Prevalence of dyslipidemia in newly diagnosed patients of type-2 diabetes mellitus at tertiary care centre of West Uttar Pradesh: A single centre study

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Abstract

Literature from Indian studies showed a threefold rise in the prevalence of diabetes in rural as well as urban areas and India may become the diabetic capital of the world in near future. Patients suffering from type 2 DM have more risk of developing vascular diseases because of changes in lipid profile. Diabetic dyslipidemia is more atherogenic and is characterised by increase in serum levels of total cholesterol (TC), triglycerides (TGs), or both, or decrease in serum levels of high-density lipoprotein cholesterol (HDL-C). Dyslipidemia is a risk factor for cardiovascular diseases and is modifiable. The present study was conducted to determine the prevalence of dyslipidemia in newly-diagnosed patients of type-2 diabetes mellitus. In the study, 100 newly diagnosed type 2 diabetes patients were included as cases and 100 non-diabetic subjects were included as controls. Blood samples were collected from the subjects of both the study and control groups and were analyzed for fasting and post-prandial plasma glucose, HbA1c, TC, TG, LDL-C, and HDL-C. 84% of cases had dyslipidemia whereas only 52% of controls were found to have dyslipidemia and the difference between the two groups was statistically significant (p<0.05). The mean values of fasting and post-prandial plasma glucose, HbA1c, TC, TG and LDL-C were found to be higher in the cases as compared to the controls (p<0.05). Positive correlation was found between glycemic parameters and Serum – total cholesterol, triglycerides and LDL cholesterol (p<0.05). This study demonstrated that the dyslipidemia is prevalent in newly diagnosed T2DM patients. Hence this study stresses the need and importance of implementation of measures to control dyslipidemia in diabetic patients as dyslipidemia is a known risk factor for cardiovascular diseases.

Keywords: Type 2 diabetes mellitus, HbA1c (Glycosylated haemoglobin), Fasting blood glucose, Dyslipidemia, Triglycerides, High density lipoprotein-cholesterol.

Introduction

Diabetes mellitus is a metabolic disease which is characterized by the hyperglycemia due to either insulin deficiency or insulin resistance.[1] Chronic hyperglycemia occurs due to deficiency of insulin along with disturbances of metabolism of carbohydrate, protein, and fat.[2] Frequency of T2DM is higher than T1DM which accounts for more than 90% of all diabetic patients.[3] In both high and low-income countries the prevalence and incidences of T2DM are rapidly increasing.[4] According to the International Diabetes Federation (IDF) Atlas guideline report- 2017, it was estimated that 425 million people (20–79 years of age) suffered from DM, and it is expected to increase to 629 million people by 2045. As per IDF Atlas there were 72.9 million people with diabetes in India (2017) and is expected to increase to 134.3 million by 2045.[5]

The prevalence rate of diabetes ranging from 6.1% to 16.6% in different states of India was reported by the National Urban Survey.[6] It is one of the chronic non-communicable diseases (CNCDs) which have emerged as a leading global health problem. In 2015, 39.5 million of the 56.4 million deaths globally were due to non communicable diseases.[7] About 30-80% of people with diabetes are undiagnosed which is a major challenge associated with diabetes mellitus.[8] Hence there is a global urgent need of early screening, diagnosis and providing appropriate care to diabetic people as the chances of preventing harmful and costly complications will be higher. China, India and the United States are the countries with largest number of people with diabetes and also had highest numbers of people with undiagnosed diabetes.[5] In India dyslipidemia in diabetic patients is one of the main causes for Coronary Artery Disease (CAD) mortality.[9] Dyslipidemia in diabetes patients is characterized by increased serum levels of Low Density Lipoprotein Cholesterol (LDL-C), Very Low Density Lipoprotein Cholesterol (VLDL-C), Triglycerides (TG) concentrations and decreased serum levels High Density Lipoprotein Cholesterol (HDL-C) concentration.[10,11] Dyslipidemia associated with diabetes has more atherogenic effect.[12] Impaired lipid metabolism is commonly observed in T2DM patients due to insulin resistance.[13] A recent study had reported that high cholesterol is present in 25-30% of urban and 15-20% rural subjects in India.[14] Hence this study was done to estimate the prevalence of dyslipidemia in newly diagnosed Type 2 diabetes mellitus cases.

Materials and Methods

A total of 200 subjects were included in this cross-sectional study and were divided into two groups: a study group having 100 T2DM patients and a control group with 100 non-diabetic subjects. The study was conducted at the Department of Medicine, LLRM Medical College Meerut, from February 2018 to January 2019. Ethical clearance was taken from Institutional ethical committee.

Inclusion Criteria

Patients fulfilling the ADA criteria for diagnosis of type 2 DM: HbA1c > 6.5%, or FBS > 126 mg/dl, or PPBS > 200 mg/dl[15] and aged > 20 years, who attended/admitted in the

medicine OPD/IPD with symptoms and signs of diabetes mellitus for the first time, were included as cases. Randomly selected non-diabetic subjects with >20 years of age, were taken as controls.

All the 200 subjects (cases and controls) were tested for fasting and post prandial blood sugar levels, HbA1c level, fasting lipid profile, glycosuria, including renal and liver function tests of the patients. The NCEP-ATP III guidelines were used for lipid profile of all the subjects (cases and controls).[16]

Exclusion Criteria

Known Type 2 diabetes mellitus patients and patients with acute metabolic complications (diabetic ketoacidosis, hyperglycemic hyperosmolar syndrome); patients having acute illnesses/ infections; patients with h/o acute myocardial infarction, cerebrovascular accidents, thyroid disorders, liver disorders and renal disease; patients having known inherited disorders of lipids and patients with secondary dyslipidemia either due to pregnancy or drugs(Beta-blockers, Thiazides, Steroids, Hypolipidemic drugs, Oral contraceptives, Anti –coagulants) and patients with h/o alcohol dependence were excluded from the study.

Data Analysis

NCSS software version 12 was used for data analysis. The results of the parametric quantitative data are shown as mean and standard deviation. Independent T-test was used to compare the quantitative variables between two groups and chi-square test was used for qualitative data. Pearson's correlation test was used to find correlation between quantitative variables. p-value <0.05 is considered as significant.

Results

Table 1 shows that 84% of cases had dyslipidemia whereas only 52% controls were found to have dyslipidemia and the difference between the two was statistically significant (P < 0.05).

71% of patients in the study group were from 41- 60 years of age group. The mean age of the subjects in study and control groups was 49.8 ± 9.1 years, and 49.6 ± 9.0 years respectively. The difference of mean age between two groups was not statistically significant (p> 0.05) (Table 2). Statistically significant difference (p<0.05) was found when the mean values of HbA1c, FBS, PPBS, S. Total Cholesterol, S. Triglycerides, LDL-C, HDL-C of cases and control groups, were compared as shown in the Table 2.

Table 1: Dyslipidemia prevalence in study groups

	Cases (n=100)	Controls (n=100)	P-value
Dyslipidemia	84	52	< 0.001
Normal lipid profile	16	48	

Table 2: Comparison of various parameters between cases and control groups

Parameters (mean± SD)	Cases (n=100)	Controls (n=100)	P-value
Age (yrs)	49.8±9.1	49.6±9.0	0.78
HbA1c (%)	8.82±1.8	5.81±0.4	0.0001
FBS (mg/dl)	153.03±33.4	107.44±7.1	0.0000
PPBS (mg/dl)	261.37±60.4	167.8±10.4	0.0000
Serum Total Cholesterol (mg/dl)	232.13±45.9	205.84±30.7	0.0004
Serum Triglyceride (mg/dl)	198.32±59.8	161.12±30.6	0.0001
Serum LDL-C (mg/dl)	156.86±39.3	134.74±35.3	0.0001
Serum HDL-C(mg/dl)	37.04±7.9	42.06±7.3	0.001

FBS= Fasting blood glucose, PPBS=Post prandial blood glucose, LDL-C=Low density lipoprotein-cholesterol, HDL-C=High density lipoprotein-cholesterol

Table 3 shows the frequency of raised blood sugar parameters (HbA1c>6.5, FBS>126mg/dl, PPBS>200mg/dl) and dyslipidemia (S. Cholesterol-total, S. Triglycerides, LDL-C, HDL-C) in cases and control groups. The statistically significant (p<0.05) difference was found between the two groups, when compared. Elevated Serum TG (77% of cases) was the most common dyslipidemia followed by decreased level of HDL-C in 71% of cases.

Table 3: Frequency of parameters of raised blood sugar and dyslipidemia in cases and controls

Parameters	Cases (n=100)	Controls (n=100)	P-value
HbA1c (>6.5%)	100	0	0.0000
FBS (>126mg/dl)	84	0	0.0000
PPBS (>200mg/dl)	99	1	0.0000
Serum Total Cholesterol (>200mg/dl)	66	44	0.002
Serum Triglycerides (>150mg/dl)	77	39	0.001
Serum LDL-C (>130mg/dl)	66	43	0.0002
Serum HDL-C(<40mg/dl)	71	59	0.001

HbA1c =Glycosylated haemoglobin, FBS= Fasting blood glucose, PPBS=Post prandial blood glucose, LDL-C=Low density lipoprotein-cholesterol, HDL-C=High density lipoprotein-cholesterol

A significant positive correlation was found between glycemic parameters (HbA1c, FBS and PPBS) and lipid profile parameters (Serum Triglyceride, Serum Total Cholesterol, Serum LDL Cholesterol) with $p < 0.05$. But insignificant correlation was found with Serum HDL-Cholesterol ($p > 0.05$) as shown in Table 4.

Table 4: Correlation of lipid profile with diabetic parameters

Lipid profile Parameters	HbA1c		FBS		PPBS	
	r	p	r	p	r	p
Serum Total Cholesterol	0.640	<0.001	0.616	<0.001	0.643	<0.001
Serum Triglycerides	0.678	<0.001	0.605	<0.001	0.664	<0.001
Serum LDL-C	0.486	<0.001	0.489	<0.001	0.501	<0.001
Serum HDL-C	0.025	>0.05	0.066	>0.05	0.037	>0.05

HbA1c =Glycosylated haemoglobin, FBS= Fasting blood glucose, PPBS=Post prandial blood glucose, LDL-C= Low density lipoprotein-cholesterol, HDL-C= High density lipoprotein-cholesterol

Discussion

It is an established fact that chronic hyperglycemia leads to complications in patients with diabetes due to its injurious health effects through various mechanisms like: dyslipidemia, platelet activation, and altered endothelial metabolism.[17,18] Appearance of dyslipidemia is commonly found in T2DM patients and the most common lipid abnormalities found in T2DM patients are increased TG and small dense LDL-C and decreased HDL-C cholesterol which is a major risk factor for CVD as described in various studies.[19,20] In the present study the mean value of plasma glucose levels, HbA1c, TC and TG were elevated in the cases (T2DM patients) as compared to the controls and HDL-C was lower in cases (T2DM patients). Similarly a study by Venkatesh et al[21] showed that the mean values of TC, VLDL-C and LDL-C were higher in T2DM patients than the normal range and HDL-C was lower in T2DM patients. Also a study done by Yuthika Agrawal et al showed that the mean plasma glucose levels, HbA1c, TC and TG were significantly raised in the diabetics as compared to those in the controls.[22]

In the present study the prevalence of dyslipidemia in two groups i.e., cases and controls was 84% and 52% respectively. Also hyper-triglyceridemia was the most common type of dyslipidemia and was found in 77% of the cases as compared to 39% in the controls with statistically significant difference (P<0.05). This was followed by decreased level of HDL-C which was seen in 71% of the cases and 59% of the controls and the difference was also found to be statistically significant (P<0.05). 66% of the cases were found to have elevated total cholesterol and elevated LDL-C each (P<0.05). Also a case control study done by Yuthika Agrawal et al showed that high TG (56%) was most commonly present in diabetics.[22] Similarly a study done by Gamit DN[23] showed the prevalence rates for high Total Cholesterol (TC) and Triglycerides (TG) were 13.6% and 41.4% respectively. The prevalence rates for high LDL-C, very high LDL-C and low HDL-C in the diabetic subjects were 8.6%, 5.0% and 72.9% respectively. In a study Bali K et al found dyslipidemia in T2DM patients and the most commonly elevated lipid was LDL-C (59.3%) followed by triglycerides (57.2%) and total cholesterol (36.5%). The HDL-C was decreased in 34.4% T2DM patients.[24]

A positive correlation was observed between the glycemic parameters (HbA1c levels, Fasting blood glucose and post prandial blood glucose) and lipid factors (Triglycerides, LDL-C, Total Cholesterol) and a weak negative correlation was observed between glycemic parameters and HDL-C, in our study, which is similar with the results of a study done by Yuthika Agrawal et al in 2014.[22]

Conclusion

The present study demonstrated that dyslipidemia is present in the diabetic patients with elevated levels of serum total cholesterol, elevated triglyceride and elevated low density lipoprotein (LDL-C) and reduced levels of high density lipoprotein (HDL-C) and it indicates that diabetic patients were more prone to cardiovascular diseases. Hence patients with T2DM needs regular monitoring of blood glucose level and serum lipid profile along with proper medication and preventive measures like life style modification and healthy diet pattern to decrease the risk of cardiovascular diseases.

Conflict of Interest: None.

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