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Serum lipids in sub clinical hypothyroidism: A retrospective study

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ABSTRACT

Background: Thyroid hormones are a potent regulator of metabolism, playing a crucial role in regulating energy expenditure and in key physiological mechanisms. Their prominent and well-known role is an increase in basal energy expenditure obtained by acting on carbohydrate, protein and lipid-metabolism. Hypothyroidism is relatively common and is associated with an unfavorable effect on lipid metabolism. Few studies reveal subclinical hypothyroidism to be a risk factor for increased incidence of lipid abnormalities and resulting in cardiovascular abnormalities.
Aim: Hence study was taken up to find the association of serum lipids with subclinical hypothyroidism.
Methodology: This was a retrospective study conducted in the department of Biochemistry, Malla Reddy hospital. Biochemically identified 102 subjects of Subclinical hypothyroidism subjects between 15-50 years and evaluated for lipid profile were included in the study. In our study, the mean serum total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol expressed in mg/dl were 189.98±24.16, 166.48±17.4, 37.62±2.89 and 121.34±27.31mg/dl respectively. 41 subjects out of 102 had higher total cholesterol, triglycerides and LDL cholesterol with lesser HDL cholesterol from the acceptable limits.
Conclusion: We conclude that impaired lipid parameters are associated with subclinical hypothyroidism. Hence a regular screening for lipid profile should be considered in subclinical hypothyroidism for early diagnosis, prevention and management of cardiovascular complications.

1. Introduction

The thyroid gland is vital in the human body because of its ability to synthesize the hormones triiodothyronine (T3) and tetra iodothyronine (T4), necessary for appropriate energy level and an active life.[1]

Thyroid hormones are a potent regulator of metabolism, playing a crucial role in regulating energy expenditure and in key physiological mechanisms, such as growth and development.[2] It influences all major metabolic pathways. Their prominent and well-known role is an increase in basal energy expenditure obtained by acting on carbohydrate, protein and lipid-metabolism.

The significant effects on lipid metabolism include: (a) increased utilization of lipid substrates; (b) increase in the synthesis, mobilization and storage in adipose tissue; (c) increase in the concentration of non esterified fatty acids (NEFA); and (d) increase of lipoprotein-lipase activity.[3]

Hypothyroidism is the most commonly occurring thyroid disorders worldwide. It is defined as a insufficiency of thyroid activity. It results from reduced secretion of both T4 and T3. Hypothyroidism is relatively common and is associated with an unfavorable effect on lipid metabolism. Hypothyroidism, characterized by low serum thyroid hormone levels, is associated with reduced metabolism, reduced lipolysis, weight gain, reduced cholesterol clearance, and elevated serum cholesterol.[3]

Alteration in lipid profile is a common observation in subjects with thyroid dysfunction.[1] Hypercholesterolemia

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is favored due to the hormone deficit and to the decreased activity of the lipoprotein lipase.[4] In hypothyroid patients the most frequent lipid abnormality is increased serum cholesterol, mainly due to an increased concentration of low density lipoproteins (LDL). Elevation of very low-density lipoproteins (VLDL) and high density lipoproteins (HDL Cholesterol) have also been reported.[4]

Subclinical hypothyroidism is a asymptomatic condition with serum thyroid stimulating hormone level above the upper limit of normal in presence of normal level of serum thyroxine and tri iodothyronine. Subclinical hypothyroidism if left untreated leads to overt hypothyroidism.

Few studies have revealed subclinical hypothyroidism to be a risk factor for increased incidence of lipid abnormalities and resulting in cardiovascular abnormalities.[5,6] However, in Indian context, there is very less literature to substantiate the association of subclinical hypothyroidism with biochemical derangements in lipids. Hence this study was taken up to find the association of serum lipids with subclinical hypothyroidism.

2. Materials and Methods

This was a retrospective study conducted in the department of Biochemistry, Malla Reddy hospital from September 2018 to August 2019 after obtaining ethical clearance from the institutional ethics committee. The data was collected from the records of clinical biochemistry laboratory and medical records department of the hospital. Biochemically identified 102 subjects of Subclinical hypothyroidism subjects between 15-50 years and evaluated for lipid profile were included in the study. Serum Total T3, Total T4 and TSH were evaluated by Chemiluminescence immunoassay using fully automated Beckman Access 2 CLIA. The following methods were employed to estimate serum lipid parameters.

Total Cholesterol: Cholesterol Oxidase Peroxidase

HDL: Direct enzymatic method

LDL: Direct enzymatic method

Triglycerides: Glycerol phosphate oxidase- peroxidase method

VLDL: By calculation [Total cholesterol-HDL-VLDL]

2.1. Inclusion criteria

Asymptomatic subjects of 15-50 years age group with normal Total T3 (0.87-1.78ng/ml), normal Total T4 (6.09-12.23 micro grams/dl) and TSH values between 5.5-10 micro IU/L and evaluated for fasting lipid profile

Exclusion criteria: Cases of overt hypothyroidism, Diabetes mellitus, Cardio vascular diseases, hepatic and renal impairment, on medication for thyroid disorders and patients on drugs impairing lipid profile.

The data were recorded and expressed as mean and standard deviation. Data was analyzed with SPSS package version 17 by calculating percentage analysis.

Table 1: ATP III Reference range for serum total cholesterol, triglycerides, LDL cholesterol and HDL Cholesterol (mg/dL)

Total Cholesterol	<200 Desirable 200-239 Borderline high ≥240 High
LDL Cholesterol	<100 Optimal 100-129 Near optimal/above optimal 130-159 Borderline high 160-189 High ≥190 Very high
HDL Cholesterol	<40 Low ≥60 High

3. Results

In our study, out of 102 subjects 15 were male and 87 were female. The mean age of the subjects was 39.73±5.78 years. The mean age of males and female were 43.86±3.4 and 35.6±4.81 years respectively.

On analysis, the mean serum TSH, Total T3 and Total T4 were 7.61±1.34 micro IU/L, 0.97±0.28 ng/ml and 8.14±1.98 micro grams/dl respectively.

In our study, the mean serum total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol expressed in mg/dl were 189.98±24.16, 166.48±17.4, 37.62±2.89 and 121.34±27.31mg/dl respectively.

In the study, 46 subjects had serum total cholesterol above the normal range. 61 subjects had higher triglyceride value and 72 subjects had higher LDL cholesterol value.

10 subjects had HDL cholesterol below the normal range and 11 had higher VLDL cholesterol value. 41 subjects out of 102 had higher total cholesterol, triglycerides and LDL cholesterol with lesser HDL cholesterol from the acceptable limits.

Table 2: Gender wise distribution of subjects and mean age in both gender

	Male	**Female**
Total subjects(100)	15	87
Mean age(in years)	43.86±3.4 years	35.6±4.81years

Table 3: Different biochemical parameters and their serum values expressed as Mean and Standard Deviation

Parameters	**Value expressed as mean and SD**
TSH	7.61±1.34 micro IU/L
Total T3	0.97±0.28 ng/ml
Total T4	8.14±1.98 micro grams/dl
Total cholesterol	189.98±24.16mg/dl
Triglycerides	166.48±17.4mg/dl
High Density Lipoprotein	37.62±2.89mg/dl
Low Density Lipoprotein	121.34±27.31mg/dl

Table 4: Number of subjects with parameters beyond the normal reference range

Parameters	Percentage of subjects with abnormal value
Total cholesterol	46 (Above normal range)
Triglycerides	61 (Above normal range)
LDL	72 (Above normal range)
HDL	47 (Below normal range)

4. Discussion

Determinining serum lipid levels at an early stage of SCH is crucial, since they represent atherogenic LDL particles and are better indicators for dyslipidemia in SCH. Consequences of SCH include risk of progression to overt hypothyroidism and adverse effects on cardiovascular system, which include diastolic dysfunction, ischemic heart disease (IHD), heart failure and the overall increase in mortality.[7]

In this retrospective study, out of 102 subjects 46 had total cholesterol levels above the normal range even though the mean for all the subjects with subclinical hypothyroidism was 189.98±24.16.

This is in accordance with the study by Luboshitzky[8] in 2010, among lipid profile levels only TG was higher in patients with SCH, compared with healthy cases.

In the study, mean triglycerides level was166.48±17.4 and 61 subjects were above the range of normal. Our study is in accordance with studies by Qasim et al.[9] and Luboshitzky et al.[8]

The LDL Cholesterol in our study was121.34±27.31 and 72 subjects were above the normal range. This was in accordance to similar studies done by Haghi et al.[10] and Al Syed et al.[11]

The mean HDL cholesterol was37.62±2.89 and 47 subjects were below the normal range. This study was in accordance to study by Haghi et al.[10]

During the study, 41 subjects with subclinical hypothyroidism had increased total cholesterol, LDL cholesterol and triglycerides with decreased HDL cholesterol from the acceptable limits and this was similar to study done by Monzani et al.,[12] Kvetny et al.[13] and Hak et al.[14]

Some reports have suggested that even high normal TSH values may adversely affect serum lipid and lipoprotein levels. It has been estimated that an increase in the serum TSH level of1microIU/ml associated with a rise in serum total cholesterol concentration 3.5mg/dl in women and 6.2mg/dl in men.[15]

Mubashir et al in his study has investigated the relationship between SCH and lipid abnormalities and has found that SCH is associated with high TG,TC and LDL-C. These effects are more pounced in patients with TSH >10miu/L The increased risk of CHD has also been associated with mild SCH in a recent meta analysis of observational studies.[16]

Thyroid hormones regulate the expression of enzymes involved in steps of lipid metabolism leading to the development of alteration of lipids in thyroid disease. Increase in serum total cholesterol and low-density lipoprotein cholesterol (LDL) in hypothyroidism might be due to several changes in the synthesis, metabolism, and mobilization of fat. Thyroid hormones modulate 3-hydroxy-3-methyl-glutaryl-coenzyme A (HMG-COA) reductase activity in the liver and, thus, decrease serum cholesterol. In addition, thyroid hormones increase LDL receptors on fibroblasts, liver, and other tissue, and they increase absorption of cholesterol from the intestine. These hormones also alter levels of high-density lipoprotein (HDL) cholesterol and hepatic lipase activity, and affect the excretion of cholesterol from the intestine by bile acids.[17]

Lin et al. in 2005 proposed that the thyroid hormones stimulate expression of uncoupling proteins in the mitochondria of fat and skeletal muscle through modulated adrenergic receptors by enhancing the responsiveness of catecholamines. Thereby thyroid hormones influence the body weight, thermogenesis, lipolysis and fat metabolism indirectly culminating in atherogenic risk.[18]

5. Conclusion

In the present study, even though the mean total cholesterol was not above the normal range still a majority of the subjects had impaired lipid parameters. We conclude that impaired lipid parameters are associated with subclinical hypothyroidism. Hence a regular screening for lipid profile should be considered in subclinical hypothyroidism for early diagnosis, prevention and management of cardiovascular complications.

Limitation of our study was that we did not evaluate the parameters in comparison with euthyroid subjects. Further an associated analysis by matching with age, gender and other demographic factors would have provided the results eliminating possible confounders.

6. Sources of Funding

Nil.

7. Conflict of Interest

None.

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