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General Medicine

DYSLIPIDEMIA NOT TO BE MISSED IN THYROID DYSFUNCTION

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ABSTRACT **Background:** Thyroid diseases rank among the most prevalent endocrine disorders globally. Thyroid hormones are crucial in regulating the synthesis, metabolism, and mobilization of lipids, and thyroid dysfunction can lead to changes in circulating lipid Hypothyroidism is relatively common and has a negative impact on lipid levels. In patients with hypothyroidism, there is an observed increase in serum total cholesterol, triglycerides (TG), low-density lipoprotein (LDL) cholesterol levels. while high-density lipoprotein (HDL) cholesterol typically remain unchanged. **Aims And Objectives:** The study aimed to investigate alterations in lipid levels associated with thyroid dysfunction. Additionally, the study seeks to identify any correlation between serum LDL and serum thyroid-stimulating hormone (TSH) levels in cases of thyroid dysfunction. **Materials And Methods:** This cross-sectional observational study analysed data through significant tests for differences in means. The study included 40 patients with hypothyroidism, 10 patients with hyperthyroidism. Levels of total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C), LDL-C were measured and compared. **Results:** In patients with hypothyroidism, there was a significant increase in total cholesterol, LDL-C, and triglyceride levels, while HDL-C levels remained largely unchanged. In contrast, hyperthyroid patients exhibited a marked reduction in total cholesterol and LDL-C levels. A strong positive correlation was observed between TSH and LDL-C levels in hypothyroid patients, whereas no significant association was found in hyperthyroid patients. **Conclusion:** Thyroid dysfunction can cause significant alterations in the lipid profile. Hypothyroidism, in particular, poses a considerable risk for atherosclerosis, making routine screening of lipids in thyroid disorders is essential for prevention and management of thyroid-related atherosclerosis disease.

KEYWORDS :

Introduction:

The thyroid gland produces two hormones, triiodothyronine (T3) and thyroxine (T4) . These hormones function via thyroid hormone receptors (TR) α and β, playing a crucial role in cell differentiation and organ formation during development, and they contribute to maintaining thermal and metabolic balance in adults[1]. Thyroid diseases are commonest endocrine disorders worldwide. India too, is no exception. Projections from various studies on thyroid disease estimate that around 42 million people in India suffer from these conditions[2]. In India, the prevalence of hypothyroidism is 11%, whereas in Western populations, it is only 2%–4.6%[3].Inland states exhibit a higher prevalence of hypothyroidism compared to coastal states (11.7% vs. 9.5%), likely due to iodine deficiency[4].

Hypothyroidism, both overt and subclinical, is a prevalent condition among individuals. Overt hypothyroidism is marked by elevated serum thyroid-stimulating hormone (TSH) levels and decreased free peripheral thyroid hormone (TH) concentrations, whereas subclinical hypothyroidism features normal free peripheral TH concentrations[5].

Thyroid hormones regulate numerous bodily processes, including stimulating resting metabolic rate and heat production, influencing cell proliferation and development, modulating responses to other hormones, and modified the metabolism of carbohydrates, proteins, and lipids[1].

Thyroid dysfunction can lead to changes in appetite, body weight, muscle mass, and adipose tissue. Besides the clinical symptoms directly associated with thyroid hormones and TSH, individuals with thyroid dysfunction often have a higher incidence of insulin resistance, type 2 diabetes, and cardiovascular diseases[6,7].

Lipids, including cholesterol and triglycerides, are absorbed from the intestines and transported throughout the body by lipoproteins for purposes such as energy, steroid production, or bile acid formation. Key components of these processes are cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, and high-density lipoprotein (HDL). An imbalance in any of these components, due to either organic or non-organic causes, can result in dyslipidemia. Dyslipidemia leads to abnormal lipid levels in the blood, raising the risk of cardiovascular diseases[8].

The link between thyroid dysfunction and dyslipidemia was first noted in 1930. Over time, it has been increasingly acknowledged that hypothyroidism can disrupt lipid metabolism, primarily leading to increased total cholesterol (TC) and LDL-C levels in the blood. Elevated LDL-C can result in progressive lipid accumulation, plaque formation in the arteries, and an increased risk of cardiovascular disease (CVD), the leading cause of death globally[9,10]. Regardless of TSH or TC levels, cholesterol levels normalize and cardiac function improves following T4 replacement therapy. Thus, it is crucial to consider the relationship between hypothyroidism and lipid metabolism.

MATERIAL AND METHOD:

Study Type: cross sectional observational study

Study Site: outdoor patients visit opd of General medicine, civil hospital Asarwa, Ahmedabad

Study Duration: 1 April to 31 July 2024

Sample Size & Sampling Method: The sample size of the study will be 50 patients, all these study subjects are going to be selected who fulfills the inclusion & exclusion criteria.

SELECTION OF STUDY SUBJECTS:

Inclusion Criteria:

Age>18 years
Newly diagnosed cases of hyperthyroidism or hypothyroidism.
Those who gave informed consent

Exclusion Criteria:

Patients on treatment for thyroid diseases (e.g., thyroid hormone replacement or anti-thyroid medications).
Known case of diabetes mellitus, chronic liver disease, chronic kidney disease, cardiovascular disease.
Pregnant & lactating women.
Patients on drugs affecting thyroid hormones.(e.g amidarone, b-blocker etc)
Patients on lipid-lowering agents or drugs affecting lipid metabolism (e.g., statins, fibrates, corticosteroids)
Those who did not give consent.

Method of Data Collection:

Examination:

Detailed history will be taken from patient and meticulous general and systematic examination with anthropometric evaluation.

Blood sample was obtained from all the patients. Complete blood count, Blood Urea, Serum Creatinine, Serum Electrolytes, Liver function test were assessed.

Serum free triiodothyronine (fT3), free thyroxine (fT4) and Thyroid stimulating hormone (TSH) levels were assessed.

Serum lipid profile includes total cholesterol, triglyceride, low density lipoprotein, high density lipoprotein were assessed.

Dyslipidemia: National Cholesterol Education Programme (NCEP) guidelines[11] were used for definition of dyslipidemia as follows:

Hypercholesterolemia – serum cholesterol levels ≥200 mg/dl (≥5.2 mmol/l).

Hypertriglyceridemia – serum triglyceride levels ≥150 mg/dl (≥1.7 mmol/l).

Low HDL cholesterol – HDL cholesterol levels <40 mg/dl (<1.04 mmol/l) for men and <50 mg/dl (<1.3 mmol/l) for women.

High LDL cholesterol – LDL cholesterol levels ≥130 mg/dl (≥3.4 mmol/l) calculated using the Friedewald equation.

Thyroid Dysfunction:

Overt Primary Hypothyroidism: Characterized by a high serum TSH and a low serum free thyroxine (T4) concentration.

Subclinical Hypothyroidism: Characterized by a high serum TSH and a normal serum free T4 concentration.

Overt Hyperthyroidism: Defined by suppressed or low TSH levels with elevated triiodothyronine (T3) and/or thyroxine (T4) levels.

Data Analysis:

Statistical analysis was done by IBM SPSS Statistics for Windows, Version 20.0.Pearson's correlation coefficient was used to check the linear relation between parameters of lipid profile and thyroid profile. A P value of <0.05 was considered as statistically significant.

RESULT:

Table 1: Demographics Parameters Of Different Groups

Variable	Hypothyroidism	Hyperthyroidism
Total patients	40(80%)	10(20%)
Female	36(90%)	8(80%)
Male	4(10%)	2(20%)
Age <35	10(25%)	4(40%)
Age 36-55	24(60%)	4(40%)
Age>55	6(15%)	2(20%)

In this study, 80% of the patients were diagnosed with hypothyroidism, predominantly affecting females (90%), while hyperthyroidism was observed in 20% of the patients, with a similar female dominance (80%). The majority of hypothyroid patients were between 36-55 years old, whereas hyperthyroidism showed a more even age distribution. Weight analysis revealed that 60% of hypothyroid patients had a normal BMI, but 25% were underweight, whereas hyperthyroidism was more commonly associated with being underweight (40%). These findings underscore the significant gender and metabolic impacts of thyroid disorders.

Variable	Hypothyroidism	Hyperthyroidism
Underweight	10(25%)	4(40%)
Normal	24(60%)	6(60%)
Overweight	6(15%)	0(0%)
Hypertension	16(40%)	4(50%)

The analysis shows an R-squared value of 0.6806, indicating that 68.06% of the variation in LDL levels can be explained by TSH levels. This suggests a strong positive correlation between higher TSH levels and increased LDL cholesterol. The findings highlight the significant impact of thyroid function on lipid levels, particularly LDL, emphasizing the need for careful monitoring of thyroid health to manage cholesterol and reduce cardiovascular risk.

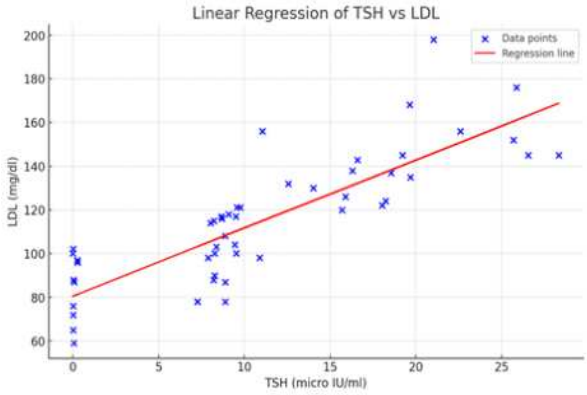

Figure 1: Comparison of thyroid-stimulating hormone and LDL among the study subject.

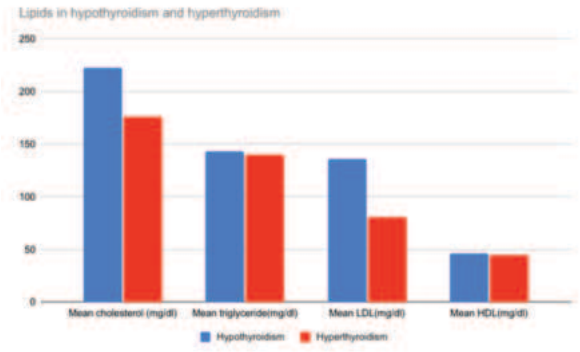

Figure 2: Correlation of lipids in thyroid disorders

The chart compares lipid profiles between hypothyroid and hyperthyroid patients. It reveals that hypothyroid patients tend to have higher levels of cholesterol and LDL (bad cholesterol) compared to those with hyperthyroidism, indicating a higher risk of cardiovascular diseases. Triglyceride levels are similar between the two groups, though slightly higher in hypothyroidism. HDL (good cholesterol) levels are low in both groups, with minimal difference. Overall, hypothyroidism is associated with a more unfavorable lipid profile, contributing to increased cardiovascular risk.

DISCUSSIONS:

Dyslipidemia, frequently observed in patients with thyroid disease, is primarily caused by the impact of thyroid hormones on nearly every aspect of lipid metabolism. Overt hypothyroidism are linked to changes in the lipid profile through various mechanisms. In thyroid disorders, dyslipidemia triggers insulin resistance and oxidative stress, creating a vicious cycle.

Previous studies have shown that in hypothyroidism lipoprotein lipase activity was either normal or decreased, while hepatic lipase activity was reduced, leading to elevated levels of triglycerides (TG)[14]. In hyperthyroidism, increased fatty acid synthesis and oxidation in the liver occur due to heightened activity of acetyl CoA carboxylase and carnitine palmitoyltransferase.

In the present study, the TC and LDL levels are higher in hypothyroid than hyperthyroid subjects. The lipid parameters, except HDL, were found to be slightly lower in hyperthyroidism when compared to hypothyroid patients and the findings are consistent with a previous study by RIZOS CV et al[17].

In our study, there is significant increase in total cholesterol and LDL level in patient with hypothyroidism. As the TSH level increases, LDL level increases. These observations are consistent with those of Colorado thyroid prevalence study, Mean TC, LDL cholesterol, and triglyceride levels rose with a significant trend across grades of decrease thyroid function.

There is no increase in values of components of lipid profile in patients with hyperthyroidism. HDL level of <50 mg/dl seen in most of the patients with hyperthyroidism.

CONCLUSIONS:

Prevalence of thyroid disease is more in females. lipid abnormalities were significantly associated with thyroid dysfunction. Patients with hypothyroidism exhibited increased levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG), whereas those with hyperthyroidism demonstrated reduced TC and LDL-C levels but elevated TG levels.

These findings underscore the necessity of evaluating lipid profiles in thyroid disease management to mitigate cardiovascular risks associated with dyslipidemia. However, the results of this study can be used as a reference in the future for conducting other large-scale population-based studies.

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