RESEARCH ARTICLE

Comparative study of lipid profile anomalies in thyroid dysfunction

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ABSTRACT

Background: Thyroid hormones play a major role in the metabolism of lipids and deranged lipid profile can, in turn, result in various cardiovascular diseases. The association between elevated LDL and coronary artery disease (CAD) risk is well established. However, the correlation between the changes in the thyroid hormone levels and lipid profile needs to be studied in detail.

Aim and Objectives: This study was conducted with the objective of estimating the serum levels of total cholesterol, triglycerides, LDL, HDL, and VLDL in hyperthyroid and hypothyroid individuals and to compare it with the euthyroid population.

Materials and Methods: A cross-sectional study was conducted among 165 study subjects who included newly diagnosed patients with untreated hypothyroidism and hyperthyroidism and controls were selected from the bystander population. Serum TSH, serum total cholesterol, serum LDL, serum triglycerides, serum VLDL and serum HDL were assessed. The baseline characteristics and blood investigation values were compared among the three groups using ANOVA and were expressed in mean ± standard deviation. The association between the various parameters in different groups was evaluated using Pearson’s correlation coefficient. \( P < 0.05 \) was considered statistically significant.

Results: Among the 165 subjects studied, majority belonged to the age group of 30–39 years and majority of the study subjects were females. The mean serum levels of total cholesterol (216.86 ± 21.99 mg/dl), LDL (142.49 ± 19.09 mg/dl), triglycerides (156.31 ± 26.33 mg/dl) and VLDL (31.26 ± 5.25 mg/dl) were significantly higher in the hypothyroid group compared to the control subjects (\( P = 0.000 \)).

The mean serum levels of total cholesterol, LDL, triglycerides, and VLDL were significantly higher in the hypothyroid group compared to the control subjects (\( P = 0.000 \)).

Conclusion: Hypothyroidism demonstrates an atherogenic lipid profile with a positive correlation with serum TSH values and lipid profile. Since altered lipid profile can predispose to cardiovascular diseases, screening for these in individuals with thyroid dysfunction especially hypothyroidism needs to made mandatory.

KEY WORDS: Lipid Profile Anomalies; Thyroid Dysfunction; Hypo and Hyperthyroidism

INTRODUCTION

Thyroid hormones form a crucial element in the proper metabolism of lipids and hence a deficiency or an excess of thyroid hormones has a great impact on the metabolism of lipids as well as on many other cardiovascular risk factors. It is well known that alterations in thyroid function result in changes in the composition and transport of lipoprotein.\(^1\) Hyperthyroidism promotes a hypermetabolic state characterized by increased resting energy expenditure, weight loss, reduced cholesterol levels, increased lipolysis, and gluconeogenesis. Conversely, hypothyroidism is associated with hypometabolism characterized by reduced resting energy expenditure, weight gain, increased cholesterol levels, reduced lipolysis, and reduced gluconeogenesis.\(^2\)

An altered serum lipid profile over a long period of time can increase the risk of atherosclerotic cardiovascular diseases, mainly due to variations in the lipid profile parameters.\(^1\)
The association between elevated LDL and coronary artery disease (CAD) risk is well established. Lowering LDL levels reduces the risk of CAD events and the mortality associated with it. Low levels of HDL and high levels of triglycerides are particularly strong risk factors for CAD.[3]

High serum LDL is implicated in hypercholesterolemia that occurs in hypothyroidism.[4-6] On the other hand, the serum levels of total cholesterol, LDL-C, ApoB, and Lp(a) usually decrease in patients with clinical or subclinical hyperthyroidism. This occurs as a result of increased LDL receptor gene expression resulting in enhanced LDL receptor-mediated catabolism of LDL particles.[7,8] In addition to this, hyperthyroidism results in enhanced LDL oxidability, which is related to FT4 levels.[9]

This study was conducted with the aim of estimating the serum levels of total cholesterol, triglycerides, LDL, HDL, and VLDL in hyperthyroid and hypothyroid individuals and to compare it with euthyroid population. We also looked at the correlation of lipid profile with serum TSH in these three study groups.

MATERIALS AND METHODS

A cross-sectional comparative study was conducted, after obtaining necessary Institutional Ethics Committee approval (IEC Ref No. GMCKKD/RP 2016/EC/174), in the outpatient department of Government Medical College. The study subjects included newly diagnosed patients with untreated hypothyroidism and hyperthyroidism and controls were selected from the bystander population as per the inclusion and exclusion criteria. After obtaining informed written consent, detailed history was taken, and clinical examinations were done.

Blood samples were collected and the following parameters were assessed: Serum TSH, serum total cholesterol, serum LDL, serum triglycerides, serum VLDL and serum HDL. All study variables were analyzed using descriptive statistical methods such as frequencies and percentage for categorical variables and mean with standard deviation or median with interquartile range for continuous variables. The baseline characteristics and blood investigation values were compared among the three groups using ANOVA and were expressed in mean ± standard deviation. The association between the various parameters in different groups was evaluated using Pearson’s correlation coefficient. \( P < 0.05 \) was considered statistically significant.

RESULTS

Among the 165 subjects studied, the majority belonged to the age group of 30 to 39 years and the majority of the study subjects were females. There was no significant difference between the age and gender of the three study groups [Table 1].

The mean serum levels of total cholesterol, LDL, triglycerides, and VLDL were significantly higher in the hypothyroid group compared to the control subjects, but there was no significant difference in these values between the hyperthyroid and control groups. In case of mean serum HDL values, there was a significant difference between the hyperthyroid group and euthyroid group but failed to show any significant difference between hypothyroid and euthyroid group [Table 2].

A positive correlation was observed between TSH levels and various parameters of serum lipid profile including total cholesterol, triglycerides, LDL, and VLDL in the hypothyroid group, while there was no significant association of these parameters among the hyperthyroid group [Table 3 and Figures 1-5].

DISCUSSION

Thyroid hormones influence the metabolism of lipids by inducing the enzyme HMG COA reductase and also regulating the gene expression for LDL receptors. Other components in lipid profile are also markedly influenced by thyroid hormones.[10] The study found that there is a significant difference in the serum cholesterol, serum LDL, serum triglyceride, serum HDL, serum VLDL and the thyroid status of the study subjects. Significant correlations were found between total cholesterol, LDL, triglyceride, VLDL, and the hypothyroid status of the study subjects in this study.

In this study, there was a significant difference between the mean values of serum cholesterol among hypothyroid and

<table>
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</table>
Lipid profile anomalies in thyroid dysfunction

While in hyperthyroidism there is decreased activity of lipoprotein lipase (LPL), which results in decreased clearance of triglyceride-rich lipoproteins.\textsuperscript{[21]} While in hyperthyroidism there is an increase in the activity of lipoprotein lipase.\textsuperscript{[12]} In our study, the mean VLDL was significantly different between hypothyroid and euthyroid group. Studies conducted by F Khan show elevated VLDL levels in hypothyroid subjects but, their findings in subjects with hyperthyroidism were unchanged levels of serum VLDL.\textsuperscript{[13]} In our study, there was no significant elevation in Serum HDL levels in the hypothyroid group compared to the control group (p = 1.000), but, in comparison, there is a significant decrease in HDL levels in the hyperthyroid group (p = 0.000). Duntas observed that plasma HDL concentrations may be normal or decreased in hyperthyroidism, and normal or even elevated in severe hypothyroidism.\textsuperscript{[22]} This occurs partly because of the regulation of CETP (Cholesterol Ester Transfer Protein) and Hepatic lipase activity by thyroid hormone.\textsuperscript{[23]} The serum TSH levels showed significant positive correlation with Total cholesterol (r = 0.697, P = 0.000), while positively correlated with LDL (r = 0.553, P = 0.00) and triglycerides (r = 0.674, P = 0.000) and VLDL (r = 0.674, P = 0.000) levels, and no significant correlation with the HDL level in the hypothyroid group. Sharma et al., in their study, found that there is a positive significant correlation between TSH and total cholesterol, LDL, triglycerides, and VLDL, which is similar to our study.\textsuperscript{[23]} Bhat et al., also

![Figure 1: Scatter plot showing correlation between total cholesterol and serum TSH in the hypothyroid group. Positive correlation. Correlation coefficient r = 0.697 (P value = 0.000)](image)
found in their study that triglycerides along with other components of metabolic syndrome were significantly associated with thyroid dysfunction. This study shows that hypothyroidism demonstrates an atherogenic lipid profile.

The prevalence of thyroid dysfunction is universal and has been known to influence carbohydrate and lipid metabolism significantly. This study was able to find the relevant significant associations and correlations. Based on the results of this study screening for dyslipidemia can be initiated in all patients with thyroid dysfunction. One of the limitations of the study is the sample size and sampling technique implemented for collecting the samples. A cohort study with a better sample size and sampling technique can further strengthen the findings of this study.

**CONCLUSION**

This study showed that there is a positive correlation with serum TSH levels and various lipid parameters such as total cholesterol, TG, LDL, and VLDL among the hypothyroid group. Mean HDL level was found to be significantly high among the hyperthyroid group when compared with the euthyroid group. Altered lipid profile as a result of thyroid dysfunction can predispose to cardiovascular diseases. Hence, screening for these parameters can reduce the risk of the development of cardiovascular diseases among patients.
with altered thyroid functions, especially those with low thyroid hormone levels.

REFERENCES


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