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Lipid Disorders in Thyroid Diseases

Neha A. Shah, MD

Associate Professor, Department of Medicine, GCS Medical College Hospital and Research Center, Ahmedabad, India

***Corresponding author:** Neha A. Shah
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Abstract **Original Research Article**

Background: Thyroid dysfunction is a major public health problem in India. Hypercholesterolemia and raised serum low density lipoprotein (LDL) cholesterol levels have been found to be associated with Thyroid disorders. Thus, altered lipid profile plays a supportive role in diagnosis of thyroid dysfunction. The aim of our study was to find out the variations of thyroid hormones and lipid profile in hyperthyroidism and hypothyroidism in patients admitted at GCS Medical College and Research Institute, Ahmedabad with their clinical implications compared to the published studies so far. ***Materials and Methods:*** This was a hospital based prospective cum retrospective study at GCS Medical College and Research Institute, Ahmedabad. The variables collected were age, gender, T4, T3, TSH, fT4, Total Cholesterol, LDL and Triglyceride levels. Descriptive statistics and testing of hypothesis were used for the analysis of data. ***Results:*** 150 Patients attending Medicine OPD at GCS Medical College and Research Center, Ahmedabad with abnormal TSH value were included in the present study. The distribution of hypothyroidism and hyperthyroidism were 64% and 36% respectively. There was a positive association between hypothyroidism and TC>200, LDL>130 and TG>200mg/dl; 28.57% of hypothyroid patient had hypercholesterolemia and 21.43% had hypertriglyceridemia. The mean TC, LDL and TG levels were increased progressively with the increase in the serum TSH.
Keywords: Thyroid dysfunction, Dyslipidemia, Cardiovascular disease (CVD).

INTRODUCTION

Diseases of thyroid gland are amongst the most abundant endocrine disorder in the world second only to diabetes mellitus [1]. This is true for India also and is a major public health hazard. Thyroid diseases are primarily conditions that affect the amount of thyroid hormones being produced. Excess production leads to hyperthyroidism while diminished production leads to hypothyroidism [2]. Thyroid hormones are important modulator of intermediary metabolism. They affect synthesis, mobilization and degradation of lipids, although degradation is influenced more than synthesis. Consequently, thyroid dysfunction particularly hypothyroidism is associated with dyslipidemia which increase the risk of endothelial dysfunction, hypertension and cardiovascular diseases [3].

Hypothyroidism, like obesity is one of the pathological conditions most frequently associated with disorders of lipid metabolism [4] and finally dyslipidemia which is one of the major risk factors of coronary disease [5]. Overt hypothyroidism is characterized by hypercholesterolemia and a marked increase in LDL because of a decreased fractional clearance of LDL by a reduced number of LDL receptors in the liver. However the controversy persists regarding the lipids level in subclinical hypothyroidism and its clinical significance. Moreover it is likely to be a risk factor for atherosclerosis and coronary diseases [3, 6].

METHODS

Patients attending Medicine OPD at GCS Medical College and Research Center were included in the study with either hypothyroidism or hyperthyroidism. These patients were further investigated for Lipid Profile and then put on appropriate therapy.

The data was collected and entered in to the proforma prepared for this study. The data thus collected are analysed using SPSS 11.5 software.

Table-1: Age Distribution

Aeg Group	Hypothyroid	Hyperthyroid
30-50	45	15
50-70	66	9

>70	15	0

Table-2: Gender Distribution

Gender	Hypothyroid	Hyperthyroid
Male	18	9
Female	108	15

Table-3: Lipid Profile Distribution

	Hypercholesterolemia (>200mg/Dl)	Hypertriglyceridemia (>150mg/Dl)	LDL (>100mg/dL)
Hypothyroid Patients No.	36	27	32

DISCUSSION

Dyslipidemia has been shown to be a common feature of thyroid dysfunction [7]. Patients with overt hypothyroidism exhibit significantly higher TC, LDL-C and TG compared to normal controls [8, 9]. The increase in lipid levels can be reversed by thyroid hormone supplementation [10]. In subjects with sub-clinical hypothyroidism, significant increase in the levels of TC, LDL-C, TC/HDL ratio compared to eu-thyroid subjects has been also observed [11]. On the other hand, hyperthyroid patients exhibit lower level of TC, HDL-C and LDL-C [12]. In our study we found female predominance for Hypercholesterolemia (>200mg/Dl).

Laboratory tests coupled with supportive clinical findings are used to diagnose thyrotoxicosis and it is best established by showing high circulating concentrations of the thyroid hormones thyroxine (T4) and triiodothyronine (T3) [13]. Thyroid stimulating hormone is undetectable in thyrotoxic patients and may even be normal in some people owing to insensitivity of the assay. The current study showed the rise in serum T3, T4 and fT4 along with reduced levels of serum TSH. Similar findings were also observed in previous studies in cases of hyperthyroidism [14]. The present study revealed that total cholesterol and triglyceride values were lowered in cases of hyperthyroidism; this is definitely a finding not reported to great extent so far in published studies. Thyroid hormones enhance the intravascular catabolism of VLDL triglyceride, modulate LDL receptor activity, both in vitro and in vivo, and hence lower plasma cholesterol concentrations [15]. Furthermore, there is increased clearance of cholesterol from plasma, excessive conversion of cholesterol to bile acids in the liver and early removal of low density lipoprotein from the plasma in hyperthyroidism [16]. Thyroid hormones also lower triglyceride levels by promoting the clearance from plasma [17].

The most sensitive indicator for hypothyroidism was TSH, more than 10 mU/l, along with reduced levels of T4. The present study revealed high values for serum TSH which reflects a reduction in the circulating levels of thyroxine (T4) and triiodothyronine (T3). Hypothyroidism can affect people of all ages. Chronic autoimmune thyroiditis affects women 3-5 times more frequently than men.

In our study, there was significant increase in the mean concentration of total cholesterol and triglycerides in cases of hypothyroidism. A similar study done by Texeira *et al*. in 2008 showed that hypothyroidism could significantly increase the levels of most of lipids, most importantly that of serum total cholesterol and LDL [18]. A study conducted by Risal *et al*. also showed similar mean values of serum total cholesterol in hypothyroid subjects [19]. Hypothyroidism is a cause of secondary hyperlipidaemia. There is usually an increase in total cholesterol and plasma triglycerides levels. The mechanisms responsible for hypercholesterolemia are increased absorption of cholesterol from intestines, decreased clearance of cholesterol and low density lipoproteins from plasma and decreased synthesis of bile acids from cholesterol in the liver in hypothyroidism [20]. There is also significant association between thyroid antibodies, obesity, hypertension, diabetes and hypercholesterolemia. All these factors contribute to elevated risk of coronary heart disease [21]. Lipoprotein Lipase (LPL), a key enzyme in lipid metabolism, catalyzes the hydrolysis of triglycerides (TG) from TG-rich lipoproteins, and serves a bridging function that enhances the cellular uptake of lipoproteins. Triglycerides are elevated due to inactivity of lipoprotein lipase and hepatic lipase. A study by Wung *et al*. revealed that elevation in plasma TG was less consistent than that of total cholesterol [22]. Therefore, abnormal lipid metabolism in hypothyroidism accelerates the process of atherogenesis and elevates cardiovascular risk [23].

The current study showed that levels of total cholesterol and TG were increased as compared to controls. In similar studies done previously, the levels of serum total cholesterol and TG were found to be 237.50 ± SD1.01mg/dl and 168.53 ± SD 0.89 mg/dl respectively in cases of subclinical hypothyroidism [24]. The major concern with subclinical hypothyroidism has been risk of progression to overt hypothyroidism, hypercholesterolemia and increased risk of cognitive impairment, particularly in elderly individuals [25]. Further, subclinical hypothyroidism may affect both diastolic and systolic cardiac function and worsen traditional risk factors for cardiovascular disease, including blood pressure, plasma lipid profile

and endothelial function. Patients with thyroid dysfunction had significant reversible alterations in levels of serum total cholesterol and triglycerides.

CONCLUSION

Thyroid dysfunction is found to be common across all age. Hypercholesterolaemia is very common in people with hypothyroidism. This is especially true for females as established in this study. It is eminently treatable and this could well result in lipid lowering.

Hypothyroidism is already known to cause lipid abnormality which is confirmed in this study. Therefore, timely screening and check-ups are necessary in order to curtail the problem of undiagnosed cases, giving specific consideration to patients who have high artherogenic profile. This will reduce the risk of future negative health events in older adults.

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