Short Communication

Glycated Hemoglobin "A1c" and Diabetes Complications

Abdullah Abdalrahman Almarzouki[1], Emaad Tashkandi[2], Mian Usman Farooq[3*]

[1]Department of Medicine, College of Medicine, Umm Al Qura University, Makkah, Saudi Arabia
[2]Intern Internal Medicine, Department of Medicine, Alnoor Specialist Hospital, Makkah, Saudi Arabia
[3]Development and Planning Department, King Abdullah Medical City, Makkah, Saudi Arabia
*Corresponding Author:
Mian Usman Farooq
Performance Measurement Manager
Development and Planning
P.O.Box   57657
King Abdullah Medical City
Makkah 21955, Saudi Arabia
Cell   :   00966568232502
Email :   drus76@yahoo.com

Abstract

Objectives: This study aimed to highlight the association of HbA1c with diabetic related complications.

Material and Methods: This retrospective study has been conducted in endocrinology department of Alnoor Specialist Hospital, Makkah, Saudi Arabia, from January 2007 to December 2009. Data has been collected from diabetic patients' files that were referred to the diabetes outpatient department either because of consultation from other health care centers or from other departments of the same hospital due to diabetes related complications. Patients' files were reviewed for levels of HbA1c and diabetes related complications. The values of HbA1c were considered at the time of diagnosis of complications.

Results: The total study subjects were 110 with mean HbA1C was 7.3 with range (5.9-11.3). Only significant association between the HbA1c and diabetic septic foot was seen (p value=0.037) while values of regression showed that HbA1c is best correlated with cardiovascular disease (R=0.39, Beta =0.004 and p-value = 0.104).

Conclusion: Our study results showed insignificant association between the HbA1c and diabetic complications except that of with diabetic septic foot.

Keywords: Diabetes mellitus, complications, glycated hemoglobins, diabetic foot.

1. Introduction

Type-2 Diabetes is an increasingly common chronic disease, effecting more than 150 million people and this number is expected to increase to 300 by the year 2025. The dramatic increase in the incidence of type-2 diabetic has prompted efforts to identify subjects who are at increased risk of developing disease related complications. According to Diabetes Control and Complication Trial these complications correlate with the HBA1c level, and every one percent reduction of it lowers the risk of developing retinopathy, nephropathy, and neuropathy by 40% (1).

HbA1c is directly related to the average glucose level over the past 6 to 8 weeks (2). The American Diabetes Association (ADA) recommended an A1c goal of less than 7%, while the American Association of Clinical Endocrinology recommended less than 6.5% (3,4). Most of the cost of the diabetes in suffering, the lost years of working capacity and in health care, comes from its complications. Efficient glucose control and monitoring using HBA1c thus can reduce diabetes complications efficiently (5).

Our study focused upon the association of HbA1c level with diabetic related complications.

2. Material and Methods

This retrospective study has been conducted in endocrinology department of Alnoor Specialist Hospital, Makkah, Saudi Arabia. Data has been collected from diabetic patients' files, referred to the diabetes outpatient department either because of consultations from other health care centers of Makkah or from other departments of the hospital due to diabetic complications from January 2007 to December 2009. The sample size was selected as 110 which were approximately 10% of the total population (1030 files). Systematic random sampling was done, i.e., every 10th file was selected. Patients' files were reviewed for levels of HbA1c. Moreover, complications' data has also been collected, i.e., ischemic heart disease (IHD), cerebrovascular accident (CVA), retinopathy, nephropathy, and diabetic foot. The values of HbA1c were considered at the time of diagnosis of complications.

Data were analyzed using SPSS version 16 (SPSS Inc., Chicago, IL, USA). Pearson correlation and regression analysis was done between HbA1c levels and complications rate.

3. Ethical Issues

The Institutional review board of Alnoor Specialist Hospital, Makkah, granted us permission to conduct this study and we declared that we have no financial or personal relationship(s) which may have inappropriately influenced us in writing this paper.

3. Results

The total study subjects were 110 with age of Diabetics was 47.2 years±10.9 (mean±standard deviation) showing female predominance 59(53.6%). Females belonged to age 45years±9.2 and males were of 49years±11. Mean HbA1C of all subjects was 7.3 with range (5.9-11.3), while females had mean HbA1c 7.8(6.1-10.9) and males had 7.6(5.9-11.3). Only significant association between the HbA1c and diabetic septic foot was seen (p value=0.037) while values of regression showed that HbA1c is best correlated with CVD (R=0.39, Beta =0.004 and p-value = 0.104). Table 1, 2.

4. Discussion

Our study results showed some insignificant association between the HbA1c and diabetic complications except diabetic septic foot. On the other hand, values of regression showed that HbA1c is best correlated with CVD (R=0.39, Beta =0.004 and p-value = 0.104.

A cross-sectional study at outpatient department of King Abdul Aziz University Hospital, Jeddah, Saudi Arabia, measured HbA1c and prediction of complications due to diabetes and found that a significant relation between HbA1c levels, retinopathy and nephropathy (p=0.02, p=0.05) (6).

Another prospective observational cohort study of Diabetics over a period of more than seven years and observed a significant association between low HbA1c levels and all-cause

mortality. Based on the causes of death they suspected that the low HbA1c levels associated with increased mortality were not a consequence of intensive glucose-lowering therapy, but rather caused by poor general health condition. For CVD events and the combination of CVD and peripheral arterial disease (PAD) events no significant association with HbA1c levels could be observed (7). On the other hand, ACCORD trial, a prospective interventional study on 10,251 patients with DM without renal failure, investigated whether HbA1c of, 6%, to be attained by intensive glucose control, reduces CVD events and mortality (8). In the ADVANCE trial, an intensive glucose control strategy, lowered the average glycated hemoglobin value to 6.5% in a broad range of patients with Type 2 diabetes and reduced the incidence of the combined primary outcome of major macro and micro vascular events (9).

Table 1. Association of Diabetic complications and HbA1c (Correlation)			
Variables	**Chi Square**	**df**	**P-Value**
Retinopathy-HbA1c	28.828	45	0.971
CVA-HbA1c	31.572	45	0.935
IHD-HbA1c	24.692	45	0.994
Nephropathy-HbA1c	14.824	45	1.000
Diabetic Foot-HbA1c	63.319	45	0.037

Table 2. Association of Diabetic complications and HbA1c (Regression)					
Variables	**R**	**R square**	**Beta**	**F**	**P-Value**
Retinopathy-HbA1c	0.162	0.026	0.132	0.280	0.922
CVA-HbA1c	0.396	0.157	0.004	1.937	0.104
IHD-HbA1c	0.263	0.069	0.101	0.774	0.573
Nephropathy-HbA1c	0.201	0.040	0.160	0.438	0.820
Diabetic Foot-HbA1c	0.239	0.057	0.129	0.631	0.677

The study performed in Al Hada Military Hospital, Taif, Saudi Arabia, found the association between HbA1c level and the severity of coronary artery disease. It was clearly showed that HbA1c was an independent factor influencing the severity of coronary artery disease as demonstrated by coronary angiography. Severity of coronary artery was correlated with the duration of DM and with poor control of diabetes as shown by higher levels of HbA1c (10).

A cross-sectional study in Congo was conducted to determine the risk factors of poor control of glycated haemoglobin and diabetic retinopathy. They found in all diabetic patients with poor control of HbA1c and some other factors, i.e., smoking, stroke, diabetic nephropathy and low HDL-cholesterol are significantly associated with the presence and the severity of diabetic retinopathy (11).

Our study might lack generalizability to other ethnic populations as well as other recruitment procedures. Another limitation of this study is the small sample size which limited the number of variables for which the analysis can be adjusted. Even if the sample size might have limited the generalizability of our findings, our study might be a stimulus for other studies which have the data with this depth (duration of observation) available for analysis.

Despite these limitations our study has notable strengths. It was a single center study with uniform laboratory measurements collected over a period of three years. We analyzed the correlation of HbA1c with ischemic heart disease, cerebrovascular accident, retinopathy, nephropathy, and diabetic foot in a time-dependent modeling framework, and we recommend for future to include all measurements including family history, duration of diabetes and complications over the whole observation period.

5. Conclusion

Our study results showed insignificant association between the HbA1c and diabetes mellitus complications except that of with diabetic septic foot. It is recommended that HbA1c should be prescribed as a primary investigation to rule out Diabetes or to monitor its control.

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