

# Study of ECG Changes in Hypothyroidism in Tertiary Care Hospital, Ahmedabad

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**Abstract:** *This study investigates the prevalence of ECG changes in patients with hypothyroidism at a tertiary care hospital in Ahmedabad. By examining 30 patients with diagnosed hypothyroidism, the study found that 70% exhibited STT wave changes, 50% had low voltage complexes, and 10% showed sinus bradycardia. The study concludes that ECG abnormalities are more common in patients with higher TSH levels, with a 100% abnormality rate in patients with TSH levels above 40 pIU/ml.*

**Keywords:** Hypothyroidism, ECG changes, TSH levels, STT wave changes, Low voltage complexes.

## 1. Introduction

Thyroid hormone has numerous physiological effects, causing alterations in essentially all metabolic pathways and organs. The thyroid hormone affects myocardium by its direct effect and by its peripheral action. Interaction with catecholamines is also responsible for its action. Thyroid hormone has important physiological effects on the cardiovascular system. Cardiovascular effects of hypothyroidism can include electrocardiographic changes such as bradycardia, right bundle branch block, flattened or inverted T waves, QRS prolongation, and even torsades de pointes ventricular arrhythmia. Excess thyroid hormone has cardiac stimulatory effect. In hypothyroidism, QT interval prolongation can occur and lead to ventricular arrhythmia, which can be resolved with T4 treatment alone. Increase in QTc interval have been seen in hypothyroidism and this increase is directly related to severity of hypothyroidism. TSH levels have also been shown to be directly correlated to QT prolongation and QT dispersion. QT dispersion is the interlead variability of QT interval on the surface ECG that reflects regional variation in myocardial repolarization and an increased QT dispersion has been strongly associated with an increase in ventricular arrhythmias and sudden cardiac death. Lastly, improvements in heart rate variability have also been documented in treated hypothyroidism.

### Purpose of study

This study aims to explore the prevalence and types of electrocardiographic ECG changes observed in patients with hypothyroidism in a tertiary care hospital in Ahmedabad.

### Significance of study:

This study highlights the clinical importance of monitoring ECG changes in hypothyroid patients, as these changes can indicate the severity of the condition and inform treatment decisions.

### Aims and Objectives

Cross sectional observational study to explore the prevalence and types of electrocardiographic ECG changes observed in patients with hypothyroidism in a tertiary care hospital in Ahmedabad.

## 2. Materials and Methods

Patients presenting with signs and symptoms of hypothyroidism were randomly selected for the study from department of Medicine – Dr. MK Shah Medical College Ahmedabad. The exclusion criteria included - patients with significant valvular abnormalities, congenital heart disease, significant arrhythmias, patients with pacemaker, patients with systemic disease like Diabetes mellitus or Systemic lupus erythematosus. 30 subjects (8 male and 22 female) were selected for the study and evaluated with ECG.

## 3. Result

We included 30 patients of hypothyroidism, diagnosis of hypothyroidism was done primarily by measuring TSH, T3 and T4 levels. Hypothyroidism patients have mean TSH of 25 pIU/ml. T3 and T4 were decreased to mean of 0.49 ng/ml and 3.15 pg/ml in hypothyroid patients respectively.

Unexplained tiredness and lethargy were the most common presenting features in hypothyroid patients 70%. Weight gain, goiter and cold intolerance were also commonly seen in 50% patients. Menstrual abnormality was also present in 50% of female reproductive age group, other symptoms were less than 50% (Table - 1).

**Table 1:** Showing clinical profile of hypothyroid patients on initial examination.

Clinical features	No. of patients	Percentage (%)
Unexplained tiredness & lethargy	21	70
Weight gain	15	50
Goitre	15	50
Cold tolerance	15	50
Menstrual abnormality in females (n=22)	11	50
Edema (pedal/periorbital)	12	40
Hoarseness of voice	6	20

Clinical features	No. of patients	Percentage (%)
Personality changes & impaired memory	6	20
Shortness of breath	6	20
Infertility (n=22)	3	14
Angina	3	10
Signs of heart failure	-3	10
Delayed relaxation of ankle jerk	3	10
Skin changes	3	10
Decreased hearing	None	-

There were ST - T wave changes, like flattening, depression with/without low voltage and T wave changes, like flattening, inverted, low voltage and T wave changes like flattening, inverted, low amplitude was found among 70% patients. Low voltage complexes with ST - T changes were found among 50% and sinus bradycardia and other ECG abnormality was found in approximately 10% of patients and 20% had normal ECG (Table - 2).

50% of patients had low voltage complexes with STT changes, 20% had STT changes without low voltage, and 10% had other abnormalities. Normal ECG was observed in 20% of patients. (Table - 3).

**Table 2:** Showing incidence of various electrocardiographic changes in hypothyroid patients.

Specific ECG abnormality	No. of cases with abnormalities	percentage (%)
ST - T wave changes: Flattening, depression with/without low voltage	21	70
T - wave changes: flattening, inverted, low voltage	21	70
Low voltage complexes with ST - T changes	15	50
Sinus bradycardia	3	10
Low voltage Complexes without ST - T changes	3	10
Conduction defect	3	10
Increase QT interval	3	10
Normal E. C. G.	6	20

**Table 3:** Showing incidence of coexistence of common ECG abnormality in hypothyroid patients

Specific ECG abnormality	No. of cases with abnormality	Percentage
Low voltage complexes with ST - T changes	15	50
ST - T changes without low voltage	6	10
Abnormalities other than ST - T changes and low voltage	3	20
Normal ECG	6	20

This study highlights the clinical importance of monitoring ECG changes in hypothyroid patients, as these changes can indicate the severity of the condition and inform treatment decisions. (Table - 4)

**Table 4:** Showing incidence of abnormal ECG with relation to TSH level in hypothyroid patients

TSH level pIU/ml	No. of patient	Abnormal ECG	Percentage (%)
<10	3	1	33
10-20	7	4	57
20 - 30	10	10	100
30 - 40	8	7	87
>40	2	2	100
Total	30	24	80

#### 4. Discussion

Hypothyroid patients have mean TSH of 25 pIU/ml whereas in Euthyroid control it was well within limit (<7 pIU/ml). None of the patient had barely measurable level of T4 as studied by previous workers nor did they had sub - clinical hypothyroidism - a well studied (6) entity now a days, which defines asymptomatic state associated with raised TSH but normal T3 & T4 with or without TRH stimulation (7). Our study shows the commonest symptoms of hypothyroidism with above 50% prevalence are unexplained tiredness, lethargy weight gain, goiter, cold intolerance and menstrual abnormality.

Our study shows the commonest ECG finding was ST - T flattening without comparable ST displacement. Twenty out of thirty patients i. e. 70% of all patients had this ECG finding. Of these twenty - one patients with ST - T flattening, low voltage QRS complexes were present in fifteen patients (50%). It is hypothesized that ECG in adult in absence of pericardial effusion may be due to premature atherosclerosis secondary to hypothyroidism. As all subjects were below forty years, age related atherosclerosis is not a possibility.

Our study shows that only ST - T flattening without comparable ST - displacement and without low voltage was present in six out of twenty - one subjects (20%), all of them adult patients again explain that these ECG changes were due to hypothyroidism. Coronary atherosclerosis occurs with twice the frequency in patients with myxedema compared with age and sex matched controls (8).

Bradycardia has been considered a common finding in severe hypothyroidism as described by Braunwald et al (9) but in our study it was seen in only three out of thirty (10%) patients. Similar observations were seen by Marriot et al. (10). The

absence of bradycardia in our study may be explained due to myocardial ischemia (evident by ST - T flattening in 70%) leading to tachycardia in most (90%) of our patients is also because our patients were not of severe hypothyroidism.

Low voltage ECG was invariably associated with ST - T change in fifteen (50%) patients without ST - T changes. This suggests that low voltage ECG as observed while only three patients (10%) had low voltage by previous workers may be a not severely hypothyroid. late phenomenon. As our subjects were (TSH level more than 50pIU) rather our subjects were mild to moderate hypothyroid. From this observation we can say that STT changes come much earlier than low voltage & bradycardia.

Low voltage QRS complexes has been described by previous workers (11). It is seen only in three (10%) out of thirty patients. Earlier presentation of disease may be the cause of normal QRS duration in our study.

QR prolongation is may be due a common finding in hypothyroid patients but this may be due to faulty measurement of QT segment, as T wave may be too small to be visualized. This may be the cause of fewer incidence of prolong QT (3 out of 30 i. e.10%) because of an attempt was made to avoid this fault during its measurement.

On correlation between TSH level and abnormal ECG, there is increase in number of abnormal ECG with increased level of TSH level is >40pIU/ml has abnormal ECG. This observation concludes that more severe is the hypothyroidism more is the abnormal ECG.

## 5. Conclusion

Conclusion: This study identified STT wave flattening as the most common ECG abnormality in hypothyroid patients, with a higher prevalence of ECG changes observed in those with elevated TSH levels. The findings suggest that ECG monitoring is crucial in the management of hypothyroidism, particularly in patients with severe TSH elevation.

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