

# ECG & Echocardiographic Changes in Newly Diagnosed 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 new hypothyroid patients by using Electrocardiogram and Echocardiography

**Material and Methods:** The present study included 90 patients, and it was conducted at People's college of Medical Sciences, Bhopal. Thyroid function tests were carried out in patients under study. Electrocardiogram and Echocardiography was also being done in the patients under study. The cardiovascular changes were analyzed with the TSH levels.

**Results:** More than 65% subjects were found to have clinically significant cardiovascular changes. ECG changes observed were Sinus bradycardia in 35.5%, Low voltage complexes in 16.6%, T Wave inversion in 7.8%, RBBB in 4.4%, and QTc prolongation in 2.2% cases. About 64% cases had changes as observed in echocardiographic examination. Most common finding was Diastolic dysfunction seen in 20% cases. This was followed by Pericardial Effusion and Increased IVSD thickness in 16.6% cases each. Increased LVPW thickness was seen in 11.1% cases.

**Conclusion:** This study suggests that it is very important to evaluate patients of primary hypothyroidism for cardiovascular changes so that prior interventions could be performed to improve the clinical outcomes.

**Keywords:** Hypothyroidism, Cardiovascular Changes, ECG, Echocardiography

## INTRODUCTION

Thyroid hormones have relevant effects on cardiovascular system. Many symptoms and signs recognized in patients with hypothyroidism are due to altered action of thyroid hormone on heart and vascular system, and the related hemodynamic derangements. Hypothyroidism is a common endocrine disorder resulting from deficiency of thyroid hormone. It usually is a primary process in which the thyroid gland is unable to produce sufficient amounts of thyroid hormone. The cardiovascular signs and symptoms of thyroid disease are some of the most profound and clinically relevant findings that accompany both hyperthyroidism and hypothyroidism. It has long been recognized that some of the most characteristic and common signs and symptoms of thyroid disease are those that result from the effects of thyroid hormone on the heart and cardiovascular system<sup>1-3</sup> Although it is well known that hyperthyroidism can produce atrial fibrillation, it is less well recognized that hypothyroidism can predispose to ventricular dysarrhythmias<sup>4</sup> In almost all cases these cardiovascular changes are reversible when the underlying thyroid disorder is recognized and treated. Thyroid hormone effects on the heart and peripheral vasculature include decreased SVR and increased resting heart rate, left ventricular contractility, and blood volume. In hyperthyroidism,

these combined effects increase cardiac output 50% to 300% higher than in normal individuals. In hypothyroidism, the cardiovascular effects are diametrically opposite and cardiac output may decrease by 30% to 50%. It is important to recognize, however, that the restoration of normal cardiovascular hemodynamics can occur without a significant increase in resting heart rate in the treatment of hypothyroidism.<sup>5</sup> There are only few studies done in our country to assess the cardiovascular parameters in hypothyroid patients. This study was done to assess the CVS parameters in new hypothyroid patients by ECG and Echocardiography.

Study aimed to find out cardiovascular changes in newly diagnosed hypothyroid patients using ECG and Echocardiography.

- To measure T3 T4 TSH patients under study
- To do an ECG in those diagnosed with hypothyroidism.
- To do an ECHO in those diagnosed with hypothyroidism.
- To analyze CVS changes with TSH levels.

## MATERIAL AND METHODS

This was an observational study done in People's college of medical sciences & research centre, Bhopal (M.P.). The study was carried out in the duration between November, 2014 – April, 2016. All OPD and IPD patients of Peoples Hospital diagnosed with primary hypothyroidism, during this period, who fulfilled the inclusion criteria, were included in our study. This study included 90 consecutive newly diagnosed patients with primary hypothyroidism attending People's Hospital, Bhopal (M.P.). The study was done after approval from the institutional ethics committee. An informed consent was being taken from the patients prior to inclusion in the study.

**Inclusion Criteria:** Hypothyroid patients which included.

- a) Newly diagnosed primary hypothyroid patients.
- b) Age 12 and above.

**Exclusion Criteria**

- a) Patients with known cardiac disease.
- b) Patients with Chronic obstructive pulmonary disorder, severe anaemia, diabetes mellitus or any other endocrinal disorder.
- c) Patients taking medications that alter the thyroid function like beta blockers, lithium, oral contraceptive pills, steroids, amiodarone and alcohol.

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### STATISTICAL ANALYSIS

Microsoft office 2007 was used for statistical analysis. Mean and SD were used to interpret the data.

### RESULTS

The present study included 90 patients, and it was conducted at People’s college of Medical Sciences, the study period being November 2014 – April 2014. Maximum patients, 29 in number, were seen in the age group 26-35 years.

Overall, there was preponderance of female patients consisting of 90% of total study population.

More than 65% subjects were found to have clinically significant cardiovascular changes. ECG changes observed were Sinus bradycardia in 35.5%, Low voltage complexes in 16.6%, T Wave inversion in 7.8%, RBBB in 4.4%, and QT prolongation in 2.2% cases.

About 64% cases had changes as observed in echocardiographic examination. Most common finding was Diastolic Dysfunction seen in 20% cases. This was followed by Pericardial Effusion and Increased IVSD thickness in 16.6% cases each. Increased

LVPW thickness was seen in 11.1% cases.

### DISCUSSION

In this study 90 patients were recruited for evaluation of cardiovascular changes in primary hypothyroidism. 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. The data obtained was analyzed by statistical methods using SPSS software. In our study more than 60% cases were found to have clinically significant cardiovascular changes. The study population consisted of males and females between the ages of 15- 65 years (Table 1). Overall, there was preponderance of female patients consisting of 90% of total study population (Table 2). In our study sex ratio (female: male) was observed to be 9:1.

In the present study, sinus bradycardia was the commonest ECG finding; accounting for total 35.5% of patients in the study population (Table 3). In a previous study by Ramesh et al it was found to be 40%.<sup>6</sup> Bradycardia reported in different studies have been 30% by Shashikanth, 14.3% by Kumar et al, 13.7% by Crowley et al.<sup>7-9</sup> In our study, low voltage complexes were seen in 16.7% cases (Table 3). Whereas in a previous study by Ramesh et al it was 30%, in a study by Rajasekhar et al it was seen in 24% cases, while in a study by Sharath Shah it was seen in 33% cases.<sup>6,9,10</sup>

In our study QTc prolongation was found to be in 2.2% cases (Table 3) whereas in a previous study it was found to be in 18.18% cases by Satpathy et al.<sup>11</sup> In our study, incidence of Right Bundle Branch Block (RBBB) in patients of hypothyroidism was found to be 4.4% (Table 3) whereas in a previous study it was found to be 7.5% by Ramesh et al.<sup>6</sup> In our study, incidence of t wave inversion was 7.8%, (Table 3) whereas it was 3.1% in a study by Sharath D Shah.<sup>10</sup>

Initial assessment revealed a normal Echocardiography in 35% of patients, (Table 4) whereas in a previous study it was 32.5%

Age group	No. of patients	%
15-25	15	16.7
26-35	29	32.2
36-45	22	24.4
46-55	17	18.9
56-65	7	7.8
Total	90	100.0

**Table-1:** Age Distribution

	No. of Patients	%
Female	81	90
Male	9	10
Total	90	100

**Table-2:** Gender Distribution

TSH Level	LVC	SB	QTc Prolongation	RBBB	T wave inversion	Total
5.6-30	1	11	0	3	6	21
31-50	1	9	0	1	1	12
51-70	5	8	0	0	0	13
71-90	1	2	0	0	0	3
91-110	2	0	0	0	0	2
11-130	0	1	0	0	0	1
131-150	5	1	2	0	0	8
Total	15 (16.6%)	32 (35.5%)	2 (2.2%)	4 (4.4%)	7 (7.8%)	60 (66.66%)

**Table-3:** Distribution of ECG changes found in various ranges of TSH

TSH Level	DD	PE	Increased IVSD Thickness	Increased LVPW Thickness	Total
5.6-30	6	1	9	4	20
31-50	7	1	1	3	12
51-70	2	5	4	2	13
71-90	0	1	1	1	3
91-110	0	0	0	0	0
111-130	0	2	0	0	2
131-150	3	5	0	0	8
Total	18 (20%)	15 (16.6%)	15 (16.6%)	10 (11.1%)	58 (64.44%)

**Table-4:** Distribution of Echo changes found in various ranges of TSH

by Ramesh et al.<sup>6</sup> In the present study diastolic dysfunction was the commonest echocardiographic abnormality, seen in 20% cases (Table 4). In a study by R. Verma in 1995 it was seen that 27% of patients had diastolic dysfunction.<sup>12</sup> Whereas in a study by Shashikanth, diastolic dysfunction was seen in 18% cases.<sup>7</sup> In our study pericardial effusion was found in 16.6% cases (Table 4) whereas it was 18% in a study by Shashikanth.<sup>7</sup> In the present study increased inter ventricular septum diastolic thickness was seen in 16.6% cases, whereas it was 10% in a study by Shashikanth.<sup>7</sup> In our study increased left ventricular posterior wall thickness was found in 11.1% cases (Table 4) whereas it was 15.6% in a study by Mulki.<sup>13</sup> However, Bello, et al, and Monzani et al did not find similar incidences.<sup>14,15</sup>

## CONCLUSION

This study comprised of 90 patients, all of whom were newly diagnosed hypothyroid patients, with no other co-morbidity. As in most literature, there was a female preponderance in this study. Hypothyroidism was mostly diagnosed in the 2nd to 4th decades of life amongst our study population. Bradycardia was an ECG finding seen in 35.6% of all patients in the study population; amongst other findings were low voltage complexes in 16.7%, QT prolongation in 2.2%, in 4.4% and T wave inversion in 7.8%. With respect to Echocardiography, 35% of the study population had normal parameters of echocardiography. The commonest abnormal finding in the sample was “diastolic dysfunction” seen in 20% patients. Other findings were pericardial effusion seen in 16.7% cases, increased inter ventricular septum diastolic dimension in 16.7% cases and increased left ventricular posterior wall thickness in 11.1% cases.

This study suggests that it is very important to evaluate patients of primary hypothyroidism for cardiovascular changes so that prior interventions could be performed to improve the clinical outcomes. Any unexplained pericardial effusion should be screened for Hypothyroidism. Also, all patients found to have the ECG and Echocardiographic changes as reported above should be screened for the presence of hypothyroidism.

## ABBREVIATIONS

CVS - Cardiovascular System, DD - Diastolic dysfunction, ECG - Electrocardiogram, ECHO - Echocardiography, IVSD - Interventricular Septal Dimension, LVC - Low Voltage Complexes, LVPW - Left Ventricular Posterior Wall thickness, PE - Pericardial Effusion, QTc - QT Interval (corrected), RBBB - Right Bundle Branch Block, SB - Sinus Bradycardia, T3 - Triiodothyronine, T4 - Tetraiodothyronine or Thyroxine, TSH - Thyroid Stimulating Hormone

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