Original Article

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Study of Glycosylated Hemoglobin and it's Relation with Changes in Lipid Profile in Type II Diabetic Patients

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Abstract

Introduction: Patients with type 2 diabetes (T2DM) have an increased prevalence of dyslipidemia, which contributes to their high risk of cardiovascular diseases (CVDs). Hemoglobin A1c (HbA1c) is widely used as an index of mean glycaemia, a measure of risk for the development of diabetes complications and a measure of the quality of diabetes care. This study is an attempt to determine the correlation between hemoglobin A1c (HbA1c) and serum lipid profile and to evaluate the importance of HbA1c as an indicator of dyslipidemia in patients with T2DM. *Study Subjects:* 100 non obese, non hypertensive type 2 diabetic patients attending the Diabetic OPD, IIMSR Medical College,Jalna will be enrolled in this study. After obtaining informed consent from patients, detailed history will be taken followed by investigations like fasting and post prandial blood sugar, HbA1c and lipid profile (Cholesterol, Triglycerides, HDL, LDL & VLDL). *Material &Methods*: Lipid profile and blood glucose levels will be analysed using respective biochemical kits Erba EM 200 automated biochemical analyser in central clinical laboratory, Biochemistry section of IIMSR Medical College, Jalna. Glycosylated Hemoglobin was analysed by using SDA1c Care portable analyser.

Keywords: Glycemic Control; HbA1c; Serum Lipid Profile; Type 2 Diabetes.

Introduction

Diabetes mellitus is characterized by chronic hyperglycaemia with disturbances in carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both [1]. Total prevalence of diabetes mellitus globally is estimated to rise from current estimate of 415 million to 642 million by 2040. The number of people with type 2 diabetes mellitus is increasing in every country and 75% of people with diabetes mellitus are living in developing countries [2]. With an increasing incidence worldwide, diabetes mellitus will be a likely leading cause of morbidity and mortality in the future [3]. Diabetes is associated with a greater risk of morbidity and mortality from cardiovascular disease (CVD). Serum lipids are frequently abnormal and are likely to contribute to the risk of coronary artery disease [4]. Worsening of glycemic control deteriorates lipid and lipoprotein abnormalities and particularly of diabetes mellitus [5]. Dyslipidemia in diabetes commonly manifests as raised low-density lipoprotein cholesterol (LDL-C), decreased high-density lipoprotein cholesterol (HDL-C) levels, or elevated triglyceride (TG) levels. Furthermore, data from the United Kingdom Prospective Diabetes Study suggest that both decreased HDL-C and elevated LDL-C predict CVD in diabetes. All national and international guidelines recommend aggressive management of lipids in this population [6,7]. Glycated hemoglobin (HbA1c) is routinely used as a diagnostic tool for measuring long term glycemic control. In accordance with its function as an

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indicator for the mean blood glucose level, HbA1c predicts the risk for the development of diabetic complication in diabetes patients. The UKPDS study has shown that in patients with type 2 diabetes, the risk of diabetic complications were strongly associatedwith previous hyperglycemia. Glycemic control with decreased level of HbA1c is likely to reduce the risk of complications [3]. Estimated risk of Cardio Vascular Diseases (CVD) has shown to be increased by 18% for each 1% increase in absolute HbA1c value in diabetic [4]. Even in nondiabetic cases with HbA1c levels within normal range, positive relationship between HbA1c andCVD has been demonstrated [8,9]. A few studies have previously tried to find the correlationbetween HbA1c levels and lipid profile. Some of these have shown that all the parameters oflipid profile have significant correlation with glycemic control [10]. On the other hand, somestudies do not report significant correlation between glycemic control and all parameters oflipid profile [11]. These controversies inspired us to take forward this study which was aimed to findout association between glycemic control (HbA1c) and serum lipid profile in non obese, non hypertensive type 2 diabetic patients attending the Diabetic OPD, IIMSR Jalna.

Aims & Objectives

To determine the impact of glycemic control on lipid profile and to know utility of HbA1c as an indirect indicator as well as predictor of dyslipidemia so that adequate preventive measures can be ensured for preventing development of dyslipidemia leading to cardiovascular diseases in type 2 diabetic patients.

Inclusion Criteria

Patients of age ≥30 years of both genders Patients with known diagnosis of type- 2 DM.

Exclusion Criteria

- Obese
- Hypertensive
- T2DM patients with concomitant diseases or conditions affecting lipid levels like chronic liver disease and hypothyroidism.
- Patients on drugs like oral contraceptive pills, steroids and diuretics.

Study Subjects

In all 100 subjects having DM – II were enrolled in the study out of which 66 were male and 34 were female100 non obese, non hypertensive type 2 diabetic patients attending the Diabetic OPD, IIMSR Medical College,Jalna were enrolled in this study. After obtaining informed consent from patients, detailed history will be taken followed by investigations like fasting and post prandial blood sugar, HbA1c and lipid profile (Cholesterol, Triglycerides, HDL, LDL & VLDL).

The patients were classified into two groups depending on their glycated hemoglobin (HbA1c); Good Glycemic Control (GGC) group having HbA1c < 7.0% and Poor Glycemic Control (PGC) group having HbA1c>7.0%. For serum lipid reference level, National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) guideline was referred [12].

Dyslipidemia was defined by presence of one or more than oneabnormal serum lipid concentration [13]. Statistical analysis was carried out by using student's unpaired 't' test. Pearson's correlation coefficient was also calculated to find the correlation between HbA1c and lipid parameters.

Material & Methods

Lipid profile and blood glucose levels wereanalysed using respective biochemical kits Erba EM 200 automated biochemical analyser in central clinical laboratory, Biochemistry section of IIMSR Medical College, Jalna. Glycosylated Hemoglobin was analysed by using SDA1c Care portable analyser.

Statistics

The results were evaluated by SPSS statistical package version 20 by one-way analysis of variance (ANOVA) followed by comparing with students t

Table 1: NCEP-ATP III guidelines for hypercholesterolemia/hyperlipidemia

Parameter	Normal/Reference ranges	Abnormal range in Dyslipidemia
Total Cholesterol	< 200 mg/dl	>200 mg/dl
Triglycerides	< 150 mg/dl	150 mg/dl
LDL	< 100 mg/dl	>100 mg/dl
HDL	>40 mg/dl	<40 mg/dl

Observation

Table 2: Mean values of Fasting Blood Glucose(FBG), Glycosylated hemoglobin(HbA1C) ; Lipid profile parameters of Male and Female type 2 Diabetic patients

Parameter	Males	Females	Total study subjects
FBG (mg/dl)	124.42 +- 28.64	119.21 +- 29.84	122.86 +- 29.04
HbA1c (%)	7.54 +- 1.32	6.98 +- 1.40	7.05 +- 1.60
Total Cholesterol (TC)[mg/dl]	157.62 ±30.40	146.54 ±35.31	153.79± 34.12
Triglycerides (TG) [mg/dl]	158.21 ± 49.33	148.43 ± 64.40	153.60 ± 58.62
Low Density Protein (LDL) [mg/dl]	92.83 ± 34.06	78.24 ± 29.32	85.40 ± 31.20
Very Low Density Protein (VLDL) [mg/dl]	32.66 ± 10.21	29.09 ± 12.90	32.02 ± 10.92
High Density Protein (HDL) [mg/dl]	45.79 ± 4.12	58.34 ± 3.23	51.95 ± 7.22

Table 3: Lipid parameters categorized according to patient's glycemic control (HbA1c)

Parameter	HbA1c < 7%	HbA1c > 7%	P value
FBG (mg/dl)	107.74 ± 21.68	139.61 ± 36.94	p< 0.0001
Total Cholesterol (TC)[mg/dl]	143.14 ± 26.92	205.42 ± 28.32	P < 0.001
Triglycerides (TG) [mg/dl]	146.83 ± 35.77	179.12 ± 27.7	P < 0.001
Low Density Protein (LDL) [mg/dl]	72.79 ± 22.86	87.96 ± 23.06	P< 0.001
Very Low Density Protein (VLDL) [mg/dl]	26.12 ± 9.15	34.10 ± 12.97	P = 0.0060
High Density Protein (HDL) [mg/dl]	50.46 ± 7.52	44 ± 7.5	P < 0.001

test. The results were expressed as Mean ± Standard deviation (S.D); P < 0.05 was considered significant.

Results

Our study revealed that 87% diabetic patients had deranged lipid profile(atleast one) while remaing 13% were having normal lipid parameters. This study showed slightly higher FBG and HbA1c levels in males as compared to females but difference was not significant (Table 1). When lipid profile of both males and females were compared; it showed no significant difference with the exception of HDL which was significantly more in females (Table 1).

In our study 62 patients had HbA1c levels more than 7% while remaining 38 patients witnessed HbA1c levels lesser than 7%. HbA1c levels were correlated with the lipid profile levels of diabetic patients and it was found that thosepatients having HbA1c levels > 7% had their lipid profile values significantly deranged as compared to other counterparts with HbA1c levels <7% (Table2).

Discussion

In this study, prevalence of dyslipidaemia in diabetic patients by at least oneabnormal lipid parameter was found to be 87% while 13% patients had normal lipid profile.

This was concordant to the study done by Mahanto RV et al. in which they found the prevalence of dyslipidaemia among type 2 diabetic patients was 80.0% in females and 83.33% in males [14].

Insulin impacts the liver apolipoprotein production which regulates the enzymatic activity of lipoprotein lipase and Cholesterol ester transport protein. These could be thelikely causes of dyslipidemia in Diabetes mellitus as reported by Goldberg [15].

Over andabove this, insulin deficiency also reduces the activity of hepatic lipase and several other stepsin the production of biologically active lipoprotein lipase may also be altered in DM [16].

This study also revealed positive correlation between HbA1c and Lipid parameters which stamps HbA1c as potential marker of deranged lipid parameters. Similar finding were suggested by Khan et al who also stated that severity of dyslipidaemia increases in patients with higher HbA1c value [17].

Erciyas F et al. also founded positive correlation between HbA1c and dyslipidemia [18].

Khan et al has reported that reducing the HbA1c level by 0.2% could lower the mortality by 10% [17].

Thus present study suggests the importance of HbA1c use as potential marker of lipid derangements; hence targeting good glycemic control can in turn can prevent as well as decrease the the incidences of cardiovascular diseases due to dyslipidemia.

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