**Journal of Neonatal Surgery**
***ISSN(Online): 2226-0439***
***Vol. 14, Issue 21s (2025)***
*https://www.jneonatalsurg.com*

OPEN ACCESS

# Assessment of Lipid Profile and Electrocardiographic Patterns in Newly Detected Hypothyroid Patients: A Cross-Sectional Analysis in a Tertiary Care Center

**[1]Dr. Kolli Laasya Sree, [2]Dr. V. R. Mohan Rao, [3]Dr. Challa Venkata Sai Vignesh and [4]Dr. Vinayak Mani Aishwariyaa**

[1]Postgraduate, Department of General Medicine, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603103, Tamil Nadu, India

[2]Professor, Department of General Medicine, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603103, Tamil Nadu, India

[3]Postgraduate, Department of General Medicine, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603103, Tamil Nadu, India

[4]Postgraduate, Department of General Medicine, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603103, Tamil Nadu, India

Cite this paper as: Dr. Kolli Laasya Sree, Dr. V. R. Mohan Rao, Dr. Challa Venkata Sai Vignesh, Dr. Vinayak Mani Aishwariyaa, (2025). Assessment of Lipid Profile and Electrocardiographic Patterns in Newly Detected Hypothyroid Patients: A Cross-Sectional Analysis in a Tertiary Care Center. *Journal of Neonatal Surgery*, 14 (21s), 860-866.

## ABSTRACT

**Background**: Hypothyroidism, a condition marked by reduced thyroid hormone levels, can impact various organ systems, including the cardiovascular system, due to metabolic slowdown. This research is proposed to evaluate the lipid profile and correlate cardiac symptoms and changes in ECG and Echo in patients recently diagnosed with hypothyroidism, emphasizing the associated cardiovascular risk factors.

**Methods**: A cross-sectional study was carried out at Chettinad Hospital and Research Institute in Kelambakkam, Chennai, over a period of three months, involving 120 patients who were newly diagnosed with hypothyroidism. Patients underwent evaluations including ECG, echocardiography, and lipid profile. Systemic examination, TSH levels, and relevant exclusion criteria were applied to assess the cardiovascular impact of hypothyroidism.

**Results**: Most patients were aged between 31 and 40 years, with females comprising a significant 81.7% of the group. Commonly reported symptoms included an increase in body weight (79.2%), fatigue (65.8%), dry skin (61.7%), and a hoarse voice (53.3%). Bradycardia was detected in 41.7% of electrocardiograms, while 30.8% showed normal results. Echocardiographic findings revelaed pericardial effusion in 26.7% of the cases, and diastolic dysfunction was observed in 26.7%, predominantly classified as mild. The analysis of lipid profiles indicated increased concentrations of total cholesterol, LDL, VLDL, and triglycerides, along with a reduction in HDL, especially among patients with elevated TSH levels (greater than 10).

**Conclusion:** This research, involving 120 patients recently diagnosed with hypothyroidism, emphasizes that bradycardia is the predominant ECG abnormality observed, with low voltage complexes following closely. Additionally, pericardial effusion emerged as the most prevalent finding in echocardiographic assessments, mandating the critical need for hypothyroidism screening in instances of unexplained pericardial effusion. The sample size provided a comprehensive view of the cardiovascular and lipid profile abnormalities associated with hypothyroidism. Increased concentrations of total cholesterol, serum triglycerides, and VLDL were noted, whereas LDL levels stayed at the upper threshold of normal despite showing statistical significance, and HDL levels remained unchanged. These results warrant the importance of conducting early assessments for cardiovascular risk in patients with hypothyroidism.

**Keywords:** *Hypothyroidism, Hormone, Metabolism, LDL, VLDL*

## INTRODUCTION

Hypothyroidism is a condition with inadequate production of thyroid hormones, resulting in a general decrease in metabolic activity. This prevalent endocrine disorder impacts around 2% of adult females and between 0.1% to 0.2% of adult males within the broader population. Thyroid hormones have a significant influence on almost every tissue in the body, and their deficiency can disrupt multiple organ systems because of altered metabolism.

The complications of cardiovascular system are among the most prominent and persistent clinical manifestations associated with hypothyroidism Hypothyroidism is closely linked to a heightened risk of cardiovascular issues and mortality. Its impact can vary from mild dysfunction in both systolic and diastolic functions to more severe conditions like heart failure and coronary artery disease Hypothyroidism is associated with an increased likelihood of developing coronary artery disease and peripheral vascular disease. A significant metabolic issue related to hypothyroidism is secondary

dyslipidemia, which typically presents as elevated total cholesterol and LDL cholesterol levels. These factors are well-established risk contributors to cardiovascular disease.

**RATIONALE FOR THE STUDY**

Several investigations within our nation have not thoroughly evaluated cardiovascular metrics in individuals diagnosed with hypothyroidism. Given the significant interest in understanding the lipid profile changes, and cardiac abnormalities associated with this condition, this research focuses on assessing biochemical irregularities and cardiovascular metrics in patients recently diagnosed with hypothyroidism, by utilizing ECG, echocardiography, and lipid profile analyses. It is noteworthy that numerous cardiovascular alterations can be reversed with suitable treatment. Consequently, this study highlights the critical need for early detection and proactive management of hypothyroidism to avert potentially severe cardiovascular complications.

**AIMS & OBJECTIVES**

The objective is to evaluate the lipid profile and detect cardiac manifestations in patients recently diagnosed with hypothyroidism, by utilizing ECG, echocardiography, and lipid profile assessments., thereby re-evaluating the importance of treatment, even in mild cardiac presentations, and aiming to prevent dyslipidemia.

**METHODOLOGY**

This research encompasses 120 newly diagnosed instances of hypothyroidism at the Chettinad Hospital and Research Institute located in Kelambakkam, Chennai.

**SAMPLE SIZE**

120 newly diagnosed hypothyroid patients.

**STUDY DURATION**

January to March 2025 .

**INCLUSION CRITERIA**

- Patients who have recently been diagnosed with hypothyroidism.
- Individuals with hypothyroidism who have yet to start treatment.
- Participants who are above 18 years of age and below 60years

**EXCLUSION CRITERIA**

- Individuals with known cardiac conditions, such as congenital heart defects, rheumatic heart disease, ischemic heart disease, or other cardiovascular complications, as well as renal or liver disorders.
- Patients with diagnoses of COPD, severe anemia, diabetes mellitus, or other endocrine abnormalities.
- Those using medications that may influence thyroid function, including beta-blockers, antiarrhythmic drugs, lipid-lowering agents, lithium, oral contraceptives, steroids, or alcohol.
- Critically ill patients requiring intensive care.
- Female smokers.

**Investigations**

The following tests are conducted: FT3, FT4, TSH, complete blood count, ESR, random blood sugar, urinalysis, blood urea, serum creatinine, lipid profile, 12-lead ECG, and 2D echocardiography (ECHO).

**Hormone Analysis:**

Fasting Blood samples are collected in the early morning, and hormone levels (FT3, FT4, TSH) are measured.

**Echocardiography**:

A 2D echocardiogram equipped with color Doppler and continuous wave Doppler, along with transesophageal imaging capabilities, is utilized. The evaluations focus on assessing systolic and diastolic dysfunction, as well as pericardial effusion. Diastolic dysfunction is classified based on the Canadian consensus criteria.

**Systolic Dysfunction Evaluation**

This is evaluated through systolic time intervals, including the pre-ejection period (PEP) and left ventricular ejection time (LVET). A PEP/LVET ratio greater than 0.76 indicates the presence of systolic dysfunction.

**Statistical Methods**

The analysis includes measures of central tendency and dispersion, standard error of the difference between means, and graphical data representation.

**Study Design**

This research is a cross-sectional clinical study involving 120 patients newly diagnosed with hypothyroidism, concentrating on the evaluation of cardiac manifestations through ECG, ECHO, and lipid profile analysis.

## RESULTS

This research indicates that the predominant age group among hypothyroid patients is 31 to 40 years, accounting for 38.3% of the overall sample. The average age of the participants was found to be 35 years.. Among the 120 cases studied, females represented a substantial majority, accounting for 81.7% (98 out of 120 patients), while males constituted 18.3% (22 out of 120). The largest number of female cases (43.9%) was also found in the 21-30 age group, whereas 40.9% of males fell within the 41-50 age range.

| Age group (Years) | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | Number | Percentage | Number | Percentage | Number | Percentage |
| 21-30 | 7 | 31.8 | 43 | 43.9 | 50 | 41.7 |
| 31-40 | 5 | 22.7 | 41 | 41.8 | 46 | 38.3 |
| 41-50 | 9 | 40.9 | 7 | 7.1 | 16 | 13.3 |
| 51-60 | 1 | 4.5 | 7 | 7.1 | 8 | 6.7 |
| **Total** | **22** | **100** | **98** | **100** | **120** | **100** |

**Fig.1**

## SYMPTOMATOLOGY

The symptoms most frequently reported by patients with hypothyroidism included weight gain, fatigue, dry skin, and a hoarse voice. Notably, weight gain was documented in 79.2% of the cases, establishing it as the most common symptom among this population.. Lethargy was reported by 65.8% of patients, followed by dry skin in 61.7% and hoarseness of voice in 60.8%. Constipation was a complaint in 50.8% of the cases, while cold intolerance was present in 46.7%. Menstrual irregularities were noted in 28.3% of female patients, reflecting an additional symptom specifically affecting the female population.

Additional symptoms, though less common, included dyspnea (25.8%) and depression (19.2%). Notably None of the patients presented symptoms indicative of proximal muscle weakness, suggesting that this particular symptom is relatively uncommon among hypothyroid patients in the study group.

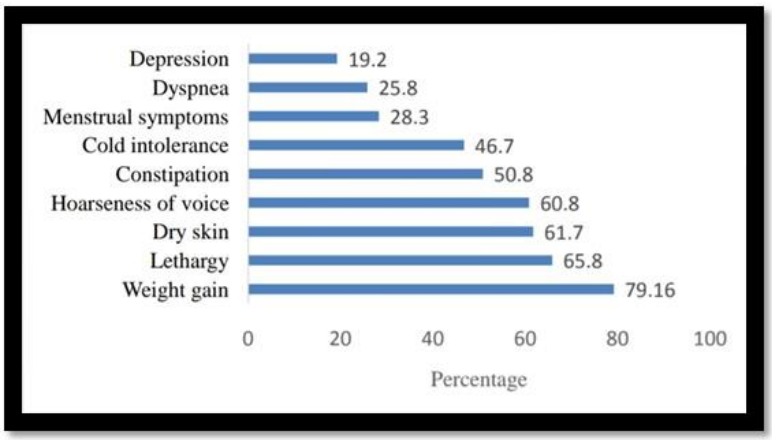


**Fig 2**

During the general examination the predominant feataures included weight increase and skin is dry, observed in 79.2% and 61.7% of patients, respectively. Bradycardia, characterized by a pulse rate of less than 60 beats per minute, was identified in 61.7% of the cases (74 out of 120 patients). Additionally, an elevated body mass index (BMI) exceeding 25 kg/m² was common, impacting 77.5% of patients, which suggests a significant prevalence of overweight or obesity among individuals with hypothyroidism.

Other remarkable findings included goitre, observed in 13.3% of patients, suggesting thyroid gland enlargement in a subset of the population. Blood pressure measurements revealed that 16.7% of patients had hypertension (BP >140/90 mmHg), while 21.7% had blood pressure in the prehypertensive range (120/80 mmHg to 140/90 mmHg These results underscore the existence of cardiovascular risk factors that are frequently linked to hypothyroidism.

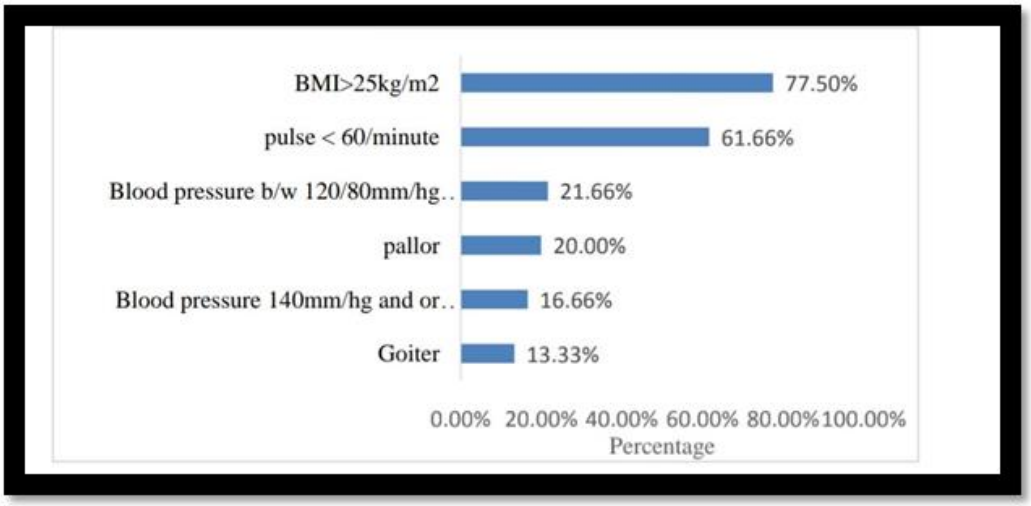


**Fig.3**

**SYSTEMIC EXAMINATION FINDINGS**

In the cardiovascular examination of hypothyroid patients, diminished heart sounds were detected in 26.7% of cases (24 out of 120), indicating a possible reduction in cardiac output. Cardiomegaly, or heart enlargement, was observed in 6.7% of patients, a sign that may point to underlying structural or functional cardiac changes related to hypothyroidism.

Neurological examination findings revealed delayed reflexes, particularly in the ankle, were present in 66.7% of patients, insisting the neuromuscular effects of thyroid hormone deficiency. Additionally, hoarseness of voice was noted in 53.3% of cases, reflecting the impact of hypothyroidism on the laryngeal muscles. These CNS symptoms are characteristic of the neuromuscular slowing often associated with this condition.

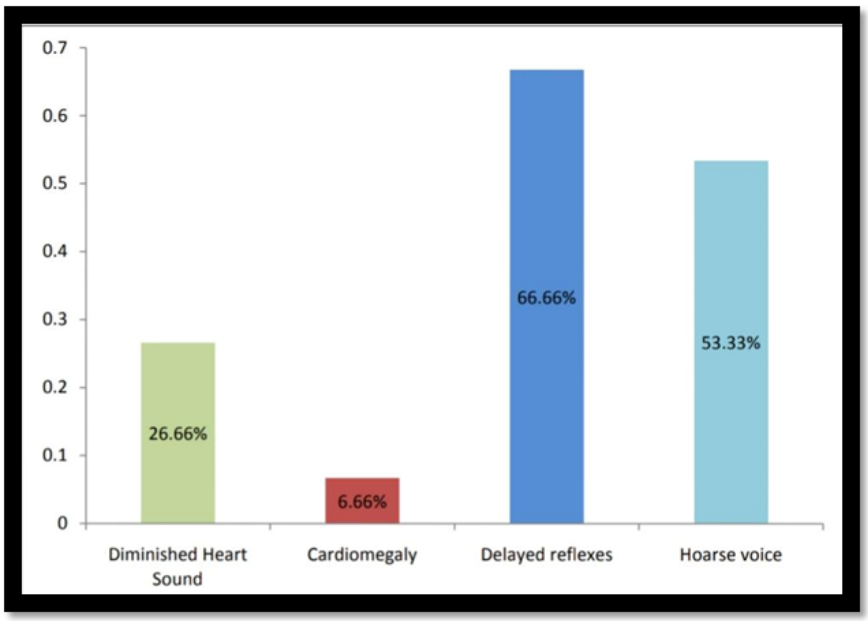


**Fig 4**

In assessing the severity according to TSH levels, 88.3% of patients (106 out of 120) exhibited TSH levels above 10, indicating a more pronounced degree of thyroid dysfunction. The remaining 11.7% (14 patients) had TSH levels below 10, suggesting a milder form of hypothyroidism.

**Lipid Profile in Relation to TSH Levels**

Lipid analysis revealed an elevation in total cholesterol (TC), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), and triglycerides (TGL), alongside a decrease in high-density lipoprotein (HDL) in patients with thyroid-stimulating hormone (TSH) levels both below and above 10. For individuals with TSH levels under 10, the mean total cholesterol was noted to be 192.35 mg/dL, with LDL at 125.35 mg/dL, VLDL at 37.78 mg/dL, triglycerides at 199.14 mg/dL, and HDL at 36.57 mg/dL.

In patients with TSH levels >10, the mean total cholesterol was slightly lower at 187.65 mg/dL, LDL at 115.39 mg/dL, VLDL at 37.83 mg/dL, triglycerides at 206.06 mg/dL, and HDL at 34.92 mg/dL. These differences were statistically significant ($p < 0.05$), indicating that lipid profile alterations are closely associated with varying levels of TSH.

| Lipid Profile | TSH <10 | | TSH > 10 | | SE between two mean | Z value | P value |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | |
| Total Cholesterol | 192.35 | 9.28 | 187.65 | 27.59 | 3.65 | 25.20 | < 0.05 |
| HDL | 36.57 | 5.89 | 34.92 | 5.98 | 1.67 | 55.08 | < 0.05 |
| LDL | 125.35 | 17.70 | 115.39 | 21.80 | 5.18 | 17.76 | < 0.05 |
| VLDL | 37.78 | 6.06 | 37.83 | 5.99 | 1.72 | 53.48 | < 0.05 |
| Triglyceride | 199.14 | 14.79 | 206.06 | 12.72 | 4.14 | 22.22 | < 0.05 |

**Fig 5**

**ECG Findings**

| ECG Changes | Number (N=120) | Percentage |
|---|---|---|
| Normal | 37 | 30.83 |
| Bradycardia | 50 | 41.66 |
| Low voltage Complexes | 28 | 23.33 |
| STT changes | 27 | 22.5 |
| LBBB | 15 | 12.5 |
| RBBB | 9 | 7.5 |

**Fig 6**

In the study, it was found that 30.8% of the patients (37 out of 120) exhibited a normal electrocardiogram (ECG). The most prevalent ECG abnormality was bradycardia, which occurred in 41.7% of the cases (50 patients). Additionally, low voltage complexes were identified in 23.3% of the patients, indicating diminished electrical activity. Other significant observations included ST-T changes in 22.5% of the cases, left bundle branch block (LBBB) in 12.5%, and right bundle branch block (RBBB) in 7.5%.

**ECHOCARDIOGRAPHY FINDINGS :**

Echocardiographic assessments revealed normal results in 30% of the evaluated cases (40 out of 120). The most common abnormality identified was pericardial effusion, which occurred in 26.71% of people (32 cases). Diastolic dysfunction also present in 26.71% of the cases, predominantly classified as mild, with no instances of severe diastolic dysfunction reported. Furthermore, an increase in interventricular septum (IVS) thickness was observed in 6.7% of the cases (8 patients), and systolic dysfunction was noted in an additional 6.7% of patients.(fig.7)

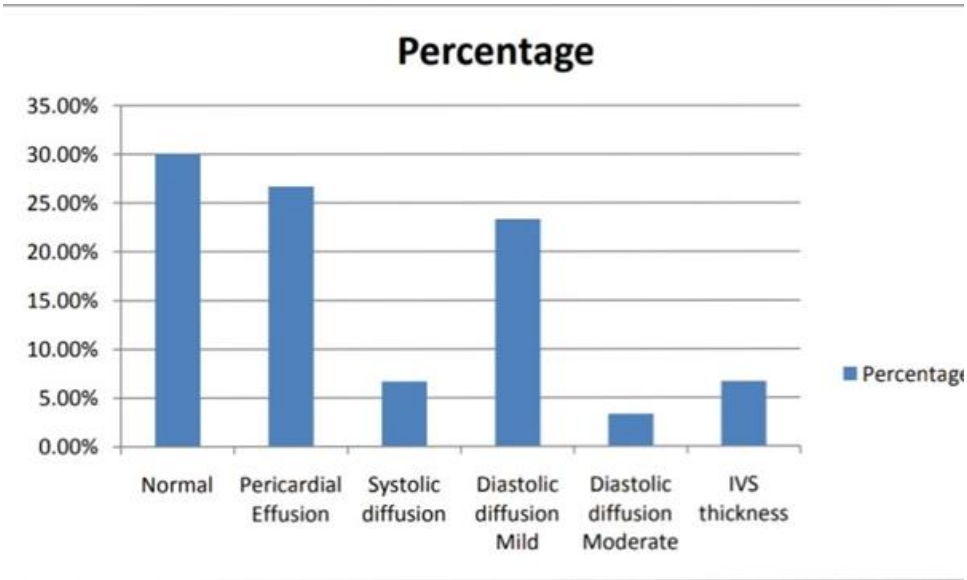


**Fig: 7**

**DISCUSSION**

In this study conducted at Chettinad Hospital and Research Institute in Kelambakkam, Chennai, involving 120 patients newly diagnosed with hypothyroidism between January and March 2025, various demographic and clinical characteristics were evaluated and analysed to existing literature. The findings elicited that many of participants were aged between 31 and 40 years, with majority of females, representing 81.7% of the total cases. This distribution aligns with commonly cited data in internal medicine texts, such as Harrison's, which also note a higher incidence of hypothyroidism in females. The most commonly reported issues among patients were weight gain, fatigue, dry skin, a raspy voice, and difficulty with bowel habits. These symptoms reflect the classic presentation of hypothyroidism and correlate well with findings from other studies on hypothyroid patients In a comprehensive assessment, the most common observations included weight gain also with dry skin, which were reported in 79.16% and 61.7% of patients, respectively. Additionally, bradycardia was observed in 61.66% of the patients, while 16.66% exhibited hypertension with readings surpassing 140/90 mmHg.. In a study by Klein on 907 hypothyroid patients, hypertension was observed in 21%, which is comparable to the 16.66% observed in our study. Other studies, such as one by Kral88 et al. (1992), found a 35% incidence of hypertension in hypothyroid patients, highlighting the cardiovascular impact of the condition Bradycardia and a diminished stroke volume, both of which lead to a reduction in cardiac output, are frequently observed, highlighting the cardiovascular effects associated with hypothyroidism.Systemic examination findings revelaed delayed ankle reflexes in 66.66% of patients, consistent with standard endocrinology textbooks and studies by Lambert and Underdahl. Reduced heart sounds, observed in 26.66% of individuals, indicated the presence of pericardial effusion, a condition often present in hypothyroidism.. Comparable findings were noted in a study by Rawat and Satyal, who reported pericardial effusion in 26.67% of hypothyroid cases. The findings revealed that elevated concentrations of total cholesterol, LDL, VLDL, and triglycerides, accompanied by a decrease in HDL levels.This aligns with research by Kanaya et al. (2002), which also found elevated cholesterol in hypothyroid patients. Additionally, the results correspond with data from Williams' Textbook of Endocrinology and research by Term Burdge in 1977, both of which reported similar lipid alterations associated with hypothyroidism. Electrocardiogram (ECG) findings revealed that 30.83% of patients had a normal ECG. Among individuals with abnormalities, bradycardia emerged as the most prevalent condition, occurring in 41.66% of cases, followed by low-voltage complexes at 23.33%. Less commonly observed were left bundle branch block (LBBB) in 12.5% of patients and right bundle branch block (RBBB) in 7.5%. These observations are consistent with findings reported by R. Varma, with the exception of conduction disturbances, which were not observed in this study. Research conducted by M. H. Nikoo (SUMS, 2002) identified sinus tachycardia, QT prolongation, and ventricular tachycardia, none of which were present in our cohort.

Echocardiographic evaluations revealed that 30% of cases had normal findings, while pericardial effusion was the most frequently noted finding, affecting 26.67% of patients. These findings are in aligned with R. Verma's 1995 study, which indicated a 45% prevalence of pericardial effusion in hypothyroid patients. However, other literature, including studies by Rawat and Satyal, suggests a prevalence range between 30% and 80%. The relatively lower incidence observed in our study may be attributed to the selection criteria, which focused on newly diagnosed cases. Diastolic dysfunction was observed in 26.66% of patients, primarily as mild dysfunction. Systolic dysfunction was noticed in 6.67% patients. Interventricular septal (IVS) thickness was recorded in only eight patients in our study, whereas previous research indicated a higher frequency of IVS and left ventricular posterior wall (LVPW) thickening in both subclinical and overt hypothyroidism. Studies by Bennet (1983), Lee (1990), and Bernstein (1995) did not report similar occurrences, suggesting variability in cardiac manifestations among different hypothyroid populations.

## CONCLUSION

This study, conducted on 120 newly diagnosed hypothyroid patients, The analysis indicates that bradycardia is the predominant ECG abnormality observed, with low voltage complexes following closely. Additionally, pericardial effusion emerged as the most prevalent finding in echocardiographic assessments, highlighting the critical need for hypothyroidism screening in instances of unexplained pericardial effusion. The sample size provided a comprehensive view of the cardiovascular and lipid profile abnormalities associated with hypothyroidism. Increased concentrations of total cholesterol, serum triglycerides, and VLDL were noted, whereas LDL levels stayed at the upper threshold of normal despite showing statistical significance, and HDL levels remain unchanged.

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