

LIPID PROFILE AND ELECTROCARDIOGRAPHIC CHANGES IN THYROID DYSFUNCTIONVandana Balgi¹, Suneetha D. K²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: BACKGROUND: The study was designed to explore lipid profile and electrocardiographic changes associated with thyroid dysfunctions. **MATERIALS AND METHODS:** A total of 50 patients of thyroid dysfunction having either hypothyroidism or hyperthyroidism were investigated with lipid profiles and electrocardiogram (ECG). **RESULTS:** Out of the 50 patients, 27(54%) were suffering from hypothyroidism, while hyperthyroidism was present in 23(46%). Female: male ratio was 1.7:1. Mean cholesterol and LDL was higher in hypothyroid patients. Maximum number of hypothyroid patients (76%) had either borderline high (27.92%) or high (48.14%) serum cholesterol. 91.3% of the 23 hyperthyroid patients had serum cholesterol levels <200 mg%. In hypothyroidism sinus bradycardia is the most common electrocardiographic findings and sinus tachycardia is most commonly seen in hyperthyroidism. **CONCLUSION:** Total and LDL cholesterol is significantly high in hypothyroid patients. Commonest electrocardiographic findings in hypothyroidism is sinus bradycardia whereas in hyperthyroid patients it is sinus tachycardia followed by atrial fibrillation

KEYWORDS: Electrocardiographic changes, Hyperthyroidism, Hypothyroidism, Lipid profile.

INTRODUCTION: Thyroid hormones are very important for normal function of heart and blood vessels. Marked changes in these organs occur in patients with thyroid dysfunction^[1] resulting in many symptoms and signs.^[2] Hypothyroidism increases the oxidation of plasma cholesterol mainly because of an altered pattern of binding and to the increased levels of cholesterol, which presents a substrate for the oxidative stress.^[3] It is also seen that thyroid dysfunction has got profound effect on lipid profile.

Overt hypothyroidism is associated with hypercholesterolemia and a marked increase in low-density lipoproteins (LDLs) and apolipoprotein B reportedly by decreased fractional clearance of LDL by a reduced number of LDL receptors in the liver in addition to decreased receptor activity.^{[4],[5],[6]} SCH is associated with adverse effects on serum lipid profiles, which have the potential to increase the risk of coronary heart disease in affected subjects.^[7]

Conversely hyperthyroid patients are found to have lower total and LDL cholesterol levels.^{[8],[9],[10]} Commonest electrocardiographic findings associated with hyperthyroidism are sinus tachycardia, increased QRS voltage, atrial fibrillation.

Other changes reported are other supraventricular arrhythmias, non-specific ST and T wave changes and ventricular extra systoles.^[11] Hypothyroidism is associated with bradycardia, low voltage complex, ST segment depression, QT interval lengthening and increased QT dispersion, flattening or inversion of T wave, which reflects the prolonged cardiac action potential. In addition, these patients are more prone to ventricular arrhythmias particularly in presence of ischemic heart disease, due to increased electrical depression in myocardium.^{[12], [13], [14]} Also in hypothyroidism there is QRS prolongation, right bundle branch block and infrequently Torsades de pointes.^[15]

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The above mentioned lipid derangements and ECG changes are responsible for hemodynamic alterations increasing the risk of coronary artery disease (CAD), cerebral ischemia risk.

METHODS: A total of 50 cases of thyroid dysfunction diagnosed as hypothyroid/hyperthyroid based on their clinical presentation and thyroid function tests were studied for cardiovascular manifestations. Patients of both sexes and above 12 years of age were included. Out of these, 23 were hyperthyroid and 27 were diagnosed to be hypothyroid. Pre-existing heart diseases like rheumatic heart disease, congenital heart disease, ischemic heart disease, hypertensive heart disease, cardiomyopathy, patients on antiarrhythmic drugs were excluded. Investigations included T3, T4, free T3, free T4, thyroid stimulating hormone, fasting lipid profile, ECG in all leads with rhythm strip.

STATISTICS: Data were compiled and analyzed. Differences in lipid profile and electrocardiographic findings between hypothyroid and hyperthyroid patients were tested for statistical significance by two sample t-test along with 95% confidence intervals of the mean difference. All statistical calculations were done through SPSS16.0 (2007) for windows.

RESULTS:

Age (in years)	Hyperthyroid (n=23)		Hypothyroid (n=27)		Total
	Male	Female	Male	Female	
21-40	4	5	4	10	23
41-60	5	7	0	9	21
>60	1	1	3	1	6
Total	10	13	7	20	50

Table 1: Age and Gender Distribution

Both hyperthyroidism and hypothyroidism was common in females. Majority of hyperthyroidism was seen in age group of 41-60 years and hypothyroidism was more seen in age group of 21-40 years.

	Hypothyroidism (n=27) mg/dl		Hyperthyroidism (23) mg/dl		MD	95% CI of MD	P value	
	Mean	SD	Mean	SD				
TC	241.29	49.89	153	26.07	88.3	66.0	110.6	<0.0001
TG	146.49	40.09	143.91	146.85	2.6	-56.6	61.7	.931
HDL	39.65	8.42	42.96	6.91	-3.3	-7.7	1.1	.140
LDL	143.75	41.16	83.78	17.28	60.0	42.3	77.6	<0.0001

Table 2: Lipid Profile

As tested by two sample t-test, total cholesterol (TC) and Low density lipoprotein (LDL) were significantly higher in hypothyroid patients but there was not much significant difference in triglyceride (TG) and High density lipoprotein (HDL) between hypothyroid and hyperthyroid groups.

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ECG changes	Total		P value
	No. of cases	Percentage	
Sinus tachycardia	9	39.1	0.297
Atrial fibrillation	6	26.1	0.022
ST-T changes	3	13	0.000
LVH	3	13	0.000
RVH	2	8.7	0.000
RBBB	2	8.7	0.000
Axis deviation	2	8.7	0.000

Table 3: ECG changes in hyperthyroid

Sinus tachycardia was commonest ECG finding in hyperthyroid (39.1%) followed by atrial fibrillation (AF) seen in 26.1%, non-specific ST-T changes and LVH in 13% cases.

ECG changes	Total		P value
	No. of cases	Percentage	
Sinus bradycardia	10	37	0.178
Low voltage complexes	6	22.2	0.004
ST-T changes	5	18.5	0.001
Long QT	3	11.1	0.000
Ectopics	2	7.4	0.000
Axis deviation	2	7.4	0.000
Prolonged PR	1	3.7	0.000
RBBB	1	3.7	0.000

Table 4: ECG changes in hyperthyroid

Among ECG changes, sinus bradycardia was commonest being present in 37.04% patients, followed by Low voltage complexes in 22.2%, ST-T changes in 18.5%, Long QT in 11.1%.

DISCUSSION: A landmark article was published by Mason and colleagues showed the significance of cholesterol values in hypothyroidism and hyperthyroidism.^[14] Hypothyroidism caused hyperlipidemia. Thyroxine therapy normalized the deranged lipids Dyslipidemia and serum mineral profiles in patients with thyroid disorders.^[16] A study by A Regmi et al in Nepal showed all the parameters of lipid profile i.e., TC, HDL, LDL and TG were found to be increased in hypothyroidism and the difference was statistically significant however no significant association was found in hyperthyroid patients.^[17]

In a multicentre study of prevalence of hypothyroidism in 752 hypercholesterolemic patients, primary hypothyroidism occurred in 3.7%.^[15] The study by P Archana and K Ashok showed a significant correlation between raised TSH levels and serum total cholesterol and LDL-cholesterol.^[18] Hypothyroid patients have elevated atherogenic parameters and are at high risk for developing cardiovascular disorders.¹⁹

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In contrast, in thyrotoxicosis, cholesterol synthesis is increased, but this is simultaneously counter-balanced by an increased rate of degradation and excretion.^[20]

The most frequent form of dyslipidemia, as shown in a study of 295 hypothyroid patients is pure hyper cholesterolemia (56%), followed by combined hyper cholesterolemia and hyper triglyceridemia (34%) and isolated hypertriglyceridemia (1.5%), only 8.5% had no lipid abnormalities.^[21] In our study 76% had hypercholesterolemia. Most hypothyroids in our study had reduced HDL levels.

In hyperthyroidism, an increase in synthesis and degradation of lipids occurs, with a predominance of degradation. Therefore, plasma levels of lipids are reduced in hyperthyroids.^[22] The study by AK Farah et al concluded increased lipid profile in hypothyroid subjects and found no effect on the lipid profile of hyperthyroid subjects.²³ In this study 91.3% of the 23 hyperthyroid patients had serum cholesterol levels <200 mg% consistent with the above findings.

In hyperthyroidism sinus tachycardia, AF is common. In this study, sinus tachycardia was the commonest ECG finding (39.1%) comparable with previous study by Zarger et al. (40%).^[24] Second most common finding was atrial fibrillation (26.1%). The prevalence of atrial fibrillation varies between 2-20%^[4] Increased LV mass is seen in hyperthyroid patients due to increase volume overload.^[25] This may cause ST-T changes and LVH as seen in his study. Hyperthyroidism can also result in intraventricular conduction defects most commonly RBBB as mentioned by Zarger et.al (11%)^[24] Comparable with 8.7% seen in this study.

Hypothyroid patients in this study had sinus bradycardia as the most common finding on their ECG (37%) with low voltage complexes and ST-T changes as next common findings comparable to previous studies conducted by Al-Farttoosi et al.^[26] and Agarwal et al.^[27]

Several limitations of this study merit discussion. First sample size is too small for any significant conclusion. Second patients were not further classified into overt and subclinical thyroid dysfunction or primary and secondary hypothyroidism. Patients should be followed up to monitor the change in above parameters with treatment.

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