



## A CLINICAL STUDY OF CARDIOVASCULAR MANIFESTATIONS IN HYPOTHYROIDISM

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**ABSTRACT** **BACKGROUND AND OBJECTIVES:** Hypothyroidism is the clinical syndrome that results from decreased secretion thyroid hormone from the thyroid gland. Hypothyroidism is associated with increased cardiovascular morbidity and mortality. Cardiovascular manifestations of hypothyroidism are quite dramatic and include bradycardia, diastolic hypertension, diastolic dysfunction, pericardial effusion, systolic dysfunction. Synthesis and to a greater extent, the degradation of lipids are depressed in hypothyroidism with a net effect of accumulation of LDL and Triglycerides. The objectives of the study are to study various cardiovascular manifestations and abnormalities in lipid profile in relation with the TSH levels in hypothyroid patients.

**METHODOLOGY :** In this study, a total of 50 newly detected hypothyroid patients presenting to the department of medicine, NRI Institute of medical sciences ,Visakhapatnam from May 2020 to June 2021 were studied for various cardiovascular abnormalities by means of Thyroid profile, ECG, ECHO, Fasting Lipid profile.**RESULTS :** In this study, most patients belonged to the age group of 41-50 years with female preponderance. Most common symptom was weight gain(62%) and the most common sign was delayed ankle jerk(64%).Bradycardia (42%), Diastolic Hypertension(32%) were the most commonly found cardiovascular signs. Bradycardia(42%), low voltage complexes (34%) were the most commonly found ECG abnormalities. Pericardial effusion(32%), Grade I diastolic dysfunction (14%), Grade II diastolic dysfunction (10%) and increased interventricular septal thickness(6%) were the various echo abnormalities observed.

**KEYWORDS :** Cardiovascular Manifestations, Diastolic dysfunction, ECG, ECHO, Lipid profile, Pericardial effusion

### BACKGROUND

Cardiovascular manifestations of hypothyroidism include reduced myocardial contractility leading to reduced stroke volume, reduced pulse rate leading to bradycardia, increased peripheral resistance accompanied by hypertension, particularly diastolic and pericardial effusions in upto 30% but rarely compromise cardiac function<sup>1</sup>. Thyroid hormones enhance the responses to catecholamines that are mediated by beta adrenergic receptors while inhibiting those mediated by alpha adrenergic receptors. This dual control is impaired in hypothyroidism or thyrotoxicosis. Study by Morteza et al in 1968 found an absolute decrease in myocardial contractility and ejection rate at rest<sup>2</sup>. Study by Edward W Bough in 1978 showed depressed systolic time intervals and increased PEP and shortened LVET<sup>3</sup>.

Resting left ventricular diastolic dysfunction is often the first manifestation of Heart disease, even preceding the systolic dysfunction at rest as found in studies by Bonow (1990) and Cuocolo(1992)<sup>4,5</sup>. In hypothyroidism, abnormalities in diastolic relaxation are thought to be due to decreased activity of sarcoplasmic reticulum calcium ATPase. Most consistent cardiac abnormality recognized in subclinical hypothyroid patients is LV diastolic dysfunction characterized by slowed myocardial relaxation and impaired early ventricular filling at rest as well as with exercise.

Hypothyroidism is associated with increased peripheral resistance. A study of hypertensive hypothyroid patients by Bing RF showed that in most of patients hypertension could be reversed with hormone therapy<sup>6</sup>. In hypothyroidism, there is decrease in the basal, average and maximal heart rates. Mechanism by which these changes occur may be related to their effects on sodium pump density and enhanced sodium and potassium permeability. All of them returned to normal after treatment<sup>7</sup>. Cardiac excitability is altered by thyroid hormones leading to arrhythmias. In this regard atria are more sensitive than ventricles. The atrial preference may be due to high beta adrenergic receptor density. In hypothyroidism, AV blocks, Sinus Bradycardia, and rare episodes of torades de pointes have been reported. Electro cardio graphic findings in hypothyroidism include Sinus Bradycardia, Low voltage complexes, atrioventricular and interventricular block, QT prolongation, incomplete or complete RBBB, Ventricular tachycardia.

Most of cardiac manifestations are reversible with adequate and timely thyroid therapy. Early diagnostic approach in patients with thyroid dysfunctional states is important for avoidance of cardiac complications that accompany these disorders<sup>8</sup>. Thus the need of the study is to assess the cardiovascular parameters in newly discovered

hypothyroid patients by ECG and ECHO.

### MATERIALS AND METHODS:

This study was a hospital based prospective observational study comprising 50 hypothyroid patients attending the department of General Medicine, NRI institute of medical sciences , Visakhapatnam from May 2020 to June 2021.

### INCLUSION CRITERIA :

- 1) Age more than 12 years
- 2) Newly diagnosed hypothyroid patients
- 3) Patients on L-Thyroxine for less than 4 months

### EXCLUSION CRITERIA :

- 1) Patients with known cardiac disease
- 2) Patients with severe anemia, COPD, Diabetes mellitus
- 3) Patients using drugs that alter the thyroid function.

Ethical clearance was obtained from Institutional ethics committee, NRI medical college, Visakhapatnam prior to the study. After taking the written and informed consent, patients satisfying the inclusion and exclusion criteria were evaluated clinically and by obtaining Hemoglobin; RBS; creatinine; ft3, ft4, TSH; Fasting lipid profile; ECG; ECHO. Patients were divided into 3 groups based on their TSH levels. First group constituted by those with TSH of 5- 20 microU/l (mild hypothyroidism)<sup>8</sup>, second group included those with TSH 20-50 microU/l (moderate hypothyroidism)<sup>8</sup> and third group formed by those with TSH >50 microU/l (severe hypothyroidism)<sup>8</sup>. Echocardiographically each patient was evaluated for presence of any pericardial effusion, Diastolic dysfunction by using trans mitral inflow velocities, systolic dysfunction by the means of Ejection Fraction and finally for any thickening of interventricular septum. The categorical data was expressed as rates, ratios and proportions. Continuous data was expressed as mean  $\pm$  standard deviation. Comparison of the data was done using chi-square test and a p value of less than or equal to 0.05 was considered as statistically significant.

### RESULTS

Out of the 50 patients included in the study, majority of them belonged to the age group of 41-50 years with overall female preponderance accounting for 64% of the study group. Clinically, weight gain was the most frequently encountered symptom which was seen in 62% of the study population followed by lethargy(58%), cold intolerance(42%) and constipation(38%). Delayed ankle jerk was the most commonly

encountered sign seen in 64% followed by BMI>25 kg/square meter(50%), dry skin(44%), pedal edema(34%) and pallor(26%). Pleural effusion and ascites were found in 6% and 4% respectively.

Bradycardia was seen in 42% of the study group and was the most common cardiovascular sign followed by diastolic hypertension and muffled heart sounds, which were encountered in 32%. Raised JVP was seen in 6%. Sinus bradycardia, which was the most common ECG abnormality in study population was seen in 42%. Other ECG abnormalities encountered in the study were low voltage complexes(34%), ST-T changes(4%), and first degree AV block(2%). Echocardiography revealed pericardial effusion in 32%, grade I diastolic dysfunction in 14%, grade II diastolic dysfunction in 10% and increased inter ventricular septal thickness in 6% and it was normal in 42%.

34% of the patients had TSH between 5 to 20 microU/l, in whom ECG was abnormal in 29.4%, ECHO was abnormal in 23.5%, pericardial effusion was found in 11.8%, and mean totalcholesterol, HDL, LDL, Triglycerides were 180.2±24.4 mg/dl, 43.3±3.6 mg/dl, 83.5±9.7 mg/dl and 164.5±81.6 mg/dl respectively.

48% of patients had TSH between 20 to 50 microU/l and in them ECG was abnormal in 66.7%, ECHO was abnormal in 66.7%, pericardial effusion was found in 41.8%, and mean total cholesterol, HDL, LDL, Triglycerides were 235.1±37.7 mg/dl, 39.9±7.3 mg/dl, 110.8±24.5 mg/dl and 219.1±69.4 mg/dl respectively.

18% had TSH more than 50 microU/l, in whom ECG was abnormal in 88.9%, ECHO was abnormal in 100%, pericardial effusion was found in 44.4%, and mean total cholesterol, HDL, LDL, Triglycerides were 243.6±43.1 mg/dl, 35.9±4.6 mg/dl, 130.3±25.1 mg/dl and 261.1±115.7 mg/dl respectively.

**Table 1 : Age And Sex Distribution Of The Study Group**

S. NO	AGE GROUP	MALES (n=18) NO (%)	FEMALES (n=32) NO (%)	TOTAL NO (%)
1	21-30	4 (22.2)	7 (21.8)	11 (22)
2	31-40	5 (27.8)	13 (40.6)	18 (36)
3	41-50	7 (38.9)	12 (37.6)	19 (38)
4	51-60	2 (11.1)	0 (0)	2 (4)
5	TOTAL	18 (36)	32 (64)	50 (100)

**Table 2 : Clinical Symptoms In The Study Group**

S.NO	CLINICAL SYMPTOM	NO. (%)
1	HOARSE VOICE	13 (26)
2	WEIGHT GAIN	31 (62)
3	CONSTIPATION	19 (38)
4	COLD INTOLERANCE	21 (42)
5	MENSTRUAL DISTURBANCES	13 (26)
6	LETHARGY	29 (58)

**Table 3: Cardiovascular Signs In The Study Group**

S.NO	CARDIOVASCULAR SIGN	NO ( %)
1	SYSTOLIC HYPERTENSION	4(8)
2	DIASTOLIC HYPERTENSION	16(32)
3	RAISED JVP	3(6)
4	MUFFLED HEART SOUNDS	16(32)
5	BRADYCARDIA	21(42)

**Table 4 : Ecg Findings In Study Group**

ECG FINDING	NO (%)
LOW VOLTAGE COMPLEXES	17(34)
BRADYCARDIA	21(42)
ST-T CHANGES	2(4)
FIRST DEGREE AV BLOCK	1(2)
NORMAL	21(42)

**Table 5: Echo Findings In Study Group**

S.NO	ECHO FINDING	NO. (%)
1	PERICARDIAL EFFUSION	16 (32)
2	GRADE I DIASTOLIC DYSFUNCTION	7 (14)
3	GRADE II DIASTOLIC DYSFUNCTION	5 (10)
4	INCREASED IVS THICKNESS	3 (6)

5	NORMAL	21 (42)
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**TABLE 6:Abnormalities in the ECG , ECHO and lipid profile based on the TSH levels.**

S. NO	TSH (mic roU/ l)	NO (%)	ABNO RMA- L ECG (%)	ABN ORM - A L ECH O(%)	PERI CARDIAL EFFU SIO-N	MEAN TOTAL CHOL (mg/dl)	MEAN HDL (mg/dl)	MEAN LDL (mg/dl)	MEAN TG (mg/dl)
1	5-20	17 (34)	29.4	23.5	11.8	180.2± 24.4	43.3±3 .6	83.5 ± 9.7	164.5 ± 81.6
2	20- 50	24 (48)	66.7	66.7	41.8	235.1± 37.7	39.9 ± 7.3	110.8 ± 24.5	219.1 ± 69.4
3	>50	9 (18)	88.9	100	44.4	243.6± 43.1	35.9 ± 4.6	130.3 ± 25.1	261.1± 115.7

**DISCUSSION**

In this study, majority of the patients belonged to the age group 31-50 years with a mean age of 40.2 years and majority of the study group were females(64%), which is similar to the demographic profile of patients found in several other studies and that mentioned in William's text book of Endocrinology<sup>9</sup>. Weight gain in hypothyroidism is usually modest and mainly due to fluid retention and was the most common clinical symptom in the study and similar result was observed in studies conducted by Wg Cdr Sampath et al<sup>10</sup>(62.5%), Sharath kumar et al<sup>8</sup>(76.6%), Abdulla J Minshed Al Farttoosi et al<sup>11</sup>(66.7%) and Sureshabu KP et al<sup>12</sup>(50%). Delayed ankle jerk was the most common sign found in the study group which is similar to that observed in the study done by Sharath kumar et al<sup>8</sup>(66.6%).

Bradycardia was encountered in 42% of the study group, which is similar to the 47% reported in Abdulla J Minshed Al Farttoosi et al<sup>11</sup> study. 34% of the patients had low voltage complexes. In studies conducted by Sharath Kumar et al<sup>8</sup>, Abdulla J Minshed Al Farttoosi et al<sup>11</sup> low voltage complexes was reported in 33.3% and 38.8% respectively.

Pericardial effusion, which was found in 32% of the patients was the most common ECHO abnormality in this study and the similar result was found in studies done by Sharath kumar et al<sup>8</sup>(26.67%), Abdulla J Minshed Al Farttoosi et al<sup>11</sup>(38.8%), Prem M jha et al<sup>13</sup>(24%), Mahmood Shakir Alzaidy et al<sup>12</sup>(30.2%). In the present study, diastolic dysfunction was encountered in 24% of the patients, which is almost equal to 26.67%, 27% reported in studies of Sharath kumar et al<sup>8</sup> and R Verma et al<sup>15</sup> respectively.

Patients with increasing levels of TSH values had more abnormal ECG and ECHO findings, with a p value of less than 0.05 suggesting the statistical significance of this association. Similar result was also found in other studies like Sureshabu KP et al<sup>12</sup> and Sharath kumar et al<sup>8</sup> studies. As the TSH levels increased dyslipidemia found to be increasing in frequency which was statistically significant with a p value <0.05, which was also the observed in study done by Klein I Pantos C et al<sup>16</sup> (2007).

Small sample size, usage of only mitral inflow velocities to diagnose diastolic dysfunction and no follow up for the reversal of cardiovascular changes after starting levothyroxine were limitations of the study.

**CONCLUSION**

In newly detected hypothyroid patients, it is always advisable to evaluate for cardiac manifestations by the means of ECG, ECHO and Fasting lipid profiles, since the early recognition and more aggressive management of the disease can reverse and prevent these cardiac complications.

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