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Original Article

Impact of hypothyroidism on lipid metabolism: a cross sectional study at a tertiary care centre of central india

Anil Kumar Jain[a], Sangita Paneri[b]*, Rajeev Lohokare[c], Purnima D.Sarkar[d]

Department of Biochemistry, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001

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ABSTRACT

aim: Overt and subclinical hypothyroidism has an adverse effect on the serum lipid profile that may predispose to the development of atherosclerotic disease. Controversies still prevail even a substantial number of studies were done to assess the lipid profile status of hypothyroid patients. So, the present study was aimed to evaluate the alteration in lipid profile of hypothyroid patients that might be helpful for their clinical management. methods: A total of 100 subjects were included in the study. After conducting thyroid function tests, subjects with TSH levels >6.0 μ IU/ml were considered as hypothyroid. These were further divided into sub-clinical hypothyroid (n=40, TSH- 6.1 to 9.9μIU/ml) and overt hypothyroid (n=28, TSH ≥ 10 μ IU/ml) group. Subjects having euthyroid state (n=32, TSH≤ 6.0μIU/ml) were taken as controls. The patients and controls were matched by ethnic group. results: Mean serum total cholesterol, triglyceride and LDL cholesterol levels in hypothyroid cases and euthyroid controls were 240.2±60.01vs. 145.86±23.12mg/dL, 215.28±100.73vs. 98.87±40.17mg/dL and 150.96±59.26 vs. 72.43±26.89 mg/dL respectively with p values < 0.001 whereas HDL cholesterol was found significantly decreased in cases compared to controls (48.59±11.65vs. 56.75±11.70 mg/dL with p value < 0.05).conclusion: Results of our study suggest that overt hypothyroidism is associated with dyslipidemia, which may lead to increased cardiac risk. So, lipid profile must be done routinely in these patients.

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Introduction

Hypothyroidism is defined as a deficiency of thyroid activity. It results from reduced secretion of both T4 and T3 [1].Biochemically decrease in T4 and T3 concentrations lead to hyper secretion of pituitary TSH and an amplified increase in serum TSH levels. This is a key laboratory finding, particularly in the early detection of thyroid failure.

Subclinical hypothyroidism (SCH), defined as the clinical status of elevated serum thyrotropin (TSH) levels, with normal levels of thyroxin (T4) and triiodothyronine (T3), is a more common disorder than overt hypothyroidism with a prevalence of 1.4 – 7.8% in older populations and even greater percentiles among women [2, 3]. SCH has been detected with increasing frequency in recent years and is causing major controversies concerning management and treatment. SCH is usually detected during biochemical screening for nonspecific symptoms by TSH measurements, especially in tertiary care hospitals [4].

Overt and subclinical hypothyroidism has an adverse effect on the serum lipid profile that may predispose to the development of atherosclerotic disease. Controversies still prevail even a substantial number of studies were done to assess the lipid profile status of hypothyroid patients [5-10]. So, we have conducted this study in our population for evaluation of lipid profile status in patients with various degrees of hypothyroidism that might be helpful for clinical management of hypothyroid patients with altered lipid profile.

MATERIALS & METHODS

This cross sectional study was conducted in the department of Clinical Biochemistry of M. G. M. Medical College, Indore (M. P.) to evaluate the lipid profile status of hypothyroid patients. A total of 100 subjects fulfilling the inclusion and exclusion criteria's were taken from the outdoor clinics of Maharaja Yashwant Rao Hospital, Indore (M.P.).Hypothyroidism was diagnosed by clinical history, physical examinations and relevant laboratory investigations. Clinically and biochemically newly diagnosed hypothyroid patients of both sexes, ages between 30 to 65 years, with no history of thyroxine and hypolipidemic drugs in the last 3 (three) months were included in the study. Patients with chronic renal failure, diabetes mellitus, liver diseases, pregnancy and age less than 30 and more than 65 years were excluded. Subjects receiving drugs known to affect lipid metabolism were also excluded from the study. The study protocol was approved by the local ethical committee and a verbal informed consent was taken from all the subjects.

* Corresponding Author : **Dr. Sangita Paneri**
Associate professor
MGM Medical College, Indore
Phone: 08871387787
Email: drpaneri17@gmail.com

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Materials and Methods:

Collection and preparation of sample

5 ml of fasting venous blood with full aseptic precautions without anticoagulant was collected and allowed it to clot. Clotted blood was centrifuged and clear serum was collected. Fresh serum samples were taken. Serum was checked for hemolysis and if hemolyzed then that serum was discarded. Serum was analyzed for, total cholesterol (TC), triglycerides (TG), HDL-C, TSH, T4 and T3.

Analytical methods

The concentration of serum total cholesterol, HDL cholesterol and triglycerides were measured by a timed-end point method using diagnostic kits by BioSystem Diagnostics (Irungattukottai, TN) on Biosystem BA400 autoanalyzer (Germany). LDL cholesterol was calculated by Friedwald's formula [11]. Data collected was subjected to standard statistical analysis, such as confidence interval (CI), correlation (r) and t –test.

Serum TSH, T4 and T3 were assayed using automated chemiluminescence immunoassay by Autobio (China).

After conducting thyroid function tests, subjects having euthyroid state (n=32, TSH≤ 6.0μIU/ml) were taken as controls. Patients with TSH levels >6.0 μ IU/ml were considered as hypothyroid. These patients were further divided into sub-clinical hypothyroid (n=40, TSH- 6.1 to 9.9μIU/ml) and overt hypothyroid (n=28, TSH ≥10 μ IU/ml).

Statistical analysis

Data was maintained on excel spread sheet. Analysis was performed using SPSS software. Descriptive data were expressed as mean and standard deviation of all variables. Mean values of the findings were compared among and between groups. Means of data in patients and controls were compared using the t-test. Pearson correlation coefficient test was done to evaluate the correlation of biochemical parameters with the severity of hypothyroidism. Differences were considered statistically significant at $p<0.05$.

RESULTS

Table1. Shows the comparison of the lipid profile parameters between the cases and the controls. Mean total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides level in cases were higher than controls. HDL cholesterol was found significantly decreased in cases compared to controls.

Table-1: Lipid profile of study subjects

Parameters	Case (hypothyroid) group (n=68)	Control (euthyroid) group (n=32)	p value
TC (mg/ml)	240.2±60.01	145.86±23.12	< 0.001
TG(mg/ml)	215.28±100.73	98.87±40.17	<0.001
HDL-C(mg/ml)	48.59±11.65	56.75±11.70	<0.05
LDL-C(mg/ml)	150.96±59.26	72.43±26.89	<0.001

a=Total Cholesterol

b=Triglyceride

c=High density lipoprotein

d=Low density lipoprotein

Table2. Shows lipid profile parameters in different groups of cases. There was no significant difference among the groups for serum total cholesterol, but a rising trend was found from Group A to Group C. For HDL cholesterol levels, significant differences were observed among the groups with maximum in Group B and minimum in Group C. Mean LDL cholesterol levels showed significant difference among the groups with maximum in Group C and minimum in Group A. Mean serum triglyceride levels showed no significant difference among groups.

Table 2: Lipid profile in different sub-groups of hypothyroid group

Parameters	SCH group (n=40)	OH group (n=28)	P value
TC (mg/ml)	213.84±43.25	253.76±59.21	> 0.05
TG(mg/ml)	225.35±88.65	220.16±110.39	>0.05
HDL-C(mg/ml)	50.36±9.74	46.21±10.56	<0.05
LDL-C(mg/ml)	120.64±45.11	72.43±26.89	<0.05

a=Sub clinical hypothyroidism
b=Overt hy6pothyroidism
c=p value <0.05 is statistically significant

Table3. Shows correlation between serum TSH level and lipid profile parameters of cases. Total cholesterol and LDL cholesterol were found to maintain significant positive correlation with serum TSH. But TSH was found to show no correlation with serum HDL cholesterol and serum triglycerides level.

Table 3: Correlation between TSH level and lipid profile of cases

	Parameters	r value	p value
TSH (in mIU/L)	TC (mg/ml)	0.220	<0.05
	TG(mg/ml)	-0.140	>0.05
	HDL-C(mg/ml)	-0.250	>0.05
	LDL-C(mg/ml)	0.260	<0.05

a=Total Cholesterol
b=Triglyceride
c=High density lipoprotein
d=Low density lipoprotein
e=Thyroid stimulating hormone

DISCUSSION

In our study, mean total cholesterol, LDL cholesterol and triglycerides were found significantly increased whereas HDL cholesterol was found significantly decreased in cases compared to controls. Jung16 found mean plasma total cholesterol and LDL cholesterol levels elevated in hypothyroid cases than in normal controls (12). Keyes & Heimberg, Laker & Mayes found triglyceride level elevated in hypothyroid patients [13, 14]. So, our study findings were consistent with the previous studies done by other investigators.

Thompson, Abrams & Grundy have stated decreased activity of LDL receptors as the main cause of hypercholesterolemia in hypothyroidism [15, 16].

Studies done by Diekman, and Tsmihodimos and showed average serum concentration of HDL higher in subclinical or clinical hypothyroidism [17, 18]. Abrams & Grundy have shown in their studies reduction of HDL cholesterol in hypothyroidism [16]. So, our study is consistent with some of the studies and inconsistent with the others. Increase in HDL cholesterol concentration is mainly due to increased concentration of HDL 2 particles. Dullaart have stated that decreased activity of CETP (cholesteryl ester transport protein) results in reduced transfer of cholesteryl esters from HDL to VLDL, thus increasing HDL cholesterol levels [19]. Lam have stated that in hypothyroid patients decreased activity of hepatic lipase leads to the decreased catabolism of HDL 2 particles leading to increased HDL [20]. So, decrease in HDL cholesterol level in our study might be due to increased activity of CETP and lipoprotein lipase in hypothyroid patients.

There was no significant difference in serum total cholesterol concentrations among the groups, but a rising trend was found from SCH Group to OH Group making our results apparently consistent with the severity of hypothyroidism. This theme seems to be further consolidated by increasing LDL concentrations in line with the increasing severity of hypothyroidism from SCH Group to OH Group as revealed in our study.

Regarding triglycerides levels, no significant difference was found among the groups, indicating no changing impact on triglycerides metabolism with severity of hypothyroidism. Hypertriglyceridemia is attributable to the decreased activity of lipoprotein lipase, which results in a decreased clearance of triglyceride-rich lipoproteins [21].

Total cholesterol and LDL cholesterol were found to maintain significant positive correlation with serum TSH. But TSH was found to show no correlation with serum HDL cholesterol and serum triglycerides level.

CONCLUSIONS

Our study concludes that overt hypothyroidism is a major cause of secondary dyslipidemia as it is associated with increase in the levels of total cholesterol, LDL-C, and triglycerides which may lead to increased cardiac risk.

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