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Research Article

Prospective study of blood lipid parameters in patients with type-2 diabetes mellitus and its correlation with the glycated hemoglobin

Kumar Prafull Chandra*, Dhirendra Kumar Shukla

Department of Medicine, Mayo Institute of Medical Sciences, Gadia, Barabanki, Uttar Pradesh, India

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***Correspondence:**
Dr. Prafull Kumar Chandra,
E-mail: drkpchandra@gmail.com

ABSTRACT

Background: Patients with type 2 diabetes mellitus (T2DM) are accompanied (many a time ignored) by dyslipidemia; such patients are the easy targets for the development of cardiovascular disease (CVD). An early treatment to normalize abnormal lipid levels can reduce the CVD and related mortality. The aim was to measure blood lipid parameters in patients with T2DM and their relation with the glycemic control.
Methods: Prospective study including 124 T2DM patients in the Department of Medicine, Mayo Institute of Medical sciences, Barabanki, Uttar Pradesh, India between January 2016 to June 2016. Brief history, examination and investigations including fasting plasma glucose (FPG), post prandial blood glucose (PPG), glycated hemoglobin (HbA1c), total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) were done. Correlation was obtained for lipid parameters between patients having HbA1c <7% and HbA1c ≥7%.
Results: Male predominance (57.25%) was recorded in present study. Mean age of study population was 52.81±10.77 years and most of them belong to age group of 56-65 years (30.64%). Mean height, weight, diabetes duration and BMI were 1.56±0.21 meters, 72.13±13.94 kgs, 5.22±2.71 years and 30.13±4.58 kg/m2respectively. Insignificant difference was obtained between mean TC, HDL-C, TG, LDL-C, TC/HDL, LDL/HDL, VLDL-C and non HDL-C in patients with HbA1c <7% (151.86±54.80 mg/dl, 46.0±22.26 mg/dl, 118.59±84.59 mg/dl, 154.86±120.36 mg/dl, 7.0±14.78, 2.05±0.84, 37.27±25.41 mg/dl and 114.24±47.12 mg/dl respectively) when compared with patients with HbA1c ≥7% (169.20±44.72 mg/dl, 40.66±10.97 mg/dl, 154.75±123.22 mg/dl, 193.11±148.94 mg/dl, 9.25±49.58, 2.42±0.93, 50.97±30.86 mg/dl and 128.40±42.12 mg/dl respectively) (p>0.05). A significant positive correlation was obtained between HbA1c and TC (r=0.216, p=0.016), TG (r=0.269, p=0.003), LDL/HDL ratio (r=0.296, p=0.001), VLDL-C (r=0.235, p=0.009) and non HDL-C (r=0.250, p=0.007) whereas a negative correlation was obtained with HDL-C (r= -0.192, p=0.032). In present study, 21.77% had hypercholesterolemia, 54.83% had low HDL-C level, 32.25% had hypertriglyceridemia and 72.58% patients had high LDL-C level.
Conclusions: Type 2 DM is associated with dyslipidemia and both together are the major risk factors for development of cardiovascular disease. There was a positive correlation between HbA1c and abnormal lipid parameters in patients with T2DM.

Keywords: Lipid parameters, Type 2 diabetes mellitus, HbA1c

INTRODUCTION

Patients with type 2 diabetes mellitus (T2DM) are at higher risk of cardiovascular disease (CVD). Large epidemiological studies have shown T2DM as the independent risk factor for CVD.[1] T2DM also exaggerates the consequences of several other risk factors like hypertension, smoking and dyslipidemia.[2]

Dyslipidemia being the most common risk factor for coronary artery disease (CAD) is more prevalent in patients with T2DM as compared to non-diabetic population. The risk of cardiovascular (CV) mortality is increased by 4 to 6 fold in T2DM patients.[3]

Glycated hemoglobin (HbA1c) is one of the commonly used markers for long term glycemic control. It also anticipates the risk of developing diabetes related complications in T2DM patient. Higher HbA1c is an important independent risk factor for CVD in people with T2DM. Reports have shown that every 1% increase in HbA1c value increases the risk of development of CVD by 18%.[1]

The present study was done to assess the lipid parameters in patients of type 2 DM of varying duration and to find the relation between HbA1c with different components of dyslipidemia (high LDL-C, low HDL-C level, hypercholesterolemia and hypertriglyceridemia.

METHODS

A prospective study including 124 T2DM patients was done in the Department of Medicine, Mayo Institute of Medical sciences, Barabanki, Uttar Pradesh, India from January 2016 to June 2016.

A written informed consent from all patients and Institutional Ethics Committee approval was obtained before starting the study.

After recording patient's brief history and physical parameters, blood glucose and lipid parameters including FPG (fasting plasma glucose), PPG (post prandial blood glucose), HbA1c (glycated hemoglobin), TC (total cholesterol), HDL-C (high density lipoprotein cholesterol), TG (triglyceride), LDL-C (low density lipoprotein cholesterol) and VLDL-C (very low density lipoprotein cholesterol) were assessed from the local laboratory. Relation between patients having HbA1c <7% and HbA1c ≥7% was assessed along with the correlation between all the lipid parameters with patient's HbA1c.

Patients with hypercholesterolemia (>200 mg/dl), hypertriglyceridemia (>150 mg/dl), high LDL (>100 mg/dl) and low HDL (<40 mg/dl) were also evaluated in present study.

All the statistical analysis was performed using IBM SPSS ver. 20. Mean and standard deviations were calculated for time varying variables and percentages were calculated for categorical variables. One way ANOVA was used to find out the relation between parameters. P value <0.05 was considered as significant.

RESULTS

In present study most of the patients belong to age group of 56-65 years (38 (30.64%)) followed by 36 (29.03%) patients who belong to age group of 46-55 years. Out of 124 T2DM patients, 71 (57.25%) were male and 53 (42.74%) were female.

Table 1: Showing different characteristics of study population.

Characteristics	Mean±SD (n=124)
Age (years)	52.81±10.77
Height (meters)	1.56±0.21
Weight (kg)	72.13±13.94
BMI (kg/m^2)	30.13±4.58
FPG (mg/dl)	141.17±44.37
PPG (mg/dl)	235.21±84.82
HbA1c (%)	8.41±2.09
DD (years)	5.22±2.71
TC (mg/dl)	204.32±144.58
HDL-C (mg/dl)	41.60±13.70
TG (mg/dl)	148.33±117.82
LDL-C (mg/dl)	126.12±46.90
TC/HDL	8.85±45.35
LDL/HDL	2.35±0.93
VLDL-C (mg/dl)	48.54±30.33
Non HDL-C (mg/dl)	125.84±43.19

BMI; body mass index, FPG; fasting plasma glucose, PPG; post prandial blood glucose, HbA1c: glycated hemoglobin, DD; diabetes duration, TC; total cholesterol, HDL-C; high density lipoprotein cholesterol, TG; triglyceride, LDL-C; low density lipoprotein cholesterol, VLDL-C; very low density lipoprotein cholesterol

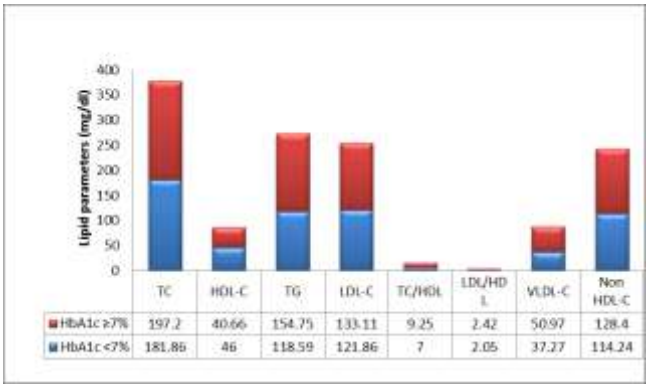

Figure 1: Lipid parameters in patients with good and poor glycemic control.

Out of 124 patients, 22 (17.74%) were having good glycemic control (HbA1c <7%) whereas 102 (82.25%) were having uncontrolled diabetes (HbA1c ≥7%).

Out of 124 patients, 27 (21.77%) were having hypercholesterolemia (p=0.008); 68 (54.83%) had low HDL-C level (p>0.05); 40 (32.25%) patients had hypertriglyceridemia (p>0.05) and 90 (72.58%) patients had high LDL-C level.

Table 2: Showing correlation of parameters of glycemic control with lipid parameters of study population.

Lipid parameters		FPG	PPG	HbA1c
TC	r	0.103	0.099	0.216
	P	NS	NS	0.016
HDL-C	r	-0.213	-0.161	-0.192
	P	0.019	NS	0.032
TG	r	0.118	0.089	0.269
	P	NS	NS	0.003
LDL-C	r	0.111	0.046	0.065
	P	NS	NS	NS
TC/HDL	r	0.100	0.034	0.019
	P	NS	NS	NS
LDL/HDL	r	0.215	0.231	0.296
	P	0.018	0.011	0.001
VLDL-C	r	0.178	0.092	0.235
	P	NS	NS	0.009
Non HDL-C	r	0.166	0.141	0.250
	P	NS	NS	0.007

FPG; fasting plasma glucose, PPG; post prandial blood glucose, HbA1c: glycated hemoglobin, DD; diabetes duration, TC; total cholesterol, HDL-C; high density lipoprotein cholesterol, TG; triglyceride, LDL-C; low density lipoprotein cholesterol, VLDL-C; very low density lipoprotein cholesterol, r; Pearson correlation, P; P value of <0.05 was considered significant.

DISCUSSION

Disturbance in lipid parameters (dyslipidemia) is well acknowledged by different authors in patients with T2DM. Reports have shown that approximately 77.5% patients with T2DM demonstrate diabetic dyslipidemias.[4] Poor glycemic control is the well documented cause for abnormal lipid parameters in T2DM patients.[4]

The present study has revealed a very high prevalence of raised LDL-C, low HDL-C level, hypercholesterolemia and hypertriglyceridemia which are the well documented risk factors for cardiovascular diseases (CVD).

Production of apolipoprotein in the liver is affected when insulin does not work properly in T2DM patients, which can lead to diabetes dyslipidaemia.[5] Action of lipoprotein lipase and cholesterol ester transport protein is regulated by apolipoprotein, which in turn can results in to abnormal lipid profile.[6]

A study done by Meenu et al on 150 T2DM patients reported 41.3% had hypertriglyceridemia; 18% had high LDL levels (>100 mg/dl) and 10.6% had hypercholesterolemia which is consistence with the present study findings.[7] Which means most of the patients in present study were having diabetic dyslipidemia (combined effect of hypercholesterolemia (21.77%), low HDL-C level (54.83%), hypertriglyceridemia (32.25%) and high LDL-C level (72.58%)).

Khan et al reported an increase in dyslipidemia in patients with high HbA1c levels.[8] Mahato et al did a similar study on 294 T2DM patients and reported that 27.89% patients had hypercholesterolemia, 63.26% had hypertriglyceridemia, low HDL-C level was reported in 15.6% and high LDL-C level were found in 47.6% patients which is consistence with present study.[9] Singh et al in a study of 120 T2DM patients reported almost similar findings.[5]

HbA1c has been recommended as the gold standard of glycemic control by diabetes complications and control trial (DCCT). Reports have shown that HbA1c value ≤7.0% in patients with T2DM can significantly reduce the cardiovascular complications. HbA1c values higher than 7% can demonstrate an increase in lipid abnormality as compared to patients with HbA1c <7%.[10] In present study, all lipid parameters were similar in patients having HbA1c <7% and HbA1c ≥7% (p >0.05), but other studies done by Meenu et al, Rohlfing et al and Mahato et al reported a significant difference in both the groups.[7,9,10] Meenu et al has also reported a positive correlation between HbA1c and TC, LDL-C and VLDL-C levels which is consistence with the present study data.[7] A negative correlation was recorded for HDL-C with HbA1c level which is consistence with the study done by Meenu et al.[7]

Patients with good glycemic control (HbA1c <7%) can significantly decrease the risk of CV events as reported by Selvin et al.[11] It has also been reported that even a 0.2% reduction in HbA1c significantly reduce the risk of mortality by 10%.[12] Therefore, presents study results propose the importance of good glycemic control to manage diabetic dyslipidaemia and associated risk of CV disease in T2DM patients.

There were few limitation of being small in sample size; a large randomized clinical trial is needed to confirm the present study findings.

CONCLUSIONS

A positive correlation between HbA1c and abnormal lipid parameters in patients with T2DM was recorded. HbA1c can be routinely used to screen the high risk of T2DM patients for early diagnosis of diabetic dyslipidemia.

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Ethical approval: The study was approved by the institutional ethics committee

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