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STUDY OF DYSLIPIDEMIA IN TYPE 2 DIABETES MELLITUS PATIENTS WITH AND WITHOUT ASSOCIATED HYPOTHYROIDISM

Medicine

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ABSTRACT

Aim: The present study was undertaken with the aim to evaluate the association between serum lipid profile and hypothyroidism in patients with type 2 diabetes mellitus (T2DM).

Methodology: This cross-sectional study was conducted on 50 T2DM patients with hypothyroidism (Group I) and 50 T2DM patients without hypothyroidism (Group II) meeting inclusion and exclusion criteria.

Results: There was a significant increase in serum lipid levels namely triglycerides (TG), total cholesterol (TC), low-density lipoprotein (LDL), very-low density lipoprotein (VLDL) and glycated hemoglobin (HbA1c) and significant decrease in serum high-density lipoprotein (HDL) levels in Group I (T2DM with hypothyroidism) as compared to Group II (T2DM without hypothyroidism).

Conclusion: There is marked derangement in lipid profile parameters in patients suffering from both diabetes and hypothyroidism.

KEYWORDS

Type 2 diabetes mellitus, hypothyroidism, dyslipidemia

Introduction

Dyslipidemia in individuals with type 2 diabetes mellitus (T2DM) is very common, with a prevalence of 72–85%.[1,2] Lipid abnormalities observed in patients with type 2 diabetes play a central role in the development of atherosclerosis. These lipid abnormalities are not only quantitative, but also qualitative and kinetic in nature.[3-5]

The prevalence rate of thyroid dysfunction is much higher among diabetic population and estimated to be from 6.9% to 16%.[6,7] Diabetes mellitus appears to influence thyroid function in two sites; firstly at the level of hypothalamic control of thyroid stimulating hormone (TSH) release and secondly at the conversion of thyroxine (T4) to tri-iodothyronine (T3) in the peripheral tissue.[8]

Thyroid function significantly affects lipoprotein metabolism as well as some cardiovascular disease (CVD) risk factors, thus influencing overall CVD risk.[9-11] Indeed, even within the normal range of TSH values, a linear increase in total cholesterol (TC), LDL and triglycerides (TGs) and a linear decrease in HDL levels has been observed with increasing TSH.[12]

The present study was undertaken with the aim to evaluate the association between serum lipid profile and hypothyroidism in patients with T2DM.

Materials & methods

The study was conducted on 50 type 2 DM patients with hypothyroidism (Group I) and 50 type 2 DM patients without hypothyroidism (Group II), attending outdoor or admitted in medicine department in Guru Nanak Dev Hospital, Amritsar.

T2DM patients of age 20 to 80 years with or without hypothyroidism were included. Patients with pre-existing chronic liver disease in form of cirrhosis or hepatocellular carcinoma, chronic kidney disease, acute illness, gestational diabetes and on treatment with drugs interfering with thyroid function were excluded.

All cases were investigated for CBC (complete blood count), FBS (fasting blood sugar), RBS (random blood sugar), two hour plasma glucose, HbA1c, fasting lipid profile such as serum cholesterol, serum triglycerides, HDL, LDL, VLDL, thyroid profile (T_3, T_4 and TSH), renal function tests such as blood urea, serum creatinine, ultrasound abdomen and Electrocardiogram (ECG).

Patients were diagnosed to have diabetes mellitus on the basis of American Diabetes Association (ADA) criteria. A fasting plasma glucose (FPG) ≥126 mg/dL, a two hours plasma glucose ≥200 mg/dL or HbA1C ≥6.5% warrants diagnosis of diabetes mellitus. Plasma glucose levels were estimated by Glucose oxidase-peroxidase method. HbA1c was estimated from the whole blood by ion exchange chromatography. T3, T4 and TSH values were estimated in the fasting blood sample by competitive enzyme-linked immunosorbent assay (ELISA).

Lipid profile estimation was performed using a semi-automated biochemistry analyzer. Total cholesterol was estimated by an enzymatic method (Cholesterol oxidase-Peroxidase), triglycerides also by an enzymatic method (Glycerol phosphate oxidase-Peroxidase). HDL cholesterol was estimated by the phosphotungstic acid precipitation method. LDL cholesterol and VLDL cholesterol were calculated using Friedewald's formula. Descriptive statistics was calculated using Excel 2010 (Microsoft, Redmond, WA, USA). Statistical analysis was performed using SPSS 21.0 statistical package (SPSS, Chicago, IL). A one-way analysis of variance (one-way ANOVA), chi- square test and student's t- test was used. Association between variables was assessed by Pearson's coefficient of correlation. Data was presented as mean±standard deviation (SD). p value less than 0.05 was considered significant.

Results

The mean age of all patients in Group I (T2DM with hypothyroidism) was 57.76±10.08 years and in Group II (T2DM without hypothyroidism) was 59.2±10.52 years. Males were 19 (38%) and females were 31 (62%) in Group I whereas In Group II, males were 18 (36%) and females were 32 (64%). The age and sex distribution in two groups did not reveal any statistically significant difference, hence both groups were comparable. The differences in baseline clinical characteristics in patients between two groups are shown in Table 1.

Table 1 Differences in baseline clinical characteristics in patients between two groups

Parameters	Group I	Group II	P value
Number of patients (M/F)	50 (19/31)	50 (18/32)	0.836
Age (years)	57.76±10.08	59.2±10.52	0.486
Haemoglobin (gm/dL)	9.87±1.95	10.1±2.3	0.67
TLC (cells/mm^3)	7742±2104.43	8061±2351	0.476
Platelet count (lakhs/μL)	1.86±0.42	2.08±0.77	0.073
FBS (mg/dL)	180.96±66.68	154.2±47.62	0.023

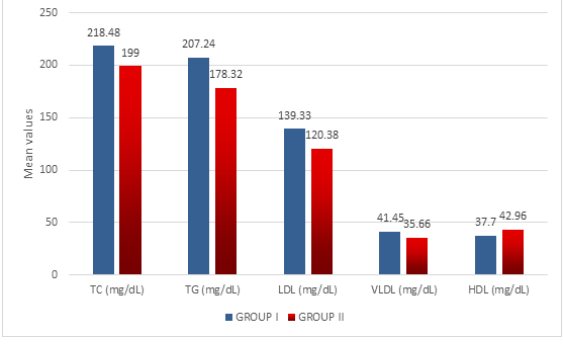
RBS (mg/dL)	259.14±84.53	229.6±58.98	0.046
2 hour plasma glucose (mg/dL)	238.24±33.77	223.22±33.77	0.028
HbA1c (%)	9.014±1.54	7.93±1.34	<0.001
T_3 (ng/mL)	0.85±0.4	1.06±0.15	0.001
T_4 (µg/dL)	5.74±2.84	7.31±1.40	<0.001
TSH (µIU/mL)	16.14±12.198	2.72±1.0	<0.001
Blood urea (mg/dL)	36.04±7.41	35.26±7.75	0.611
Serum creatinine (mg/dL)	1.098±0.24	1.077±0.294	0.699

36 subjects (72%) out of 50 had dyslipidemia in Group I (T2DM with hypothyroidism) as compared to Group II (T2DM without hypothyroidism), where 26 subjects (52%) had abnormal lipid profile which was statistically significant (p value=0.039). Levels of TC (52% vs 32%) (p value= 0.043), LDL (72% vs 48%) (p value= 0.014), TG (68% vs 40%) (p value= 0.005), VLDL (68% vs 42%) (p value= 0.005) and HbA1c (84%vs 52%) (p=0.001) were elevated more in Group I than in Group II. The difference was statistically significant. HDL was low in 70% of patients in Group I and in 42% of patients in Group II. This difference was statistically significant (p value=0.025). The mean HbA1c in Group I was 9.01± 1.54% and in Group II was 7.93± 1.34% and the difference was statistically highly significant (p value<0.001). There was significant increase in levels of TG (207.24±54.99 mg/dL vs. 178.32±59.83 mg/dL), TC (218.48±47.79 mg/dL vs. 199±49.26 mg/dL), LDL (139.33±45.49 mg/dL vs. 120.38±45.53 mg/dL), VLDL (41.45±10.997 mg/dL vs. 35.66±11.967 mg/dL) and HbA1c (9.01±1.54% vs. 7.93±1.34%) and significant decrease in HDL levels (37.70±7.93 mg/dL vs. 42.96±8.13 mg/dL) in Group I (T2DM with hypothyroididm) as compared to Group II (T2DM without hypothyroidism) (p<0.05).

TABLE 2 COMPARISON OF MEAN LIPID PROFILE BETWEEN TWO GROUPS

	GROUP I	GROUP II	p value
	Mean±S.D.	Mean±S.D.	
TC (mg/dL)	218.48± 47.79	199.00± 49.26	0.048
TG (mg/dL)	207.24± 54.99	178.32± 59.83	0.013
LDL (mg/dL)	139.33± 45.49	120.38± 45.532	0.04
VLDL (mg/dL)	41.45± 10.997	35.66± 11.967	0.013
HDL (mg/dL)	37.70± 7.93	42.96± 8.13	0.001

FIGURE 1 COMPARISON OF MEAN LIPID PROFILE IN GROUPA



There was a positive correlation between HbA1c and TSH among patients with diabetes and hypothyroidism (r=0.306, p=0.031). In these patients, the correlation between TSH and TG was r= 0.281, p= 0.048; between TSH and TC was r= 0.326, p= 0.020; TSH and LDL was r= 0.327, p= 0.020 and between TSH and VLDL was r= 0.281, p= 0.048; between TSH and HDL was r= -0.297, p= 0.036. This showed that the serum TSH levels were positively correlated with TG, TG, LDL and VLDL levels and negatively correlated with serum HDL levels in diabetic hypothyroid patients.

Table 3 Correlation of TSH with HbA1c and lipid profile in group I (T2DM with hypothyroidism)

	TSH (µIU/mL)	
	r value	p value
HbA1c (%)	0.306	0.031
TC (mg/dL)	0.326	0.020
TG (mg/dL)	0.281	0.048
LDL (mg/dL)	0.327	0.020
VLDL (mg/dL)	0.281	0.048
HDL (mg/dL)	-0.297	0.036

FIGURE 2 SCATTER PLOT SHOWING CORRELATION BETWEEN TSH AND TC IN GROUP I (T2DM WITH HYPOTHYROIDISM)

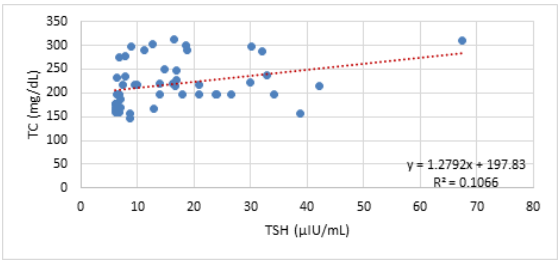
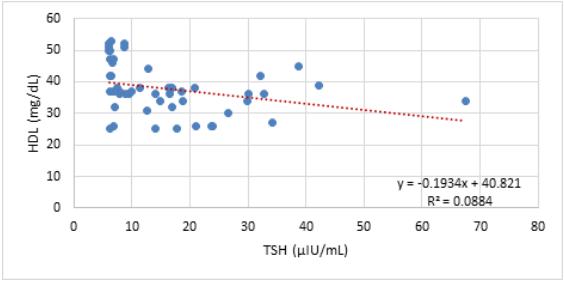


FIGURE 3 SCATTER PLOT SHOWING CORRELATION BETWEEN TSH AND HDL IN GROUP I (T2DM WITH HYPOTHYROIDISM)



Discussion

Both diabetes mellitus and hypothyroidism are major endocrine disorder leading to hyperlipidemia.[13] Diabetes affects thyroid function tests to variable extents. Also, thyroid hormones play role in the regulation of carbohydrate metabolism and pancreatic function.

In this study, we found dyslipidemia in 72% in patients with T2DM and hypothyroidism whereas its prevalence was 52% in patients with T2DM without hypothyroidism. Nirmala et al in their study had shown similar results (73.3% vs 33.3%).[14]

Among the lipids, serum levels of TC (52% vs 32%), LDL (72% vs 48%), TG (68% vs 40%) and VLDL (68% vs 42%) were elevated more in patients with both T2DM and hypothyroidism than in patients with T2DM alone. Afkhami-Ardekani M et al in their study had shown similar results where T2DM patients with thyroid dysfunction had higher proportion of TC (52.3% vs 43.6%), LDL cholesterol (71.8% vs 64.3%) and TG (84.3% vs 81.2%) compared with euthyroid group.[15]

It was found that HDL-cholesterol was low in 70% of patients with T2DM and hypothyroidism and in 42% of patients in T2DM without hypothyroidism. In study done by Nirmala et al, HDL was low in 46.6% of patients in the group with thyroid dysfunction and in patients in the group without thyroid dysfunction, HDL was low only in 13.6%.[14] These results were comparable to that of our study.

It was observed in our study that there was significant increase in serum levels of lipids namely TG (207.24±54.99 mg/dL vs. 178.32±59.83 mg/dL), TC (218.48±47.79 mg/dL vs. 199±49.26 mg/dL), LDL (139.33±45.49 mg/dL vs. 120.38±45.53 mg/dL) and VLDL (41.45±10.997 mg/dL vs. 35.66±11.967 mg/dL) in patients with T2DM and hypothyroidism as compared to patients with T2DM without hypothyroidism. Similar results were shown by Katayini R and Benglorkar VM in their study in which there was a significant difference of the mean TG (232.77±20.1 mg/dL vs 286.33±40.14 mg/dL), TC (209.56±45.59 mg/dL vs 199.48±41.55 mg/dL), LDL (132±23.74 mg/dL vs 153.67±24.61 mg/dL) between euthyroid diabetics and hypothyroid diabetics.[16]

It was also found that the mean HDL cholesterol was significantly lower in patients with T2DM and hypothyroidism as compared to patients with T2DM without hypothyroidism (37.70±7.93 mg/dL vs 42.96±8.13 mg/dL). Afkhami-Ardekani M et al in their study had shown similar results where there was a significant difference between

HDL (37.69±16.78 mg/dL vs. 43.79±20.25 mg/dL) between two groups.[15]

The HbA1c levels were elevated in 84% population in patients with T2DM and hypothyroidism as compared to 52% in patients with euthyroid diabetics. Similar results were shown by Afkhami-Ardekani M et al in which there was higher prevalence of elevated levels HbA1c (83.8%) in T2DM patients with hypothyroidism as compared to 35.9% in T2DM patients without hypothyroidism.[15]

The mean HbA1c levels were significantly higher in patients with both T2DM and hypothyroidism as compared to patients with T2DM without hypothyroidism (9.01±1.54% vs 7.93±1.34%). Katyayini R and Benglorkar VM in their study also showed significant difference between mean HbA1c in hypothyroid diabetics (9.33±1.23%) as compared to that in euthyroid diabetics (7.95±1.45%).[16]

It was also found that there was a positive correlation between HbA1c and TSH among patients with diabetes and hypothyroidism ®= 0.306 , p= 0.031). Similar results were shown in study by Afkhami-Ardekani M et al in which there was a positive correlation between TSH and, HbA1c (r = 0.2, P = 0.001) and TG (r = 0.04, P = 0.05).[15]

In our study, the serum TSH levels were positively correlated with TG, TC, LDL and VLDL levels and negatively correlated with serum HDL levels in patients with T2DM and hypothyroidism. In study done by Shashi et al, the serum TSH levels were positively correlated with TC, VLDL, LDL and negatively correlated with HDL in hypothyroid diabetic patients, however correlation between serum TG and TSH was statistically non significant.[17]

Conclusion

The study finally concluded that there is marked derangement in lipid profile parameters in patients suffering from both diabetes and hypothyroidism. There is an increase in TC/TG/LDL and VLDL levels and reduction in HDL levels among these patients. So, regular screening for thyroid profile in T2DM and routine assessment of lipid profile parameters in these patients should be incorporated in the clinical practice guidelines to reduce the risk of cardiovascular diseases

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