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Original Research Article

Association between Level of HbA1c and Lipid Profile in T2DM Patients Attending Diabetic OPD at PMCH, Patna, Bihar

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Abstract:

Background: Insulin-induced hyperglycemia is the feature of diabetes mellitus (DM), a group of metabolic diseases. Those with type 2 diabetes (T2DM) are more likely to be obese, have high blood pressure, and have high cholesterol. Our study was to determine the usefulness of Hba1c as a dyslipidemia indicator in individuals with type 2 diabetes.

Methods: After a minimum of eight hours of fasting, we obtained venous blood samples from 168 T2DM patients in both plain and EDTA vials. An entirely automated analyzer was used for the biochemical analysis. substantial negative correlations were seen between HbA1c and the HDL/LDL ratio and substantial positive correlations with total cholesterol, LDL-C, and triglycerides.

Results: Compared to patients with poor glycemic control, those who had good glycemic control had reduced mean values for TC, LDL-C, and TG. However, compared to individuals with poor glycemic control, the mean value of HDL and HDL/LDL ratios was higher in the former group. At the p-value of less than 0.05, these differences were significant.

Conclusion: Our study recommends using HbA1c as an additional dyslipidemia indication.

Keywords: HBA1C, Diabetes, Lipid Profile, Patna, Bihar.

Introduction

Diabetes, a chronic metabolic condition, can cause high blood glucose levels that can damage blood vessels, kidneys, eyes, hearts, and nerves. The most common kind of diabetes, known as type 2 diabetes (T2D), is caused by an immune system response to insulin. The WHO [1] reports that 422 million people worldwide have diabetes, which accounts for 1.6 million annual mortality. Most of these people live in low- and middle-income countries. Pancreatic beta cell failure, which is caused by a combination of acquired and hereditary factors, plays a major role in the onset and development of type 2 diabetes. (T2D). Specialized endocrine cells known as beta cells produce, store, and secrete insulin in response to a range of coordinated cues, therefore tightly controlling blood glucose levels. Usually measuring 10 mm in diameter, they contain 20 pg of insulin. Between 50 and 80 percent of the islet cells in mature pancreatic islets are beta cells [2].

Obesity, hypertension, and hyperlipidemia are more common in diabetics. The most common illness, type 2 diabetes, can spend years without showing any symptoms in its early stages. Diabetes is a chronic metabolic illness brought on by a complicated interaction of behavioral, environmental, and hereditary variables. Deaths from diabetes are increasing due to a number of factors, such as inactivity, smoking, obesity, and poor diet [3]. In certain cases, diabetes screening could be helpful because diabetes's burden and consequences might be lessened with early detection and treatment. Diabetes problems may be indicated by the average blood glucose level in diabetics, which is commonly represented by the long-term glycemic control marker HbA1c. In both diabetics and non-diabetics, HbA1c is now recognized as an independent risk factor for cardiovascular disease (CVD) in addition to other well-established risk factors including hyperlipidemia and hypertension. Because it provides information about average blood glucose levels over the preceding few months, the HbA1c diabetes biomarker is helpful [4].

The complications associated with diabetes, such as microvascular problems, carry a risk of increasing morbidity and mortality. Diabetic dyslipidemia (DD) is a typical microvascular complication of

diabetes mellitus. Diabetes is recognized as a major health concern and one of the primary risk factors for cardiovascular disease (CVD) in both developed and developing countries. When it comes to type 2 diabetes (T2DM), dyslipidemias are present in more than 75% of patients with mixed dyslipidemias. The components of DD5 are characterized by the kind and quantity of triglycerides that raise the risk of CVD because of insulin resistance.

Poor glycemic control in type 2 diabetes is linked to elevated levels of LDL, triglycerides, cholesterol, and HDL, all of which are atherosclerotic risk factors. Increased VLDL and LDL particles together lead to elevated levels of apolipoprotein B. On the other hand, elevated serum triglyceride levels after a meal indicate an increased risk of cardiovascular disease. Lipid buildup in bodily tissues is the source of the metabolic syndrome, which is characterized by insulin resistance and obesity brought on by elevated blood lipid levels. Obesity is the most common characteristic for T2DM patients. It suggests that insulin resistance led to elevated blood glucose levels, which in turn raised cholesterol and LDL levels and dropped HDL levels in line with the diabetes control status [6].

Material and Methods

This cross-sectional study was carried out from July 2022 to June 2023 at Patna Medical College and Hospital in Patna, Bihar, in cooperation with the Department of Medicine. Enrolled in the trial were 168 consecutive individuals who visited the outpatient department (OPD) and were either diagnosed with type 2 diabetes according to the American Diabetes Association criteria 2022 or were already receiving therapy for the condition. The Adult Treatment Panel (ATP) III criteria of the National Cholesterol Education Programme (NCEP) were used to define dyslipidemia. Patients of any age were included, regardless of the course of their illness. Individuals who did not desire to participate in the study, had severe anemia, were on statins for dyslipidemia, had metabolic instability, a cutaneous or systemic infection, CVS, or renal problems, or were not taking part in the study were excluded. The subjects gave their informed permission. Blood was drawn after a minimum of eight hours of fasting. Three milliliters of venous blood were taken and placed in a simple vial, while two milliliters were placed in a potassium-EDTA vial. After allowing blood samples in plain vials to coagulate, the serum was separated by centrifuging the samples for five minutes at 3000 rpm. Different lipid profile parameters, such as TC, HDL-C, LDL-C, and TG, were analyzed in serum, and haemolysate was prepared to measure HbA1C in whole blood. Analysis was done in fully automated.

Data were in entered in Microsoft Excel 2020 and analysed using SPSS 28.

Data that is normally distributed has been shown as mean and standard deviation, while data that is not parametric has been shown as median and interquartile range. The spearman rho test for non-parametric data and the Pearson correlation test for parametric data have been used to determine correlation. Student's t test has been used to compare means between two groups of parametric data. The Mann Whitney U test has been used to compare the median values between two groups of non-parametric data. A P value of <0.05 is regarded as significant.

Results

In this cross-sectional study, 168 patients with type 2 diabetes are included. Long-term glycemic management, as measured by HbA1C, has been found to be correlated with lipid profile markers, including TC, HDL-C, LDL-C, and TG. There were 77 males and 91 females among the 168 patients. The patients' mean±standard deviations for age, TC, HDL-C, LDL-C, HDL/LDL ratio, and HbA1C were 52.2±11.9 years, 182.9±41.9 mg/dl, 41.6±8 mg/dl, and 94.9±20 mg/dl, 0.47±0.18, and 6.5±1.5% each. TG was 152.5 (109, 195) mg/dl at the median.

Calculations were made to compare the amounts of these parameters in male and female patients, but no statistically significant differences were found.

Table1: Biochemical parameters in males and females

	Male (77)	Female (91)	'p' value
AGE (years)	52.7±11.9	51.84±12.1	0.64a
TC (mg/dl)	176.3±42.4	188.4±41	0.06a
HDL(mg/dl)	40.9±9.2	42.1±6.9	0.32a
LDL(mg/dl)	95.1±19.8	94.7±20.3	0.9a
HDL/LDL	0.4±0.1	0.5±0.1	0.8a
HbA1C(%)	6.5±1.4	6.5±1.3	0.98a
TG(mg/dl)	130(99, 179)	167(124,217)	0.05b
Hs-CRP (mg/dl)	1.6(1.0,2.8)	2.0(0.9,2.7)	0.33b

An Independent t test, b Mann whitney U test. We used the NCEP ATP criteria to classify dyslipidemia and discovered that 36%, 50%, and 33% of the individuals had hypercholestrolemia,

hypertriglyceridemia, and elevated LDL-C, respectively. In 47% of females and 16% of males, the HDL-C level was poor. Additionally, 63% of patients had HbA1c levels below 7%, indicating adequate glycemic management. It was discovered that HbA1c had a substantial negative connection with HDL (r=-0.897, <0.01) and HDL/LDL ratio (r=-0.690, <0.01) and a significant positive association with TC (r=0.257, <0.01), LDL (r=0.785, <0.01), and TG (r=0.272, <0.01).

Table 2: Correlation of HbA1c with S.lipid profile

	TCa	HDLa	LDLa	HDL/LDLa	Triglyceridesb
HbA1Ca	0.257* p<0.01	-0.897* p<0.01	0.785* p<0.01	-0.690* p<0.01	0.272* p<0.01

a Pearson's correlation, b Spearman rho correlation, * Correlation is significant at 0.01 level.

We separated the participants into two groups, good and bad glycemic control groups, based on the levels of HbA1c as <7% and >7%, respectively, to examine the usefulness of HbA1c as a marker of dyslipidemia. Patients with strong glycemic control had mean values of TC, LDL, and TG that were lower than those with poor glycemic control. However, it was discovered that patients with strong glycemic control had higher mean values for HDL and HDL/LDL ratios than did those with poor glycemic control.

The distinctions were noteworthy at the p-value of less than 0.05. (Table 3)

Table 3: Comparison of lipid profile between subjects with good and poor glycemic control

HbA1c	<7	≥7	'p' value
TCa(mg/dl)	5.15±40.5	196.16±41.5	<0.01*
HDLa(mg/dl)	46.3±4.9	33.5±5.4	<0.01*
LDLa(mg/dl)	84.8±8.2	112.2±22.3	<0.01*
HDL/LDLa	0.55±0.11	0.33±0.19	<0.01*
Triglyceridesb (mg/dl)	149(106,182)	172(119,233)	0.03C

a Independent t-test, bMann Whitney U test, Significant at level of p=0.01, **Significant at the level of p=0.05

Discussion

This cross-sectional study was carried out to investigate any potential correlation between glycemic control and dyslipidemia, a CVS risk factor, in people with Type 2 Diabetes. We have also made an effort to investigate our patients' dyslipidemia patterns. Out of all the dyslipidemia parameters, hypertriglyceridemia was shown to be the most prevalent. Male and female differences in lipid levels were observed, however they were not statistically significant. Numerous studies have shown that women have greater levels of HDL-C, triglycerides, and total cholesterol [7–10].

It has been suggested that persons with type 2 diabetes mellitus are more likely than the general population to have dyslipidemia [11], and that the lipid particle composition of diabetic dyslipidemia is more atherogenic than that of other kinds of dyslipidemia [12]. This implies that compared to non-diabetics, those with diabetes may be more atherogenic at even normal lipid concentrations. Additionally, given that HbA1c has been shown to be a separate risk factor for both stroke and coronary heart disease [13,14], the co-occurrence of dyslipidemia and persistently uncontrolled blood sugar may be linked to an increased risk of CVS in these individuals. Since HbA1c levels are frequently measured in patients with type 2 diabetes, the study's indicated correlation between HbA1c and lipid profile characteristics may help identify dyslipidemia early and begin treatment promptly. According to our research, there is a substantial negative link between HbA1c and the HDL/LDL ratio and a significant positive correlation between HbA1c and total cholesterol, LDL-C, and triglycerides. Higher values of correlation coefficients 0.785 and -0.897, respectively, indicate a strong association between HbA1c and LDL-C and HDL-C. Similar findings were reported by Khan et al. and a number of other authors [12,15,16].

HbA1c has been the gold standard for glycemic control since the Diabetes Complications and Control Trial (DCCT) was founded, and a value of ≤7.0% has been linked to a lower risk of cardiovascular complications [17]. Subjects were split into two groups: good and poor glycemic control groups based on HbA1c levels of less than 7% and more than 7%, respectively. Patients with strong glycemic control had mean values of TC, LDL, and TG that were lower than those with poor glycemic control. However, it was discovered that patients with strong glycemic control had higher mean values for HDL and HDL/LDL ratios than did those with poor glycemic control.

Given the strength of these associations, it is important to consider the likelihood of dyslipidemia in patients with elevated HbA1c

levels. The American Diabetes Association recommends that people with type 2 diabetes have their lipid levels checked annually and their HbA1c levels checked at least twice a year, or quarterly. Raised HbA1c levels should be seen as suggestive of dyslipidemia, as our study and numerous others have indicated, and in such individuals, lipid profile levels should be examined right away.

Conclusion

The level of HbA1c has an important relationship with lipid profile characteristics, indicating that it can be used as a marker of dyslipidemia in addition to chronic hyperglycemia. As such, it should be analyzed appropriately. Our research contributes to the body of research that suggests HbA1c as a dyslipidemia indication.

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