



Study of Apolipoprotein B and Lipid Profile in the Assessment of Cardiovascular Risk in Cases of Hypothyroidism of North Coastal Andhra Pradesh Region

Authors

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Abstract

Introduction: Hypothyroidism is a condition with decreased levels of thyroid hormones and elevated levels of Thyroid stimulating Hormone. Hypercholesterolemia is the characteristic feature of hypothyroidism and is also predisposing factor of atherosclerosis.

Patients and Methods: 50 patients of hypothyroidism and 50 healthy subjects are included in this study.

Results: Serum Total cholesterol, Triglycerides, LDL cholesterol, and Apo B are increased, serum HDL cholesterol are decreased in patients with hypothyroidism.

Conclusion: Hypothyroid patients show dyslipidemic profile and Apo-B is significantly high and they are improved markers for prediction of cardiovascular risk in hypothyroidism.

Introduction

Thyroid disorders are the most prevalent endocrine disorders. Thyroid hormones nearly influence all metabolic pathways. Hypothyroidism is continuing to pose a significant health challenge in both developing as well as developed world.¹ Hypothyroidism is a deficiency of thyroid activity. It results from reduced secretion either of total thyroxine (T4) and triiodo-thyronine. A biochemical decrease in T3 and T4 concentrations leads to hypersecretion of pituitary thyroid stimulating hormone (TSH) with an increase in serum TSH levels. It is a crucial laboratory finding, particularly in the early detection of thyroid failure.

About 42 million people in India have thyroid disorders. The risk of hypothyroidism in females (15.8%) is three times more as compared to males (5.01%).² There is around 11 % prevalence of hypothyroidism in India. Approximately 15% of

patients with subclinical hypothyroidism develop overt disease annually. In India, the prevalence has been found to vary from 0.5-3.9% for subclinical and 1.2-1.3% for overt hypothyroidism. Hypothyroidism account for 2% of all cases of secondary dyslipidemia. Thyroid hormones have profound effects on synthesis, mobilization, and metabolism of lipids.^{3,4} In hypothyroid patients, the most frequent lipid abnormality is hypercholesterolemia, mainly due to an increased concentration of low-density lipoproteins (LDL). Plasma triglycerides are increased because of enhanced esterification of fatty acids at the hepatic level.⁵ Moreover, a decrease in lipoprotein lipase activity is found in hypothyroidism, decreasing the clearance of triglyceride- rich lipoproteins. Apo lipoprotein B present in LDL, VLDL, and IDL is considered as atherogenic. Increased levels of Apo B in plasma is directly related to the development of

CAD. Dyslipidemia is a well - known risk factor for cardiovascular diseases. The risk of coronary heart disease and other forms of atherosclerotic vascular diseases rises with increasing cholesterol concentration. Early diagnosis and timely management can reduce the mortality and morbidity of dyslipidemic cardiovascular disorders. Extensive large scale randomized trials have shown that lowering total cholesterol and LDL cholesterol reduces the risk of cardiovascular events like angina, myocardial infarction, and stroke.⁶ Many studies have strongly elucidated that Apo B estimation has come out to be a better marker of vascular disease and a better guide to the adequacy of statin treatment than any cholesterol index.⁷ Therefore, patients with thyroid dysfunction must be tested for lipid profile and Apo B to assess the risk of cardiovascular diseases.

Patients and Methods

Case control study was conducted between September 2018 to August 2019 in the Department of Biochemistry, King George Hospital, Visakhapatnam. 100 subjects with age group 20 to 60 years were selected and they are divided into two groups, fulfilling inclusion and exclusion criteria.

Group A: 50 clinically diagnosed and biochemically confirmed cases of hypothyroidism

Group B: 50 age and sex matched healthy controls with normal thyroid function tests.

Data collection: After proper Institutional Ethical Clearance and informed written consent from the participants. Every effort was made not to disclose the identity of participants. Overnight fasting venous blood samples were drawn from patients of hypothyroidism and normal healthy subjects with dry disposable syringe and needle by vene puncture under aseptic conditions. The blood samples were allowed to clot for 15min, and then they were centrifuged to separate the serum. T3, T4, TSH were quantitatively estimated by Chemiluminiscence (CLIA) method on fully automated analyser (Beckman Access-2 Immunoassay system). Serum lipid profile was estimated on fully automated analyser (Beckman Coulter AU 480) using the

enzymatic kit methods for Total cholesterol, Triglycerides and HDL cholesterol. LDL cholesterol by using Friedwald's formula. Serum Apo B estimation done using a semi auto analyser (Erba) by immunoturbidimetric method at 340nm wave length.

Inclusion Criteria

Study Group

- 1) All subjects are clinically diagnosed and biochemically confirmed cases of hypothyroidism.
- 2) Patients attending Endocrinology department, King George Hospital regularly over a period of one year (Sep 2018 to Aug 2019).
- 3) All subjects age range between 20 to 60 years.
- 4) Signed informed consent to participate in the study.

Control Group

- 1) All subjects age range between 20 to 60 years.
- 2) Signed informed consent to participate in the study.

Exclusion Criteria

1. Patients using hypolipidemic drugs, antihypertensives, steroids and women on oral contraceptive pills or hormonal preparations.
2. Patients with renal disease, hepatic disease, cardiovascular disease, cerebrovascular accident, diabetes mellitus, neoplasia and pregnancy.
3. Patients with history of smoking, chronic alcoholism and any concomitant acute or chronic infection.

Results

The mean age in years of cases is 41.64 ± 10.73 and, controls are 38.36 ± 9.82 . The maximum number of participants falls in the age group of 31-40 years.

Table 1: Age Distribution of Subject studied

Age in Years	Control group		Test group	
	No	%	No	%
20-30	13	26	9	18
31-40	17	34	17	34
41-50	14	28	12	24
51-60	6	12	12	24
Total	50	100	50	100
Mean \pm SD	38.36 \pm 9.82		41.64 \pm 10.73	

The total number of males in cases is 11, and controls are 10. The total number of females in cases is 39, and controls are 40. There are more females when compared to males in both cases and controls.

Table 2: Gender Distribution of Subject studied

Gender	Control group		Test group	
	No	%	No	%
Male	10	20	11	22
Female	40	80	39	78
Total	50	100	50	100

Table 3: Lipid profile parameters in Control and Test group

Study parameters	Control Group	Test group	Significance
TC	156 \pm 24.239	218.54 \pm 35.884	t=10.212 p<0.0001
TG	109.5 \pm 24.734	185.98 \pm 50.835	t= -9.559 p<0.0001
VLDL	21.884 \pm 4.997	37.196 \pm 10.167	t= -9.557 p<0.0001
HDL	44.72 \pm 4.611	33.82 \pm 3.879	t=12.791 p<0.0001
LDL	70.38 \pm 21.337	148.764 \pm 34.618	t= -13.630 p<0.0001
APO B	65.0 \pm 19.53	167.94 \pm 20.271	t= -25.859 p<0.0001

Table 4: Thyroid profile parameters in cases and controls

Study parameters	Control group	Test group	Significance
T3	140.68 \pm 30.335	87.116 \pm 30.79	t=8.763 p<0.0001
T4	8.386 \pm 1.584	5.665 \pm 2.683	t=6.175 p<0.0001
TSH	2.181 \pm 0.883	15.577 \pm 11.199	t= -8.432 p<0.0001

Discussion

Hypothyroidism, a common endocrine disorder affecting adults of all ages, is due to the relative deficiency in thyroid hormones. It is the most familiar pathologic hormone deficiency among endocrine disorders. It is estimated that 2% - 5% of SCH has a propensity to progress to overt hypothyroidism in 2 – 3 years. Thyroid hormones (T4 and T3) regulate the rate of metabolism, affect growth, and modulate energy utilization by increasing the basal metabolic rate, increasing oxygen consumption, and facilitating heat production. Thyroid hormones have significant effects on synthesis, mobilization, and metabolism of lipids. The cardiovascular system is a definite target of thyroid hormone, and when the secretion of the hormone is chronically altered, this is accompanied by profound changes in cardiovascular hemodynamics. The abnormalities in myocardial contractility and changes in the lipoprotein profile are frequently documented in hypothyroid patients. Our study was undertaken to determine the serum lipid disturbances in hypothyroidism and to assess the significance of Apolipoprotein B levels in hypothyroidism. It was found that hypothyroidism is associated with significant alterations in the lipid profile. In the present study, there were 39 females and 11 male subjects in the cases, while the controls consisted of 40 females and 10 males. The mean age of the cases was 41.64 \pm 10.73 years, while in controls, it was 38.36 \pm 9.82. The maximum number of patients are of the age group of 31–40. This study shows female predominance with 79% of total patients. The higher prevalence of hypothyroidism suggests a possible role of estrogen in the pathophysiology of thyroid function. In the present study, female predominance is more than the male of total cases. Similar findings were reported by Bhandopadhyay et al.⁸ The mean TC of cases is 218.54 \pm 35.884, and controls are 156 \pm 24.239. The mean LDL of cases is 148.764 \pm 34.618, and controls are 70.38 \pm 21.337. The mean TG's of cases is 185.98 \pm 50.835, and controls are 109.56 \pm 24.734, the mean HDL of cases is 33.82 \pm 3.879, and controls are 44.72 \pm 4.611, the mean VLDL of cases

is 37.196 ± 10.167 , and controls are 21.884 ± 4.997 with a statistically significant p value < 0.0001 . The mean Apo B of cases is 167.94 ± 20.271 , and controls are 65 ± 19.53 with a statistically significant p-value of < 0.0001 . The results in the present study are in accordance with the studies of Desai JP et al.⁹, William J. Hueston et al.¹⁰ and Priyanka G. Rakshasmare et al.¹¹ In the present study, the mean \pm SD levels of TSH were significantly higher in hypothyroid patients than that of healthy euthyroid subjects. The mean T3, T4 and TSH of cases and controls are 87.116 ± 30.79 , and 140 ± 30.335 , 5.665 ± 2.683 , and 8.386 ± 1.58 , 15.577 ± 11.199 , and 2.181 ± 10.883 with a statistically significant p value < 0.0001 . A study conducted in Andhra Pradesh on female patients suggests that the effect of hypothyroidism on the serum concentration of lipids is more marked in patients with higher serum TSH levels. Hence lipid abnormalities exhibit great individual variability, and there might be a potential link between hypothyroidism and atherosclerosis.¹² Most of the existing data support that thyroid disease is associated with increased cardiovascular risk, which is mainly attributed to hemodynamic alterations as well as to a high risk of atherosclerosis.

Limitations of the study

The present study was conducted on a small group of patients with hypothyroidism and lipid abnormalities were assessed. In future we can think of conducting the study on a larger scale and estimate the probability of patients who are at risk to develop cardiac problems. By doing so we can decrease the mortality rate of sudden cardiac death.

Conclusion

The present study was done to see the effect of hypothyroidism on Lipid profile especially the Apolipoprotein B which is one of the most atherogenic lipid parameter. The various parameters like TC, TG, LDL, VLDL, were significantly elevated in the study group and also there was a significant reduction in the HDL levels in the study group. Apo B levels were found to be significantly

higher number of cases than in controls. All the above derangements confirm that hypothyroidism contributes to the development of atherosclerosis by making the lipid profile more atherogenic. Thyroid hormone deficiency represents a well-known cause of hyperlipidemia both in overt and subclinical hypothyroid patients. The reported frequencies of dyslipidemia vary considerably due to differences in patients' selection, sex and age distribution, and degree of hypothyroidism. It was concluded that patients with hypothyroidism will present a dyslipidemic picture and thus will increase the risk of cardiovascular complications. As such biochemical screening for thyroid dysfunction is of paramount importance in all dyslipidemic patients, as well as in patients with unexpected improvement or worsening of their lipid profile and treatment should be done at the earliest.

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