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Evaluation of Lipid Profile and Electrocardiographic Changes in First Time Diagnosed Hypothyroid Patient

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ABSTRACT

Background: Hypothyroidism is associated with metabolic and cardiovascular abnormalities, including dyslipidemia and electrocardiographic (ECG) changes. Early detection of these alterations is essential to prevent long-term cardiovascular complications.
Objective: To evaluate lipid profile abnormalities and ECG changes in first-time diagnosed, treatment-naïve hypothyroid patients.
Methods: A cross-sectional study was conducted at Krishna Mohan Medical College and Hospital from May 2024 to November 2025. 120 newly diagnosed hypothyroid patients aged ≥18 years were included. Exclusion criteria included known cardiac, renal, hepatic, or endocrine disorders and medications affecting thyroid function. Thyroid function tests (T3, T4, TSH), haematological parameters, lipid profile, and ECG were analysed. Data were expressed as mean ± SD and percentages.
Results: The mean age was 42.3 ± 12.5 years, with female predominance (70%). Common clinical features included fatigue (79.2%) and weight gain (73.3%). Laboratory analysis revealed elevated TSH (18.6 ± 7.4 µIU/mL) with low-normal T4 (4.2 ± 1.1 µg/dL). Dyslipidemia was observed in more than 50% of patients, with elevated total cholesterol (56.7%), LDL (62.5%), and low HDL (58.3%). ECG abnormalities were present in 62.5% of patients, most commonly sinus bradycardia (33.3%).
Conclusion: Newly diagnosed hypothyroid patients frequently exhibit dyslipidemia and ECG abnormalities, indicating early cardiovascular involvement. Routine lipid and ECG evaluation at diagnosis, along with timely levothyroxine therapy, is essential to reduce cardiovascular risk.

Keywords*: Hypothyroidism, Lipid Profile, Electrocardiogram, Dyslipidemia, Cardiovascular Risk, TSH.*

INTRODUCTION

Hypothyroidism is a common endocrine disorder characterized by deficient production of thyroid hormones, primarily thyroxine (T4) and triiodothyronine (T3), leading to a generalized slowing of metabolic processes in the body [1]. The prevalence of hypothyroidism varies worldwide, affecting approximately 4–5% of the general population, with higher rates observed in women and older individuals [2].

Thyroid hormones play a critical role in regulating cardiovascular function, lipid metabolism, and energy homeostasis. Deficiency of these hormones can result in bradycardia, reduced myocardial contractility, and diastolic hypertension, increasing the risk of cardiovascular morbidity [3,4]. Electrocardiographic (ECG) abnormalities, such as sinus bradycardia, low-voltage QRS complexes, and conduction defects, are commonly reported in hypothyroid patients, reflecting both the direct and indirect effects of thyroid hormone deficiency on the heart [5].

Hypothyroidism is also associated with altered lipid metabolism, leading to elevated total cholesterol, low-density lipoprotein (LDL), and triglycerides, which contribute to accelerated atherosclerosis and increased risk of coronary artery disease [6,7]. Dyslipidemia in hypothyroid patients has been correlated with the degree of thyroid hormone deficiency, emphasizing the importance of early diagnosis and management [8].

Despite the recognized cardiovascular and metabolic complications of hypothyroidism, data on the cardiac and lipid profile manifestations in newly diagnosed, treatment-naïve patients remain limited, especially in rural and semi-urban populations. Understanding these changes is crucial for early risk stratification and prevention of long-term cardiovascular events [9,10].

This study was undertaken to evaluate lipid profile abnormalities and electrocardiographic changes in patients with first-time diagnosed hypothyroidism, aiming to provide insights into the cardiovascular risk profile of these patients.

MATERIALS AND METHODS

Study Design:

This was a **cross-sectional clinical study** conducted to evaluate cardiac manifestations and lipid profile abnormalities in newly diagnosed hypothyroid patients.

Study Setting:

The study was carried out at **Krishna Mohan Medical College and Hospital**, a tertiary care teaching hospital.

Study Duration:

May 2024 to November 2025.

Sample Size and Study Population:

A total of **120 patients** newly diagnosed with hypothyroidism were included. Sample size was determined based on convenience sampling of patients meeting the inclusion and exclusion criteria during the study period.

Inclusion Criteria:

4. Patients **newly diagnosed with hypothyroidism** (clinical and laboratory criteria)
5. **Treatment-naïve** hypothyroid patients
6. Age **≥18 years**

Exclusion Criteria:

Patients with conditions or medications that could affect thyroid function or cardiovascular status were excluded:

- Known cardiac diseases (congenital heart disease, rheumatic heart disease, ischemic heart disease, or other cardiovascular diseases)
- Renal or liver disease
- Chronic obstructive pulmonary disease (COPD), severe anemia, diabetes mellitus, or other endocrine disorders
- Use of drugs affecting thyroid function: beta-blockers, antiarrhythmic drugs, hypolipidemic drugs, lithium, steroids, oral contraceptives, alcohol
- Critically ill patients admitted to ICU
- Female smokers

Data Collection:

- A **detailed history** and **physical examination** were conducted for each patient, focusing on clinical features of hypothyroidism and cardiovascular manifestations.

Laboratory Investigations:

- **Thyroid Function Tests (TFTs):** Serum **T3, T4, and TSH** were measured using **chemiluminescence immunoassay**. Blood samples (3 mL) were collected in **plain, clotted tubes** after **overnight fasting**.
- **Hematological Parameters:** Hemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC), erythrocyte sedimentation rate (ESR), and random blood sugar (RBS).
- **Urine Analysis:** Routine microscopy, glucose, and albumin.
- **Renal Function Tests:** Blood urea and serum creatinine.
- **Lipid Profile:** Total cholesterol, triglycerides, HDL, LDL, VLDL.
- **Cardiac Evaluation:** Standard **12-lead electrocardiogram (ECG)** performed to detect rhythm abnormalities, conduction defects, or other cardiac manifestations.

Statistical Analysis:

- Data were analyzed using **descriptive statistics**: mean, standard deviation (SD), and range for continuous variables; frequency and percentage for categorical variables.
- **Comparison of means** performed using standard error of difference.

- **Graphical representations** (bar charts, pie charts, histograms) used for visualization of results.
- Statistical significance considered at **$p < 0.05$**.

Ethical Considerations:

- The study was conducted after obtaining **ethical approval** from the Institutional Ethics Committee.
- Informed consent was obtained from all participants before enrollment.

RESULTS AND OBSERVATIONS

A total of **120 newly diagnosed hypothyroid patients** were included in this study. The **mean age** was **42.3 ± 12.5 years**, with **female predominance (70%)**. Clinical features, laboratory findings, ECG changes, and lipid profile abnormalities were analysed.

Table 1: Demographic Characteristics of Study Population (n = 120)

Variable	Number (%) / Mean ± SD
Total patients	120 (100%)
Age (years)	42.3 ± 12.5
Gender	
- Male	36 (30%)
- Female	84 (70%)
BMI (kg/m²)	26.1 ± 3.5

Table 2: Clinical Features in Hypothyroid Patients (n = 120)

Clinical Feature	Number (%)
Fatigue	95 (79.2%)
Weight gain	88 (73.3%)
Cold intolerance	70 (58.3%)
Hair loss / thinning	65 (54.2%)
Constipation	60 (50%)
Bradycardia (pulse <60 bpm)	42 (35%)
Edema	35 (29.2%)
Goiter	28 (23.3%)

Table 3: Thyroid Function Tests (n = 120)

Parameter	Mean ± SD	Normal Range
T3 (ng/mL)	0.8 ± 0.3	0.8 – 2.0
T4 (µg/dL)	4.2 ± 1.1	4.5 – 12.0
TSH (µIU/mL)	18.6 ± 7.4	0.4 – 4.0

*Majority of patients had **elevated TSH** with low-normal or low T4, consistent with primary hypothyroidism.*

Table 4: Hematological and Biochemical Parameters (n = 120)

Parameter	Mean ± SD	Normal Range
Hemoglobin (g/dL)	11.2 ± 1.5	12 – 16
TLC (×10³/µL)	6.8 ± 1.2	4 – 11
ESR (mm/hr)	25 ± 10	<20
RBS (mg/dL)	92 ± 12	70 – 110
Blood urea (mg/dL)	28 ± 8	15 – 40
Serum creatinine (mg/dL)	0.9 ± 0.2	0.6 – 1.2

Table 5: Lipid Profile Abnormalities (n = 120)

Lipid Parameter	Mean ± SD	Normal Range	Number (%) with Abnormality
Total Cholesterol (mg/dL)	220 ± 35	<200	68 (56.7%)
LDL (mg/dL)	140 ± 28	<130	75 (62.5%)
HDL (mg/dL)	38 ± 8	>40	70 (58.3%)
Triglycerides (mg/dL)	180 ± 40	<150	60 (50%)
VLDL (mg/dL)	36 ± 8	5 – 40	45 (37.5%)

*Dyslipidemia was a common finding, predominantly **high LDL** and **low HDL**, consistent with hypothyroidism.*

Table 6: ECG Findings in Hypothyroid Patients (n = 120)

ECG Abnormality	Number (%)
Sinus bradycardia	40 (33.3%)
Low voltage QRS	15 (12.5%)
Prolonged QTc interval	12 (10%)
First-degree AV block	8 (6.7%)
Normal ECG	45 (37.5%)

Bradycardia was the most common ECG finding in hypothyroid patients

DISCUSSION

Hypothyroidism is a common endocrine disorder characterized by decreased synthesis of thyroid hormones, leading to systemic metabolic slowing and significant cardiovascular and metabolic consequences [1]. In the present study, we analyzed **120 newly diagnosed hypothyroid patients** to evaluate lipid profile alterations and electrocardiographic changes, aiming to assess cardiovascular risk even at the time of first diagnosis.

Demographic Characteristics

Our study demonstrated a **female predominance (70%)**, which is consistent with prior epidemiological studies indicating that women are 5–10 times more likely to develop hypothyroidism than men [2,3]. The mean age was 42.3 ± 12.5 years, reflecting that hypothyroidism is more commonly diagnosed in middle-aged adults. The higher prevalence in females may be attributed to autoimmune thyroiditis, which is the most frequent cause of hypothyroidism in adults [1].

Clinical Features

The majority of patients reported **fatigue (79.2%)**, **weight gain (73.3%)**, and **cold intolerance (58.3%)**, followed by **hair loss (54.2%)**, **constipation (50%)**, **bradycardia (35%)**, and **edema (29.2%)**. These findings are in concordance with classical descriptions of hypothyroidism [4]. Fatigue and lethargy are related to decreased basal metabolic rate and impaired mitochondrial energy production, while weight gain results from reduced thermogenesis and fluid retention. Cold intolerance is a direct effect of reduced thyroid hormone–mediated thermogenesis.

Bradycardia was observed in 35% of patients. Thyroid hormones have a direct positive chronotropic effect on the sinoatrial node; their deficiency leads to decreased heart rate and cardiac output [5]. **Edema** in hypothyroid patients is caused by mucopolysaccharide deposition in interstitial tissues (myxedema) and decreased renal clearance of water and sodium [6].

Thyroid Function Tests

The mean **TSH (18.6 ± 7.4 µIU/mL)** was markedly elevated, with low-normal **T4 (4.2 ± 1.1 µg/dL)**, indicative of **primary hypothyroidism**. Elevated TSH is a compensatory response to reduced thyroid hormone synthesis, a hallmark of primary thyroid failure [7]. These findings correlate with several previous studies reporting TSH as the most sensitive marker for diagnosing primary hypothyroidism [8].

Hematological and Biochemical Findings

The study observed mild anemia (mean Hb 11.2 ± 1.5 g/dL), elevated ESR (25 ± 10 mm/hr), and normal renal function in most patients. Hypothyroidism can induce **normocytic, normochromic anemia** due to decreased erythropoietin production, reduced gastrointestinal iron absorption, and diminished oxygen demand [9]. ESR elevation reflects a low-grade inflammatory state, often associated with autoimmune thyroiditis.

Lipid Profile Abnormalities

Dyslipidemia was a frequent finding: **56.7% had elevated total cholesterol**, **62.5% elevated LDL**, **50% elevated triglycerides**, and **58.3% low HDL**. These findings are consistent with the known effects of hypothyroidism on lipid metabolism. Thyroid hormones increase hepatic LDL receptor expression and stimulate cholesterol clearance; their deficiency leads to **accumulation of LDL and total cholesterol** [10]. Additionally, hypothyroidism reduces lipoprotein lipase activity, resulting in elevated triglycerides and VLDL [11].

Several studies have reported similar lipid abnormalities, emphasizing the increased risk of atherosclerosis and cardiovascular disease even in subclinical or newly diagnosed hypothyroid patients [12]. Early diagnosis and thyroid hormone replacement therapy have been shown to **improve lipid profiles**, thus reducing long-term cardiovascular morbidity [13].

Electrocardiographic Findings

ECG abnormalities were observed in 62.5% of patients. **Sinus bradycardia (33.3%)** was the most frequent abnormality, followed by **low-voltage QRS (12.5%)**, **prolonged QTc interval (10%)**, and **first-degree AV block (6.7%)**. These findings are attributable to the direct effects of thyroid hormone deficiency on cardiac myocytes, including decreased sympathetic activity, slowed depolarization, and reduced conduction velocity [14,15].

Interestingly, 37.5% of patients had **normal ECGs**, despite abnormal thyroid function and lipid profiles. This indicates that **early hypothyroidism may not always manifest as detectable electrical changes**, but subclinical cardiac involvement may still exist, warranting early cardiovascular risk assessment.

Correlation Between Lipid and ECG Changes

The study highlights a significant overlap between **dyslipidemia and ECG abnormalities**, suggesting that hypothyroid patients may develop **both structural and metabolic cardiovascular risks** at an early stage. These findings underline the importance of comprehensive evaluation, including lipid profile and ECG, in first-time diagnosed hypothyroid patients [16].

Clinical Implications

Our study demonstrates that **even newly diagnosed, treatment-naïve hypothyroid patients** can present with significant dyslipidemia and ECG abnormalities, indicating increased cardiovascular risk. Routine screening of lipid profile and cardiac evaluation should therefore be considered **at the time of diagnosis**, particularly in middle-aged and female patients. Early initiation of **levothyroxine therapy** may not only normalize thyroid function but also improve lipid profiles and reduce arrhythmogenic risk [13,17].

Limitations

1. The study was **cross-sectional**, limiting causal inference. Longitudinal studies are required to assess changes after treatment.
2. The sample was **hospital-based and from a single centre**, which may limit generalizability.
3. Other cardiovascular assessments, like **echocardiography** or **carotid intima-media thickness,** were not performed.

CONCLUSION

First-time diagnosed hypothyroid patients frequently present with significant lipid abnormalities, including elevated total cholesterol and LDL, and low HDL, along with electrocardiographic changes, most commonly sinus bradycardia. These findings indicate that cardiovascular involvement occurs early in hypothyroidism, even before treatment initiation. Early screening of lipid profile and ECG, followed by timely levothyroxine therapy, is crucial to reduce cardiovascular risk and prevent long-term complications.

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