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Study of dyslipidemia in Type 2 Diabetes Mellitus and its correlation with glycemic parameters

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Abstract

Introduction: Diabetes Mellitus (DM), caused by relative or definite insulin deficiency or by insulin resistance is a progressive chronic disease leading to hyperglycemia, characterized by disorders of carbohydrate, lipid and protein metabolism. Dyslipidemia is a well-known factor leading to atherosclerosis. Diagnosis and treatment of dyslipidemia in patients with diabetes is important in reducing the high morbidity and mortality from macrovascular disease.

Thus we designed a study to assess the prevalence and pattern of dyslipidemia in type 2 DM, and also to determine its association with biochemical markers of diabetes mellitus.

Materials & Methods: This was a non-interventional and observational study. We included 100 T2DM patients (50 males & 50 females) in our study. Convenient sampling technique was used for the present study. The patients and their legally acceptable representative were given complete information about the study, its benefits, and its future prospects. Patient's detailed physical and clinical examination, history was taken. Each of the subjects were evaluated for body weight, height, BMI and for WC.

Results: 43 (43%) patients had optimal LDL cholesterol level, 29 (29%) patients had near optimal/above optimal LDL cholesterol level, 25 (25%) patients had borderline high LDL cholesterol level, 2 (2%) patients had high LDL cholesterol level and 1 (1%) patient had very high LDL cholesterol level. 28 (28%) patients in our study were having deranged LDL cholesterol level (>130 mg/dl). 65 (65%) patients had total cholesterol level in the desirable range, 28 (28%) patients had borderline high total cholesterol level and 7 (7%) patients had high total cholesterol level. 35 (35%) patients in our study were having deranged total cholesterol (> 200 mg/dl). In our study we found negative but statistically non-significant correlation of HbA1c and PPBS with HDL cholesterol.

Conclusion

On the basis of our study we conclude that dyslipidemia in diabetes mellitus is very common and it is associated with poor glycemic control. Thus, we recommend routine estimation of lipid profile along with strict glycemic control and healthy life style modification among the patients with T2DM.

Key words: diabetes mellitus, dyslipidemia, HbA1c

Introduction

Diabetes Mellitus (DM), caused by relative or definite insulin deficiency or by insulin resistance is a progressive chronic disease leading to hyperglycemia, characterized by disorders of carbohydrate, lipid and protein

metabolism. Even though there is a worldwide increase in the prevalence of both T1DM and T2DM, it is estimated that there will be an increase in the incidence of T2DM, the major causes being obesity and decreased physical activity.[1] Atherosclerotic process begins in prediabetic state thus, glycemic control is insufficient to prevent cardiovascular events.[2-4] High total cholesterol and LDL Cholesterol levels as well as low HDL Cholesterol concentrations are important factors for athero-thrombotic vascular diseases and they can be reduced with proper treatment. During this process continuing over years, atherosclerosis can lead to mortal events; beginning with endothelial dysfunction, than pursuing with fatty streak composition and ending with atherosclerotic plaque.[5] Plaque rupture will lead to events like myocardial infarction and cerebrovascular accidents. Dyslipidemia is a well-known factor leading to atherosclerosis. In multiple studies, reducing LDL Cholesterol levels leads a decrease in cardiovascular event frequencies.[6,7] T2DM is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities, including reduced HDL cholesterol, a predominance of small dense LDL particles, and elevated TGs. These changes might be related with insulin resistance and increased FFAs levels. Asian Indians have abnormal lipid ratios, lower HDL cholesterol values and have abnormal TGs and TGs rich lipoproteins. The 'LOW HDL' syndrome and 'normolipidemic' dyslipidemia among native dyslipidemia may result from either over-production or lack of clearance of the lipoprotein particles, or may be related to other defects in the apolipoproteins or metabolic enzyme deficiencies. The pathways and means of lipid metabolism in the human reflect interactions of genetics, complex biochemical processes influenced by medical disorders, medications, and/or environmental factors. Diagnosis and treatment of dyslipidemia in patients with diabetes is important in reducing the high morbidity and mortality from macrovascular disease.

Thus we designed a study to assess the prevalence and pattern of dyslipidemia in T2 DM, and also to determine its association with biochemical markers of diabetes mellitus.

Materials and Methods

The present study entitled "Pattern of Dyslipidemia in type 2 Diabetes Mellitus and its correlation with diabetes parameters" was carried out on type 2 diabetic patients in the Department of Medicine, AIIMS, Bhopal.

Study design: This was a non-interventional and observational study.

Study period: November 2017 to February 2018.

Study area: Department of General Medicine, AIIMS, Bhopal

Study population: All T2DM patients coming to the OPD or admitted in the IPD of hospital during the study period formed our study population.

Sample size and sampling technique: We included 100 T2DM patients (50 males & 50 females) in our study. Convenient sampling technique was used for the present study.

Inclusion criteria: All adult Patients fulfilling the ADA criteria for diagnosis of T2DM.

Exclusion criteria: Acute metabolic complications, Acute illnesses, Chronic alcoholics, Hypothyroidism, Liver disorders, Renal disease (of non-diabetic etiology), Known inherited disorders of lipids, Patient on drug interfering with lipid metabolism

Methodology: The patients and their legally acceptable representative were given complete information about the study, its benefits, and its future prospects. After getting their approval for participation in the study, a voluntary written informed consent was obtained. Patient's detailed physical and clinical examination, history was taken. Each

of the subjects were evaluated for body weight, height, BMI and for WC.

Definitions

Dyslipidemia: National Cholesterol Education Programme (NCEP) guidelines[8] were used for definition of dyslipidemia as follows:

Hypercholesterolemia– serum cholesterol levels ≥200 mg/dl.

Hypertriglyceridemia – serum triglyceride levels ≥150 mg/dl.

Low HDL cholesterol – HDL cholesterol levels <40 mg/dl for men and <50 mg/dl for women.

High LDL cholesterol – LDL cholesterol levels ≥ 130 mg/dl.

Isolated low HDL cholesterol – HDL cholesterol levels ≥ 40 mg/dl (male) and ≥ 50 mg/dl (female) without hypertriglyceridemia or hypercholesterolemia.

Blood pressure was measured using standard Sphygmomanometer and mean of three readings was taken as average systolic and diastolic blood pressure. Fundus examination was done by indirect ophthalmoscopy. Fasting peripheral venous blood samples was obtained for estimation of fasting blood sugar levels and serum lipid estimation (S. TGs, S. Cholesterol, serum HDL cholesterol and Serum LDL cholesterol).Venous blood samples was also obtained for HbA1c, PPBS, RFT and LFT. Complete blood count, Serum Thyroid Stimulating Hormone and urine examination was done in all cases. Electrocardiography (ECG), USG for whole abdomen was done for all the patients.

Statistical analysis: The data from the customized proforma was entered into the Microsoft Excel sheet and then transferred to relevant statistical software package for analysis (SPSS). Correlation results between two groups were obtained by applying pearson correlation coefficient, comparison study between two group were done by Unpaired‘t’ test. P value of < 0.05 was taken as statistically significant.

Results

The table 1 shows the distribution of patients according to age.

Table 1: Distribution of patients according to age

(N=100)

Age Group	Number	Percentage
21-40 years	10	10.0
41-60 years	59	59.0
61-80 years	30	30.0
>80 years	1	1.0
Total	100	100.0

There were 10 (10%) patients in the age group 21-40 years, 59 (59%) patients in the age group 41-60 years, 30 (30%) in the age group 61-80 years and 1 (1%) patient was in the age group more than 80 years. Majority of the patients were in the age group 41-80 years.

Table 2: Distribution of patients according to gender

(N=100)

Gender	Number	Percentage
Female	50	50.0
Male	50	50.0
Total	100	100.0

The above table shows the distribution of patients according to gender. There was equal distribution of males and females in our study group constituting 50% each.

Table 3: Distribution according to LDL cholesterol

(N=100)

LDL cholesterol	Number	Percentage
Optimal (<100)	43	43.0
Near optimal / above optimal (100-129)	29	29.0
Borderline high (130-	25	25.0

159)		
High (160-189)	2	2.0
Very high (>190)	1	1.0
Total	100	100.0

The above table shows the distribution of patients according to LDL cholesterol. The ATP III Classification was used for LDL. According to it, 43 (43%) patients had optimal LDL cholesterol level, 29 (29%) patients had near optimal/above optimal LDL cholesterol level, 25 (25%) patients had borderline high LDL cholesterol level, 2 (2%) patients had high LDL cholesterol level and 1 (1%) patient had very high LDL cholesterol level.

28 (28%) patients in our study were having deranged LDL cholesterol level (>130 mg/dl).

Majority of the patients had optimal or near optimal /above optimal LDL cholesterol level.

Table 4: Distribution according to HDL cholesterol

(N=100)

HDL cholesterol	Number	Percentage
Low (<40)	57	57.0
Normal (40-60)	43	43.0
High (>60)	0	0.0
Total	100	100.0

The above table shows the distribution of patients according to HDL cholesterol. The ATP III Classification was used for HDL. According to it, 57 (57%) patients had low HDL cholesterol level and 43 (43%) patients had normal HDL cholesterol level.

Majority of the patients had low HDL cholesterol level.

Table 6: Distribution according to Triglycerides

(N=100)

Triglycerides	Number	Percentage
Normal (<150)	31	32.0
Borderline high (150-199)	26	26.0
High (200-499)	43	42.0
Very high (≥ 500)	0	0.0
Total	**100**	**100.0**

The above table shows the distribution of patients according to triglyceride level. The ATP III Classification was used for triglyceride level. According to it, 31 (31%) patients had normal triglyceride level, 26 (26%) patients had borderline high triglyceride level and 43 (43%) patients had high triglyceride level. 69 (69%) patients in our study were having deranged triglyceride levels (> 150 mg/dL).

Table 7: Distribution according to Total cholesterol

(N=100)

Total Cholesterol	Number	Percentage
Desirable (<200)	65	65.0
Borderline high (200-239)	28	28.0
High (>240)	7	7.0
Total	100	100.0

The above table shows the distribution of patients according to total cholesterol. The ATP III Classification was used for total cholesterol. According to it, 65 (65%) patients had total cholesterol level in the desirable range, 28 (28%) patients had borderline high total cholesterol level and 7 (7%) patients had high total cholesterol level. 35 (35%) patients in our study were having deranged total cholesterol (> 200 mg/dl).

Table 8: Correlation of FBS with LDL, HDL, Triglycerides and Total Cholesterol

(N=100)

Pair wise	'r' Value	P Value	Significance
FBS to	0.055	0.585,	Very weak,

LDL		NS	positive, statistically non-significant correlation
FBS to HDL	0.002	0.984, NS	Very weak, positive, statistically non-significant correlation
FBS to TGs	0.057	0.568, NS	Very weak, positive, statistically non-significant correlation
FBS to Total cholesterol	0.037	0.708, NS	Very weak, positive, statistically non-significant correlation

The above table shows the correlation of FBS with LDL, HDL, Triglycerides and Total Cholesterol.

Table 9: Correlation of PPBS with LDL, HDL, Triglycerides and Total Cholesterol

(N=100)

Pair wise	'r' Value	P Value	Significance
PPBS to LDL	0.035	0.726, NS	Very weak, positive, statistically non-significant correlation
PPBS to HDL	-0.021	0.835, NS	Very weak, negative, statistically non-significant correlation
PPBS to TGs	0.104	0.299, NS	Very weak, positive, statistically non-significant correlation
PPBS to Total cholesterol	0.026	0.791, NS	Very weak, positive, statistically non-significant correlation

The above table shows the correlation of PPBS with LDL, HDL, Triglycerides and Total Cholesterol.

Table 10: Correlation of HbA1c with LDL, HDL, Triglycerides and Total Cholesterol

(N=100)

Pair wise	'r' Value	P Value	Significance
HbA1cto LDL	0.1	0.322, NS	Very weak, positive, statistically no-significant correlation
HbA1cto HDL	-0.029	0.774, NS	Very weak, negative, statistically non-significant correlation
HbA1cto TGs	0.027	0.789,NS	Very weak, positive, statistically non-significant correlation
HbA1c to Total	0.120	0.232,NS	Very weak, positive,

cholesterol			statistically non-significant correlation

The above table shows the correlation of HbA1c with LDL, HDL, Triglycerides and Total Cholesterol.

Discussion

In our study we included a total number of 100 T2 DM cases out of which 50 were male and 50 were female, during the study period from November 2017 to February 2018. The purpose of our study was to study the occurrence and pattern of dyslipidemia in T2DM, to see its correlation with diabetes parameters.

In our study, prevalence of the dyslipidemia was 96% which was nearly similar to results observed by Shrewastwa et al.[9] However it was significantly higher compared to results observed by Bali et al.[10] and Sheth et al.[11] This discrepancy may be due to high abnormal BMI of our subjects.

In our study, dyslipidemia was mainly seen with HDL cholesterol (81%) and with TGs (69%), while only 28 % patients had high LDL cholesterol and 35% had hypercholesterolemia.

In our study, the female diabetic patients had more deranged lipid profile as compared to male diabetic patients.

In our study we found negative but statistically non-significant correlation of HbA1c and PPBS with HDL cholesterol, somehow explaining very high prevalence of low HDL cholesterol with poor glycemic control.

In our study FBS, PPBS and HbA1c had positive correlation with LDL cholesterol, TGs and total cholesterol which was statistically non-significant, also favouring that poor glycemic leads to development of dyslipidemia. Dixit et al.[12] observed same correlation with TGs and total cholesterol which was statistically significant.

Conclusion

On the basis of our study we conclude that dyslipidemia in diabetes mellitus is very common and it is associated with poor glycemic control. Thus, we recommend routine estimation of lipid profile along with strict glycemic control and healthy life style modification among the patients with T2DM.

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