



**ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC CHANGES IN  
SUBCLINICAL PRIMARY HYPOTHYROIDISM**

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## ABSTRACT

**Introduction:** The cardiovascular system is one of the most important targets of thyroid hormones and is very sensitive to a minimal decrease of circulating thyroid hormones. This study was done to assess the cardiovascular parameters in newly diagnosed subclinical hypothyroid patients by using Electrocardiogram and Echocardiography. **Material and Methods:** The present study included 25 patients. **Results:** ECG changes like Sinus Bradycardia were seen in 16% of patients, AV block was seen in 8%, low voltage complex was seen in 24%, generalized and non-specific t wave inversion was seen in 4%. The left ventricular end-systolic diameter and left ventricular end-diastolic diameter did not differ from the normal values. The mean left ventricular posterior wall thickness was  $9.12 \pm 0.85$  and Mean interventricular septum thickness was  $9.152 \pm 0.749$  in the study group, which were increased. A significant association was found between the occurrence of increased LVPW thickness and the severity of disease. A similar relationship was also demonstrated for abnormal IVSW thickness. IRT was significantly prolonged in subclinical group and E/A ratio was reduced. These two parameters directly represent the impaired diastolic dysfunction. Mild pericardial effusion was found in 3 individuals of subclinical group. **Conclusion:** This study suggests that it is very important to evaluate patients of subclinical hypothyroidism for cardiovascular changes so that prior interventions could be performed to improve the clinical outcomes

**KEYWORDS:** Hypothyroidism, Echo, IRT.

## INTRODUCTION

Hypothyroidism is a clinical state, due to the decreased secretion of thyroid hormones or more rarely, from their impaired activity at the tissue level. It is the most common pathological hormone deficiency. Pathology of the thyroid gland (Primary Hypothyroidism) accounts for over 99.5% of cases of thyroid gland failure and < 0.5% result from a disorder of the pituitary gland or hypothalamus (central hypothyroidism).

Thyroid hormone has the ability to alter the cardiovascular hemodynamics. Besides its direct effects, the thyroid hormone also causes a secondary increase in cardiac contractility by increasing the substrate requirement and oxygen consumption. Thyroid hormone is known to increase sympathetic activity, angiotensinogen and atrial natriuretic peptide. It decreases vasopressin.

Cardiovascular Manifestations of Subclinical Hypothyroidism include Impaired LV function and cardiorespiratory adaptation to effort that becomes unmasked during exercise. Cardiovascular abnormalities have been detected echocardiographically. Subclinical

hypothyroidism does not produce structural abnormalities, but it does manifest functional disturbances. More specifically, these patients have resting LV diastolic dysfunction, evidenced by delayed relaxation and impaired systolic dysfunction on effort that results in poor exercise capacity. Flow-mediated vasodilatation, a marker of endothelial function is significantly impaired in subclinical hypothyroidism and decreased heart rate variability a marker of autonomic activity suggests hypofunctional abnormalities in the parasympathetic nervous system.

Subclinical hypothyroidism does result in a small increase in LDL cholesterol and a decrease in high-density lipoprotein cholesterol, changes that enhance the risk for development of atherosclerosis and coronary artery disease. It has been established that subclinical hypothyroidism is an independent risk factor for atherosclerosis and myocardial infarction.<sup>[1]</sup>

In India, the Sub Himalayan belt extending from Kashmir to Assam is a well recognized area of endemic iodine deficiency. Iodine content of staple food (rice) and drinking water was found to be poor in sub-Himalayan

zone of India.<sup>[2]</sup> Thyroid disorders are common endocrine diseases in Himachal Pradesh and District Kangra is a known area of endemic iodine deficiency.

Since there was a lack of studies in our country and hardly any study in this area regarding the association of hypothyroidism and cardiovascular system. This study was performed to assess electrocardiographic and echocardiographic changes in untreated newly diagnosed primary hypothyroid patients.

### Methods

This hospital based observational study was conducted in the Department of Medicine and Cardiology of Dr. Rajendra Prasad Government Medical College and Hospital, Kangra (at Tanda) for a period of one year (from December 2020 to November 2021) after approval from Institutional Ethics Committee.

A total of 25 patients with subclinical hypothyroidism were included. Inclusion criteria were: newly diagnosed patients, detected hypothyroid patients not on treatment, and patients on L-thyroxine for less than 4 months. Exclusion criteria were patients with known cardiac disease, patients with COPD, severe anaemia, diabetes mellitus or any other endocrinological disorder, patients taking medications that alter the thyroid function like beta-blockers, lithium, OCP's, steroids and alcohol.

All subjects gave informed consent before participating in the study. Clinical assessment was done as per the proforma, which included a detailed history and examination. In patients with symptoms and signs suggestive of hypothyroidism hematological and biochemical investigations were carried out in the hospital-based laboratory.

### Echocardiography

Following parameters (LVEDD, LVESD, diastolic LVPWT & IVST) were assessed using standard m-mode echocardiography. M-mode tracing was obtained by placing the cursor just beyond the tips of the mitral valve leaflets in a 2D-echocardiographic para-sternal long-axis view. The ultrasound beam was kept parallel to the IVS. Measurements are made by leading-edge method, using R wave on ECG at the end-diastole and the peak of LV posterior wall thickening at the end-systole. LV dimensions and wall thickness are measured both at end-diastole and end-systole.

Doppler echocardiography was used to assess systolic and diastolic function which includes the following parameters EF%, FS%, PEAK E(cm/sec), PEAK A(cm/sec), E/A, IRT (msec).

### Data analysis

The data were presented as mean, standard deviation, frequency, and percentages.

## RESULTS

### Electrocardiogram findings

Electrocardiographic results in hypothyroid patients show different changes. ECG changes like Sinus Bradycardia were seen in 16% of patients, AV block was seen in 8%, low voltage complex was seen in 24%, generalized and non-specific t wave inversion was seen in 4% of patients whereas without any changes, normal results were seen in 48% of patients (Table 1).

**Table 1: Electrocardiogram findings.**

	Frequency	Percentages
Normal	12	48%
Sinus bradycardia	4	16%
AV block	2	8%
Low voltage complex	6	24%
Generalized t wave Inversion	1	4%
Non-specific t wave Changes	1	4%

### M-Mode Echo parameters

Table 2 shows M mode echo parameters in subclinical hypothyroidism. The left ventricular end-systolic diameter and left ventricular end-diastolic diameter did not differ from the normal values. The mean left ventricular posterior wall thickness was  $9.12 \pm 0.85$  and Mean interventricular septum thickness was  $9.152 \pm 0.749$  in the study group, which were increased. A significant association was found between the occurrence of increased LVPW thickness and the severity of disease. A similar relationship was also demonstrated for abnormal IVSW thickness.

**Table 2: M-Mode Echo parameters.**

Symptoms	Normal	Results
LVEDD (mm)	41.5-56	$46.71 \pm 1.35$
LVESD (mm)	26-38	$29.43 \pm 2.12$
dIVST (mm)	6-9	$9.15 \pm 0.75$
LVPWT (mm)	6-9	$9.12 \pm 0.85$

### Doppler derived parameters

Table 3 summarizes Doppler-derived parameters. Mean  $\pm SD$  of Transmural E and A velocities, E/A ratio, and IRT. IRT was significantly prolonged in subclinical group and E/A ratio is reduced. These two parameters directly represent the impaired diastolic dysfunction.

**Table 9: Doppler echocardiographic changes in subclinical hypothyroidism.**

Parameter	Normal values	Achieved values (Mean $\pm$ SD)
EF%	55%	$66.04 \pm 3.92$
FS%	26-44%	$36.8 \pm 1.46$
PEAKE(cm/sec)	50-90	$81.08 \pm 3.80$
PEAKA(cm/sec)	40-90	$60.24 \pm 6.25$
E/A	1-2	$1.338 \pm 0.157$
IRT(msec)	60-90	$94.48 \pm 4.290$

### Pericardial effusion

Pericardial effusion can be present in systemic disorders including hypothyroidism. We presented 25 patients in study of subclinical hypothyroidism with an ubiquitous pericardial effusion. Also, this case focuses attention on subclinical hypothyroidism. As a result, presence of mild pericardial effusion was seen in 3 patients.

### DISCUSSION

Our study focused on cardiac abnormalities in the patients with primary hypothyroidism. Electrocardiographic results in hypothyroid patients show different changes. ECG changes like low voltage complex were seen in 24%, Sinus Bradycardia was seen in 16% of patients, AV block was seen in only 8%, generalized and non-specific t wave inversion was seen in 4% of patients whereas without any changes, normal results were seen in 48% of patients.

Gupta et al., found the predominant abnormality in the ECG study of hypothyroid cases was sinus bradycardia which was found in 16 (61.5%) cases ( $P < 0.05$ ). ST-T changes in the form of T-wave inversion or ST-segment depression and flattening was present in 7 cases (26.9%).<sup>[3]</sup>

As a non-invasive method echocardiography can play important role in recognising the cardiac pathology as well as to follow up the effect of the therapy.<sup>[4]</sup> While left ventricular end-systolic diameter and left ventricular end-diastolic diameter did not differ from the normal values, the mean left ventricular posterior wall thickness was  $9.12 \pm 0.85$ . Mean interventricular septum thickness was  $9.152 \pm 0.749$  in the study group of subclinical hypothyroidism. Both slightly increased. The prevalence of abnormal LVPW thickness increased as the severity of hypothyroidism increased. A significant association was found between the occurrence of increased LVPW thickness and the severity of disease. A similar relationship was also demonstrated for abnormal IVSW thickness. IRT is significantly prolonged in subclinical group and E/A ratio is towards the lower side. These two parameters directly represent the impaired diastolic dysfunction.

Pericardial effusion has long been known to be a feature of the so-called myxedema heart. Pericardial effusion can be present in systemic disorders including hypothyroidism. We present 25 patients in a study of subclinical hypothyroidism with an ubiquitous pericardial effusion. Also, this case focuses attention on subclinical hypothyroidism. As a result mild pericardial effusion was present in 3 patients. Karki et al., stated that pericardial effusion was one of the significant complications in hypothyroidism. The incidence varies to be as high as 80% in severe, long-standing, and congenital hypothyroidism, and only 3% in early stages and mild form of the disease. The frequency of pericardial effusion in well-established myxedema justifies the need to assess pericardial effusion; however,

its occurrence in mild cases and as first presentations cannot be overlooked.<sup>[5]</sup>

### CONCLUSION

The subtle impairment of LV diastolic dysfunction and mild pericardial effusion in subclinical hypothyroidism justify the need for hormone replacement in these patients. The early diagnosis and treatment may revert these cardiac complications, stressing a greater emphasis on preventive medicine. However, further studies with a larger sample size are required to validate our findings.

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