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Original Article

Study of LDL/HDL Ratio in Patients with Euthyroid and Hypothyroidism

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ABSTRACT

Background: Blood TSH levels over the upper limit of the standard range combined with blood T3 and T4 concentrations within reference ranges is known as hypothyroidism. A lab diagnosis of subclinical thyroid illness is made. Few or no clear-cut clinical indicators or symptoms of thyroid dysfunction are present in patients with subclinical illness. Higher levels of some cardiovascular risk factors have been linked to it. Numerous investigations have discovered that persons with hypothyroidism have greater levels of low density lipoprotein cholesterol and total cholesterol than euthyroid subjects, despite some contradictory findings. It is commonly known that dyslipidemia and hypothyroidism are related.

Aim and Objectives: This study aims to determine the significance of the LDL-C/HDL-C ratio (low density lipoprotein-cholesterol/high density lipoprotein-cholesterol) in patients with hypothyroidism.

Materials and Methods: This a prospective, case-control, comparative study conducted in our tertiary care hospital on 60 euthyroid controls and 60 hypothyroid cases with ages over 35.
We studied serum total cholesterol, HDL cholesterol, and LDL cholesterol, measured using the Friedewald formula, the enzymatic CHOD-PAP method, respectively and the ELISA method for T3, T4, and TSH.

Results: Serum TSH ($p<0.001$), total cholesterol ($p<0.001$), LDL cholesterol ($p<0.001$), LDL-C/HDL-C ($p<0.001$), diastolic and systolic blood pressure ($p<0.001$), and all showed a significant increase. The serum T3, T4, and HDL-cholesterol levels did not significantly alter.

Conclusion: Patients with hypothyroidism have elevated levels of total cholesterol, LDL cholesterol, and the LDL-C/HDL-C ratio. A more accurate measure of dyslipidemia in cases of hypothyroidism is the LDL-C/HDL-C ratio.

Keywords: Cardiovascular risk, Dyslipidemia, Subclini-cal hypothyroidism (SCH), LDL-C/HDL-C ratio

INTRODUCTION:

When serum T4 (T4) concentration is within its reference range, hypothyroidism is defined as a serum TSH concentration above the statistically defined upper limit of the reference range [1]. TSH will vary 100 times in response to a 2-fold change in free thyroxine. Serum TSH levels above the normal range will rise in response to even a small drop in T4 levels within the normal range. In the event that peripheral thyroid hormone levels are within the normal laboratory range, serum TSH measurement is therefore a crucial test for the diagnosis of mild thyroid failure [2]. With a prevalence of 3% to 8% in people without a known thyroid condition, hypothyroidism is a common issue [3]. There is ongoing discussion regarding the clinical significance, treatment options, and upper limit of normal range for mild elevation of serum TSH (<10 mIU/L) [1–4]. In general, levothyroxine therapy is recommended when TSH levels are higher than 10 mIU/L [5].

It is debatable, though, whether or not to begin treatment for patients whose serum TSH level is less than 10 mIU/L. While some writers support selective therapy, others support routine management [6]. Elevated levels of certain cardiovascular risk factors are linked to hypothyroidism. Numerous studies have revealed that individuals with hypothyroidism have higher levels of low density lipoprotein cholesterol and total cholesterol than euthyroid subjects, despite the inconsistent results [7].

The emergence of hypercholesterolemia in hypothyroidism is caused by a variety of mechanisms, including decreased receptor activity and a decreased number of LDL-C receptors in the liver that contribute to the LDL-C's fractional clearance. The enzyme cholesterol 7-hydroxylase is responsible for catabolizing cholesterol and converting it into bile. This particular liver-specific enzyme is negatively regulated by T3, which may be linked to the elevated serum cholesterol levels and reduced catabolism that are symptoms of hypothyroidism. Both overt and subclinical hypothyroidism have higher serum lipid levels, which may be linked to an increased risk of cardiovascular disease. It has been discovered that thyroid hormone replacement treatment reverses the risk ratio and restores euthyroidism [8].

Increased superior vena caval resistance is a result of endothelial dysfunction and decreased vascular smooth muscle relaxation in hypothyroidism. About 30% of patients experience diastolic hypertension as a result of these effects, but most recover their blood pressure to normal with thyroid hormone replacement therapy, which also causes endothelial-derived vasorelaxation [8].

A higher risk of atherosclerosis has been linked to hypothyroidism. There are contradicting findings in individuals with hypothyroidism and coronary heart disease (CHD) [7]. Much attention has been paid to alternative biochemical markers to help identify individuals at risk of clinical cardiac events, even though established risk factors account for the majority of cardiac events [9]. This study emphasizes the significance of the LDL-C/HDL-C ratio in identifying the dyslipidemic state linked to SCH, as opposed to the measurement of specific lipid profile parameters.

AIM AND OBJECTIVES:

This study aims to determine the significance of the LDL-C/HDL-C ratio (low density lipoprotein-cholesterol/high density lipoprotein-cholesterol) in patients with hypothyroidism in Dept. of General Medicine in ICARE Institute of Medical Sciences & Research & Dr. Bidhan Chandra Roy Hospital, Haldia.

MATERIALS AND METHODS:

The study is carried out in the Department of Medicine, ICARE Institute of Medical Sciences & Research & Dr. Bidhan Chandra Roy Hospital, Haldia. We studied 60 hypothyroid cases aged above 35 years and 60 euthyroid controls from the general population according to the inclusion and exclusion criteria mentioned below.
This study was approved by the Institutional Ethics Committee.
All the subjects gave an informed consent before undergoing further investigations.
Study design: It is a prospective, case control, comparative, hospital-based study.
Sample size: 120

Inclusion Criterion: Hypothyroidism cases having TSH in the range of 4.50 to 14.99 mlU/L, T3 and T4 within normal limits. The euthyroid controls having normal TSH [0.3-4.5 mlU/L.]

Exclusion Criterion: patient with external radiation, previous radioactive iodine therapy, primary or secondary dyslipidemia, patients with diabetes mellitus**,** patients with other systemic illness, renal and hepatic failure cases**,** patients on statins were excluded from the study.

RESULTS:

Table 1- Comparison of Parameters between Hypothyroidism cases and Euthyroid controls

Parameter	Controls(N=60)	Hypothyroid(N=60)
T3 (nmol/l)	001.87 ± 00.98	001.55 ± 00.37
T4 (nmol/l)	090.41 ± 23.14	083.47 ± 18.71
TSH (mlU/L)	002.74 ± 01.42	009.22 ± 02.86
TC (mg/dl)	180.40 ± 36.15	276.43 ± 31.68
LDL (mg/dl)	128.65 ± 36.51	190.52 ± 43.48
HDL (mg/dl)	045.82 ± 18.73	042.27 ± 09.16
LDL/HDL	003.2 ± 00.72	005.7 ± 02.89

The data is presented as mean ± SD, statistical analysis was carried out using unpaired student 't' test for all variables. P value of 0.05 or less was considered as statistically significant.
Table 1 demonstrates that serum mean levels of TSH, TC, LDL-C, LDL-C/HDL-C, were significantly higher in hypothyroid patients when compared to controls, whereas T3 and T4 did not significantly differ from controls statistically.
The change between the values of TSH, TC, LDL & LDL/HDL (ratio) has a p-value of <0.001 (highly significant) and has a p-value of <0.01(significant) for the levels of T3 between controls and hypothyroid patients.

DISCUSSION AND CONCLUSION:

The underlying proinflammatory state, cardiovascular risk, neuromuscular and psychiatric dysfunction, and the associated dyslipidemic state are among the still-debatable aspects of hypothyroidism. It is still clear in this regard. [17, 18]. Serum lipid levels and hypothyroidism continue to have a contentious relationship. Numerous studies have documented higher and more erratic changes in serum HDL-C as well as a variable and inconsistent increase in total cholesterol and LDL-C [19–21]. While hypothyroidism was not linked to hyperlipidemia in the Whickham survey [22], NHANES III found that hypothyroidism subjects had higher mean cholesterol than euthyroid subjects, but there was no difference in LDL-C or HDL-C [23].

In their study of dyslipidemia in hypothyroidism in the Indian population, Marwaha et al. found that while there was no significant difference in lipid profile parameters when TSH levels were less than 10 mlU/L as compared to controls, there was an increase in total cholesterol and LDL cholesterol in subclinical hypothyroidism with TSH >10 mlU/L [24]. Hypothyroid women in the Rotterdam study had lower total cholesterol than euthyroid women [25].
According to estimates by Bindels et al. [26], a rise in serum TSH of 1 mlU/L was linked to an increase in serum cholesterol of 0.09 mmol/L (3.5 mg/dl) in women and 0.16 mmol/L (6.2 mg/dl) in men. The occurrence of cardiovascular event is not solely dependent on atherogenic lipoproteins, but is based on the balance between atherogenic and athero-protective lipoproteins [27].

The more effective ratio of the lipid parameters LDL-C/HDL-C ratio has now shifted the focus away from LDLC as the main cause of atherogenesis [28]. A 75% increase in the risk of MI is linked to a 1-unit increase in the LDL-C/HDL-C ratio [29]. The LDL-C/HDL-C ratio has been shown in numerous studies to be a more effective way to track the results of lipid-lowering treatments. When determining the risk of heart disease, the LDL-C/HDL-C combination predicts dyslipidemia more accurately than LDL-C alone. The movement of cholesterol by entry and exit in the arterial intima is reflected in the ratio of LDL-C/HDL-C [30]. Additionally, a number of studies have demonstrated that dietary cholesterol has no effect on the LDL-C/HDL-C ratio [31, 32].
As compared to individual parameters like TC (49.73%) and LDL-C (48.93%), we saw that the percentage change for LDLC/HDL-C (68.31%) was greater (Fig. 1). Our research is comparable to that of Mala Mahto et al. [9], which found that while individual parameters, such as TC, HDL-C, and LDL-C, are not significant, the LDL/HDL ratio is more significant between the two groups. However, statistically significant values for TC and LDL-C were also found in our study. When the LDL-C/HDL-C ratio is compared between the two groups, our study has shown a significant p value of <0.001, and both TC and LDL-C are significant. Our study's findings are similar to those of B. U. Althaus and J. J. Staub et al. [33], who also found a significant LDL-C/HDL-C ratio but no significant values for HDL-C or LDL-C. In contrast, our study found significant values for TC and LDLC.
This study's results indicate that patients with subclinical hypothyroidism have elevated levels of total cholesterol, LDL cholesterol, and the LDL-C/HDL-C ratio. A more accurate measure of dyslipidemia in cases of subclinical hypothyroidism is the LDL-C/HDL-C ratio. This ratio may be used as a screening tool to identify and treat SCH cases with a higher cardiovascular risk. It can also predict the cardiovascular risk in subclinical hypothyroidism. A thorough investigation is necessary due to the size of the population.

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Conflicts of interest
There are no conflicts of interest

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