Study of Correlation Between Glycated Hemoglobin (Hba1c) and Serum Lipid Profile in Type 2 Diabetic Patients

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ABSTRACT

Introduction: Diabetic mellitus is a chronic metabolic disease characterized by hyperglycemia. Type 2 diabetes mellitus accounts for more than 90% of cases worldwide. Elevated HbA1c and dyslipidemia proportionately increases the risk of development of cardiovascular disease (CVD) which is the major cause of morbidity and mortality worldwide. **Aim** : To Study the correlation between glycated hemoglobin (HbA1c) and serum lipid profile in type 2 diabetic patients. **Methods**: This is a hospital based cross sectional study conducted at Nepalgunj medical college teaching hospital, which included 104 type 2 diabetic patients (54 males and 50 females).Venous blood samples were collected from all patients and serum was used for analyzing HbA1c, lipid profile panel and fasting blood glucose (FBG). DM was defined as per American diabetic association (ADA) criteria. Dyslipidemia was defined as per the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III Guidelines. The data were analyzed using standard statistical methods, including SPSS 21. **Results** : Abnormal lipid parameters were demonstrated with increased Total Chloseterol (TC), Triglyceride (TG), Low density lipoprotein (LDL),Very low density lipoprotein (VLDL) and low High density lipoprotein (HDL) suggestive of dyslipidemia.HbA1c showed direct and significant correlation with TC,LDL,TG and VLDL. Patients with HbA1c > 7.0% had a significantly higher value of TC, LDL, TG and VLDL as compared to patients with HbA1c ≤7.0%.However, the significant difference in value of HDL-C was not found between two groups. **Conclusion**: Due to the strong correlation with lipid profile, HbA1c could be the ideal marker for predicting dyslipidemia in type 2 DM . Patients with higher HbA1c value and dyslipidemia should be considered as a very high risk group for CVD.

Keywords: **Dyslipidemia, HbA1c, Type 2 Diabetes mellitus**

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INTRODUCTION

Diabetes Mellitus (DM) refers to a group of common metabolic disorder that share the phenotype of hyperglycemia. The factors contributing to hyperglycemia are reduced insulin secretion, decreased glucose utilization and increased glucose production. [1] DM causes about 5% of all deaths globally each year. The chronic hyperglycemia of DM is associated with long term dysfunction and failure of various organs like kidney, nerves, eye, heart and blood vessels. 50% of people with diabetes die of cardiovascular disease.[2,3] With an increasing incidence worldwide, DM will be leading cause of morbidity and mortality for the forseable future.

Type 2 diabetic patients may have several forms of dyslipidemia, most common pattern being hypertriglyceridemia and reduced HDL cholesterol levels which greatly increase the risk of cardiovascular disease (CVD) compared with people without DM. An early investigations to correct dyslipidemia has shown to reduce cardiovascular events and morbidity in individual with DM.[4,5]

Measurement of glycated hemoglobin (HbA1c) is the standard method for assuring long term glycemic control and it reflects the glycemic history of previous 2-3 months.[1] Classical risk factors as well as elevated HbA1c has now been regarded as an important risk factor for CVD in individuals with or without diabetes. CVD risk increases by 18% for each 1% increase in absolute HbA1c value in diabetic population[6] where as reduction of HbA1c by 0.2% reduces cardiovascular mortality by 10%.[7] Even within normal range of HbA1c, positive relationship between HbA1c and CVD has been demonstrated in non diabetic cases.[8] The aim of this study was to find out the relationship between HbA1c and serum lipid profile in type 2 DM in Nepalese population.

METHODS

This is a Hospital based cross sectional study conducted at Nepalgunj Medical College Teaching Hospital , Kohalpur,Nepal, Department of Internal Medicine from December 2019 to June 2020.Total of 104 type 2 diabetic patients (54 males and

50 females) attending Medicine OPD and admitted at medicine wards were included in the study. The study was approved by Institutional Review Committee (IRC) and informed consent was obtained from all patients. Cases were enrolled into the study after meeting inclusion and exclusion criteria.

Inclusion criteria : Age ≥30yrs
Both male and female patients
Known case of type 2 DM under medication or newly diagnosed type 2 DM

Exclusion criteria : known case of type 1 DM
Hypothyroidism, chronic renal failure
Patients already on lipid lowering drugs

Venous blood samples were collected from all patients after at least 8 hours fasting. The serum was used for analyzing fasting blood glucose (FBG), Lipid profile panel –TC,TG,HDL-C by using fully automated biochemistry analyzer,Mindray BS380/ BS230(Germany) and indirect LDL-C was calculated using Fridewald's formula . HbA1c was estimated by using automatic BIORAD D10 (USA). DM was defined as per ADA criteria . NCEP ATP Panel III guideline was referred for serum lipid reference level. Hypercholesterolemia is defined as TC >200mg/dl, high LDL-C when value >100mg/dl, Hypertriglyceridemia as TG>150mg/dl and Low HDL-C when value <40mg/dl.[1] Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentration. The data were analyzed using standard statistical methods including SPSS 21. Quantitative data were expressed as mean and standard deviation (SD). Statistical tool used was student's t-test. P value less than 0.05 was considerd to be statistically significant.

RESULTS

A total of 104 type 2 diabetic patients were enrolled in the study ,54 were males and 50 were females.The mean age of male and female patients were 56.26 ±11.24 and 54.34±10.79 respectively. Although mean value of lipid profile, HbA1c and FBG were slightly higher in females than males , these differences were statistically non significant (Table I).

Parameter	Male (n=54) Mean±SD	Female (n=50) Mean±SD	P Value
Age (Years)	56.26±11.24	54.34±10.79	
TC	181.99±32.79	187.12±25	0.374
TG	174.07±50.39	181.06±101.22	0.653
LDL	103.89±25.03	107.66±20.99	0.409
HDL	43.20±6.69	45.31±8.96	0.176
VLDL	34.80±10.08	35.92±20.09	0.717
FBS	149.48±40.75	153.29±41.90	0.639
HbA1c	9.05±2.45	9.34±2.73	0.579

Table I : Age and Biochemical parameters of male and female type 2diabetic patients

Hypercholesterolemia was found in 39 patients (37.5%), increased LDL-C in 58(55.8%) patients, hypertriglyceredemia and increased VLDL-C in 62(59.6%) patients and decreased HDL-C 19(18.3%) patients as shown in table II.

	TC	LDL	TG	VLDL	HDL
Male	17 (43.6%)	28 (48.3%)	37 (59.7%)	37 (59.7%)	12 (63.2%)
Female	22 (56.4%)	30 (51.7%)	25 (40.3%)	25 (40.3%)	7 (36.8%)
Total	**39 (37.5%)**	**58 (55.8%)**	**62 (59.6%)**	**62 (59.6%)**	**19 (18.3%)**

Table II : Abnormal lipids parameters in type 2 diabetic patients

According to glycemic status, patients were classified into two groups. HbA1c ≤ 7.0% was considered first group and HbA1c >7.0% was considered second group. Patients with HbA1c > 7% had statistically significant higher value of TC (P = < 0.001), TG (P = 0.028), LDL-C (P = <0.001), VLDL(P = 0.021), FBG(P= < 0.001) as compared to the patients with HbA1c ≤ 7.0% where as HDL-C showed negative correlation with HbA1c though it was statistically non significant (table III).

Parameter	Glycated Haemoglobin (HbA1c)		P Value
	≤7% (n=35)	**>7% (n=69)**	
	Mean±SD	Mean±SD	
TC	168.62±36.45	192.50±20.98	<0.001*
TG	153.71±47.88	189.45±88.31	0.028*
LDL	92.59±26.72	112.35±17.92	<0.001*
HDL	45.57±9.26	43.53±7.07	0.213
VLDL	30.39±8.95	37.84±17.65	0.021*
FBS	118.14±18.42	168.14±39.26	<0.001*

Table III : Biochemical parameters categorized by glycemic control (HbA1c)

DISCUSSION

The present study evaluated the pattern of lipid profile parameters in type 2 diabetic patients and its correlation with HbA1c. This study shows high prevalence of hypertriglyceredemia, high LDL- C, hypercholesterolemia and low HDL-C levels in type 2 diabetic patients. These are well known risk factors of cardiovascular diseases. Insulin affects liver appolipoprotein production. It regulates the enzymatic activity of lipoprotein lipase (LPL) and cholesterol ester transport protein. All these factor are likely cause of dyslipidemia in DM.[9] In this study, most significant disorder in lipid profile was hypertriglyceredemia. Similar finding was shown by Regmi P et a[10] and Mahato RV et al.[11]

This study shows highly significant correlation between HbA1c and FBG which is similar to studies done by Ito c et al[12] , ko GT et al[13] and Rosediani et al.[14] This study also found significant correlation between HbA1c and TC, LDL- C as reported by Er ciyas F et al[15], Anderson GE et al[16], Ohta T et al[17] in their studies.

The diabetes complications and control trial (DCCT) considered HbA1c as the gold standard of glycemic control. The target HbA1c value for reducing cardiovascular complication was

≤7.0% . In this study, we classified diabetic patients in 2 groups as per the HbA1c cut off of 7.0%. Th patients with HbA1C value >7.0% showed significant increase in TC, LDL –C, TG and VLDL without any significant change in HDL-C in comparision to patients with HbA1c ≤7.0%. Khan HA et al[18] showed the impact of glycemic control on various lipid parameters. Though there was no signifant differences in LDL-C with regard to glycemic control , alterations in other lipid parameters were statistically significant. Thus, this study suggests that severity of dyslipidemia increases with higher HbA1c value and diabetic patients with increased HbA1c and dyslipidemia should be considered as very high risk group for cardiovascular disease (CVD). Therefore, we should focus on improving glycemic control which can essentially reduce the risk of cardiovascular events in diabetics.[19] It has been considered that reduction in HbA1c level by 0.2% could lower the cardiovascular mortality by 10%.[7]

LIMITATION

Though menopausal status affects the lipid profile, it was not considered in this study. Non diabetic controls would provide better comparison of lipid profile which should be added in future studies. In addition to this, sample size also might have been inadequate for drawing the definite conclusion.

CONCLUSION

This study shows that type 2 DM has significant relation with dyslipidemia. Along with blood glucose , frequent monitoring of lipid profile is equally important for the best care of type 2 diabetic patients and to decrease the risk of cardiovascular events. HbA1C is the gold standard tool for the assessment of glycemic control and it could be the ideal marker for identifying dyslipidemia in type 2 DM.

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