18.33%; group 2 (10.83%) in group 3 (8.33%) similar findings are observed in female in group 1 (15.0%); group 2 (18.33%) and group 3 (12.50%) respectively. Irrespective of gender and group it was found to be statistically significant with various complications $p<0.01$. The risk increase at higher versus lower HbA1c 6.89±0.88 mmol/L, Ischemic stroke has found to be lag behind the risk factors of smokers $p<0.01$. The Cut off values of HbA_{1c} controlled population was

3.85mmol/L and uncontrolled population, the cutoff value was 7.36 mmol/L derived by polynomial curve fitting method figure 1&2

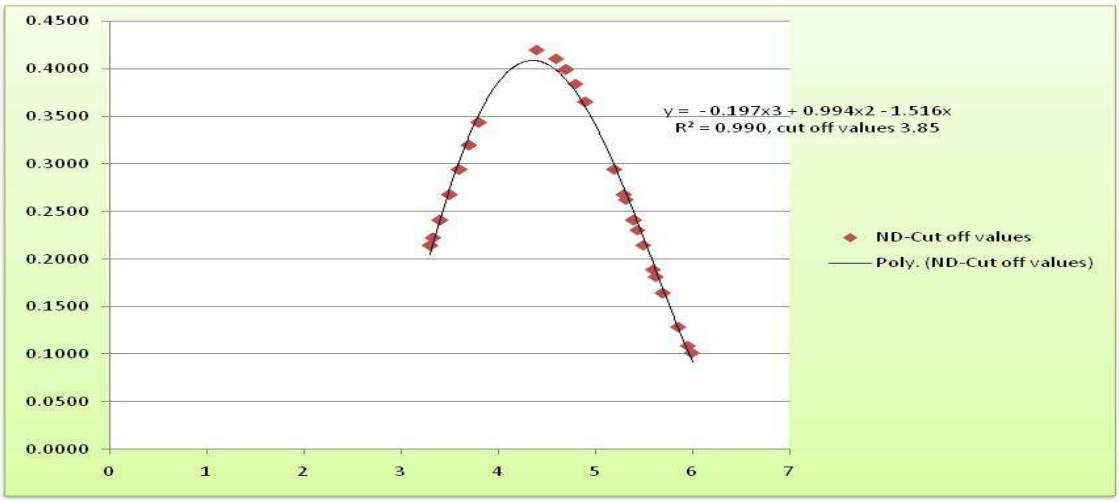

Figure 1: Cut off Values of Hba1 Controlled Population

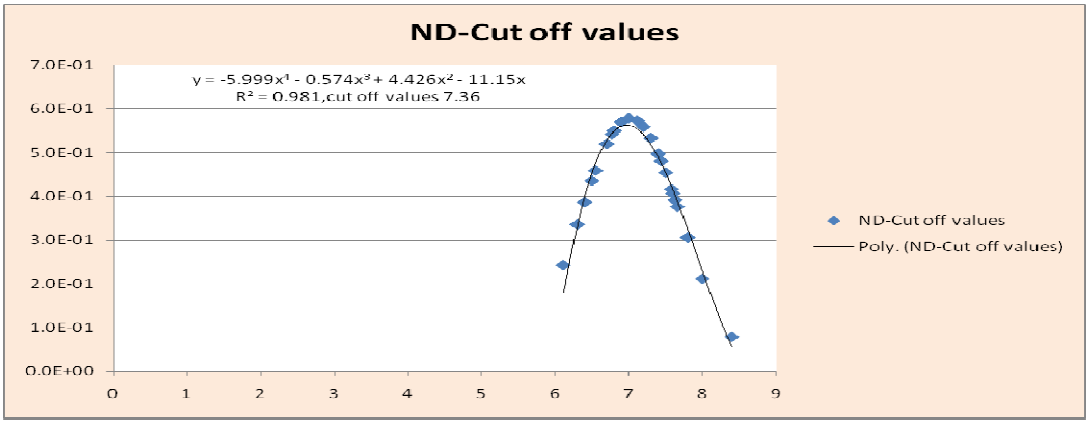

Figure 2: Cut off Values of HBa1un Controlled Population

DISCUSSIONS

An increase in HbA_1c as observed in conditions of poor diabetic control has been associated with increased blood viscosity. Glycosylation of HB and increased glucose levels tend to affect RBC properties. Glycosylation of hemoglobin may also affect membrane lipid-proteininteractions in RBCs, altering their internal viscosity, modifying viscoelastic properties of the erythrocyte membrane, and impairing RBC deformability [(10)]. The glycation of hemoglobin appeared to lead to blood pressure reduction in type-2 diabetes patients untreated for hypertension [(12).] Since 8-10% HbA_1c is considered to be a threshold beyond which the effects of hemoglobin glycosylation become significant ($p<0.01$),The study findings state that mean arterial blood pressure for patients not treated for hypertension below and above 9% HbA_1c and found to be significant $p<0.01$ reduction in mean arterial blood pressure below the threshold level (88.62 with SD 4.10 mm/hg) as compared to above the threshold level (95.52 SD 13.63 mm/hg).Non-diabetes usually falls within the 4-5.60% HbA_1c range. The predictable pre-diabetes usually has the HbA_1c levels as 5.7-6.40% while those with 6.40% or higher hba1c levels have diabetes. Since diabetes is associated with several comorbidities, the recommendations for individuals with diabetes include a healthy lifestyle and maintaining the HbA1c levels below 7.0%.Diabetes related complications are directly proportional to the levels of Hba1c –the increase in the Hba1c levels also increases the risk of such complications

(p<0.01). The excessive use of Vitamin C, B and E supplements and increased levels of cholesterol, liver and kidney diseases can also prevent abnormally high levels of Hb A1c. Dyslipidemia, which is an imbalance of lipids and fats circulating in the bloodstream, is another debilitating disease associated with diabetes. However, maintain healthy glucose levels for type-ii diabetes is of paramount importance and may help in preventing micro, macro and CHD complications (p<0.01).The present study describes to subject on CHD and micro and macro vascular complication is found to statistically significant p<0.01, if the HbA_1c as not been carefully monitored, the higher levels of HbA_1c may cause the long –axis cardiac dysfunction in the exposed population of diabetes p<0.01. A similar study reported in the Indian context, it is evident that direct relation between reduced HbA_1c levels and reduced percentage of mortality, marinating healthy levels of the HbA_1c significantly ameliorates the higher the risk of CHD among individuals with diabetes uncontrolled blood sugar. Significant association of HbA_1c with various lipid parameters, non HDL–C, LDL-C /HDL-C ratio and TC (P<0.01).Further, there was no significant interaction between gender-matched and Hba1c with respect to lipid profile suggesting the validity of HbA1c for predicting dyslipidemia irrespective of patients.

CONCLUSIONS

The present study concludes that an HbA1c target of >7.0 mmol/L might to be too high for some patients and geometrically progressed diabetes-associated complications, in HbA1c levels should be approached cautiously. The resulted findings also pointed out that, the risk increase at higher versus lower HbA1c 6.89 mmol/L would be serving for the clinical guide for taking a clinical decision at inception or early stage. However, this findings replication in future studies before making any definitive recommendations regarding the development of various HbA1c targets for mid and older aged diabetes patients.

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