

A STUDY OF LEFT VENTRICULAR FUNCTION IN HYPOTHYROID PATIENTS IN A TERTIARY CARE CENTRE

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Abstract

Background: Thyroid disorders are very prevalent endocrinopathies. Thyroid and heart share same embryologic origin. Thyroid gland secretes two related hormones: triiodothyronine (T3) & thyroxine (T4). Hypothyroidism is linked to notable cardiac dysfunction, especially at the subendocardial level, during systole and diastole. The objective is to study the status of left ventricular systolic and diastolic function among hypothyroid patients and to find out the proportion of left ventricular systolic and diastolic dysfunction among hypothyroid patients. To study the left ventricular systolic and diastolic dysfunction among patients with subclinical and overt hypothyroidism. **Materials and Methods:** It is a cross sectional study conducted among newly diagnosed hypothyroid patients, aged > 18 years, treated IP as well as OP, in the department of General Medicine, using a preformed questionnaire, after taking informed consent. The study included 92 patients, who met all the inclusion criteria and pregnancy, those with comorbidities and those on regular medications were excluded. Convenience sampling procedure was used. Subclinical hypothyroidism is characterized by normal free T4 levels and elevated TSH levels. Overt hypothyroidism is characterized by elevated TSH and decreased free thyroxine (T4) levels. Hemogram, liver function test, renal function test, and random blood sugar were obtained. In the echocardiography, Left ventricular diastolic function assessed using the E/A ratio, IVRT, and Deceleration Time. Left ventricle systolic function assessed by Ejection fraction and Stroke volume. For the analysis of numerical data, mean and standard deviation were utilized, frequency and percentages for categorical variables. The Unpaired T-test was used to determine whether LV systolic and diastolic dysfunction was present in both overt and subclinical hypothyroidism. **Result:** Of the 92 study population, 42 patients had subclinical hypothyroidism and 50 patients had overt hypothyroidism. There was no statistically significant difference between groups. (p>0.05). The study population's mean age was 49.26 years (± 14.46) for the subclinical hypothyroidism group and 51.58 years (± 12.1) for the overt hypothyroidism group. Differences were statistically not significant (p-value = 0.406). Most of the patients with subclinical hypothyroidism came for general health check-ups i.e. 26.19% and most of the patients with overt hypothyroidism presented with dyspnea i.e. 34%. Left ventricular diastolic dysfunction was present in 56% overt hypothyroidism patients, and in 28.57% subclinical hypothyroidism patients. Overall diastolic dysfunction prevalence was 43.48%. The E/A ratio, Dt, and IVRT did not significantly differ between the patients with overt and subclinical hypothyroidism in our study. In our investigation, patients with overt hypothyroidism had a significantly lower ejection fraction than patients with subclinical hypothyroidism (p = 0.02). Stroke volume did not show significant difference between overt and subclinical hypothyroidism patients (p = 0.43). **Conclusion:** We conclude that hypothyroidism is associated with diastolic dysfunction of the left ventricle, and the diastolic function parameters do not vary significantly between overt and subclinical hypothyroidism. The Left ventricular systolic function is affected even in newly detected patients with overt hypothyroidism, though not severe enough to cause LV failure. So, early detection and treatment are essential.

INTRODUCTION

Thyroid hormones play a critical role in cardiovascular physiology, affecting heart rate, contractility, vascular tone, and myocardial metabolism. Hypothyroidism is a well-recognized risk factor for cardiovascular dysfunction, including systolic and diastolic abnormalities, which may contribute to heart failure and increased cardiovascular mortality. The embryologic and functional relationship between the thyroid and heart highlights the need for comprehensive cardiac assessment in hypothyroid patients.

This study aims to evaluate left ventricular systolic and diastolic function in newly diagnosed hypothyroid patients, differentiating between overt and subclinical hypothyroidism, to determine the proportion of LV dysfunction and its clinical implications. The early detection and initiation of treatment may revert the cardiac changes caused by hypothyroidism, stressing stronger emphasis on the role of preventive medicine. However studies including both diastolic and systolic function especially in our population is lacking thus the significance of this study.

MATERIALS AND METHODS

The study had its objective as to study the status of left ventricular systolic and diastolic function among hypothyroid patients and to find out the proportion of left ventricular systolic and diastolic dysfunction among hypothyroid patient and secondary objective as to study the left ventricular systolic and diastolic dysfunction among patients with subclinical and overt hypothyroidism. This was a cross-sectional study conducted in the Department of General Medicine, Jubilee Mission Medical College, Thrissur for 18 months, from November 2022 to August 2024 after ethical approval was obtained. It was conducted among 92 patients who met all the inclusion criteria and used convenience sampling procedure.

Inclusion Criteria

- Newly diagnosed hypothyroidism (TSH >4.5 mIU/L).
- Age \geq 18 years.
- Individuals who provide consent for participation
- Individuals whose thyroid function tests and 2 D echocardiogram are available

Exclusion Criteria

- Patients with pre-existing cardiovascular disease.
- History of diabetes mellitus, hypertension, or chronic illnesses.
- Pregnant women
- Individuals who has been consuming more than 2 units of alcohol per day for a duration of at least 1 year
- Patients on regular medications such as beta blockers, oral contraceptive pills, amiodarone, glucocorticoids, beta agonists, lithium, antineoplastic medicines

The study was undertaken on individuals who were for the first time diagnosed with hypothyroidism with TSH levels more than 4.5mIU/L.^[1] Consent was gained after providing the necessary information. We acquired a comprehensive medical history including information on the individual's age, gender, history of diabetes mellitus, hypertension, any endocrine illnesses, any heart disease, or other chronic sickness. A comprehensive physical examination was conducted. TSH, FT3, and FT4 levels were noted in order to assess thyroid function. Subclinical hypothyroidism is characterized by normal free T4 levels and elevated TSH levels. Overt hypothyroidism is characterized by elevated TSH and decreased free thyroxine (FT4) levels.^[2] A comprehensive hemogram, LFT, RFT, and RBS were also carried out. In the echocardiography, the left ventricular diastolic function was assessed using the E/A ratio, IVRT, and Deceleration Time.^[3] The Ejection fraction and Stroke volume were used to assess the left ventricle's systolic function.^[4] For the analysis of numerical data, mean and standard deviation were utilized, whereas frequency and percentages were employed for categorical variables. The Unpaired T-test was used to determine whether LV systolic and diastolic dysfunction was present in both overt and subclinical hypothyroidism. Table and graph used to present data in organized manner.

RESULTS

Two groups were formed from the 92 patients based on the results of the thyroid function tests. Group 1 comprised of 42 patients with subclinical hypothyroidism defined as elevated TSH with normal levels of free T4 and group 2 comprised of 50 patients with overt hypothyroidism defined as high TSH with low free T4. There was no statistically significant difference between groups. ($p > 0.05$). The mean age in the Subclinical hypothyroidism group was 49.26 years (± 14.46) and in Overt hypothyroidism was 51.58 years (± 12.1) which was statistically not significant (p -value = 0.406). There was a greater percentage of female patients with overt hypothyroidism i.e. 62.07% in our study. Gender distribution among patients is described in [Table 1]. Most of the patients with subclinical hypothyroidism came for general health check-ups i.e. 26.19% and most of the patients with overt hypothyroidism presented with dyspnea i.e. 34% in our study. The mean heart rate of patients with subclinical hypothyroidism was 70.42 ± 7.01 beats/min, whereas patients with overt hypothyroidism had a mean heart rate of 65.86 ± 7.55 beats/min. In our study, the overt hypothyroidism patients had a significantly lower mean heart rate. ($p = 0.003$).

In our investigation, patients with overt hypothyroidism had ejection fraction lower when compared to patients with subclinical hypothyroidism, which was statistically significant. ($p = 0.02$) [Table 2] Between patients with overt and

subclinical hypothyroidism, there was no statistically significant difference in stroke volume in our study. ($p = 0.43$).

In our study, the proportion of patients with overt hypothyroidism having left ventricular diastolic dysfunction was 56%, and those with subclinical hypothyroidism having left ventricular diastolic

dysfunction was 28.57%. Overall diastolic dysfunction of the left ventricle was present in 43.48% of the patients in our study. [Graph 1] The E/A ratio, Dt, and IVRT did not significantly differ between the patients with overt and subclinical hypothyroidism in our study. [Table 3]

Table 1: Gender distribution among patients.

GENDER	Subclinical Hypothyroidism		Overt Hypothyroidism		
	Count	Percentage	Count	Percentage	
Males	31	49.21%	32	50.79%	63(68.48%)
Females	11	37.93%	18	62.07%	29(31.52%)

Table 2: Left ventricular systolic function assessment among the patients

	Subclinical Hypothyroidism		Overt Hypothyroidism		P-value
	Mean	SD	Mean	SD	
Ejection fraction(%)	65.2	6.77	60.93	9.91	0.02
Stroke volume(ml/sec)	56.54	14.81	54.13	14.81	0.43

Table 3: Left ventricular diastolic function parameters among the patients

	Subclinical Hypothyroidism		Overt Hypothyroidism		P-value
	Mean	SD	Mean	SD	
E/Aratio	1.18	0.38	1.09	0.46	0.29
IVRT	78.4	15.7	83.86	19.25	0.14
Deceleration time	164.33	43.57	166.52	41.83	0.8
	Overall patients				
	Mean		SD		
E/Aratio	1.133		0.43		
IVRT	81.36		17.84		
Deceleration time	165.52		42.41		

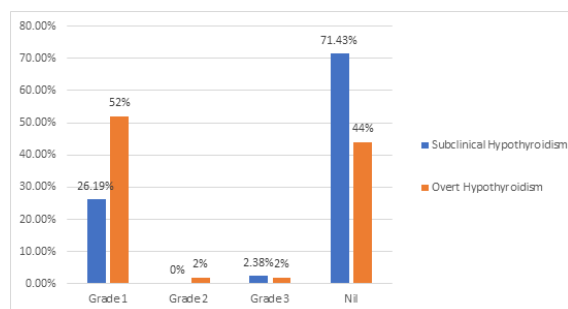


Figure 1: Left ventricular diastolic dysfunction among the patients

DISCUSSION

It is less common for cardiovascular changes to occur in patients with recently discovered hypothyroidism. The length of the illness determines changes in the cardiovascular system; complications are more likely when diagnosis is postponed. Clinically, hypothyroidism manifests as nonspecific signs and symptoms. Therefore, it is crucial to base a high level of suspicion on clinical signs and symptoms. When hypothyroidism is detected early, public health is greatly benefited. Hypothyroidism must be diagnosed and treated as soon as possible to minimize its effects on the cardiovascular system. The advancement of hypothyroidism-related cardiovascular problems is significantly halted by early thyroxine treatment.

This cross-sectional study set out to determine the state of left ventricular systolic and diastolic function in hypothyroidism patients as well as the prevalence

of systolic as well as diastolic dysfunction in this patient population. For eighteen months after the date of ethical clearance, the study was conducted in the general medicine department of Jubilee Mission Medical College and Research Institute, Thrissur. The study included 92 patients in total who met all inclusion criteria. Two groups were formed out of them. Group 1 included 42 patients with subclinical hypothyroidism and group 2 included 50 patients with overt hypothyroidism.

The study population's mean age was 49.26 years (± 14.46) for the subclinical hypothyroidism group and 51.58 years (± 12.1) for the overt hypothyroidism group. These differences were statistically not significant (p -value = 0.406). There was a greater percentage of female patients with overt hypothyroidism which was 62.07% in our study. Among males, 49.21% had subclinical and 50.79% had overt hypothyroidism respectively. There were 73.81% of male patients and 26.19% of female patients with subclinical hypothyroidism, and 64% and 36% of patients with overt hypothyroidism, respectively. No patients in either group in our study had any additional comorbidities, such as diabetes mellitus, hypertension, or pre-existing medical conditions. None were pregnant or were on any regular medications in our study. In our study, the overt hypothyroidism patients had a significantly lower mean heart rate. ($p = 0.003$). Most of the patients with subclinical hypothyroidism came for general health check-ups i.e. 26.19% and most of the patients with overt hypothyroidism presented with dyspnea i.e. 34% in our study.

Systolic function was measured in our study using stroke volume and ejection fraction. In our investigation, patients with overt hypothyroidism had ejection fraction lower when compared to patients with subclinical hypothyroidism, which was statistically significant. ($p = 0.02$). Between patients with overt and subclinical hypothyroidism, there was no statistically significant difference in stroke volume in our study. ($p = 0.43$).

Rina et al.'s study also found a connection between hypothyroidism and problems with the systolic and diastolic functioning of the left ventricle.^[5]

Similarly, research by K. Ramesh and colleagues revealed that diastolic dysfunction affected 27.5% of patients and systolic dysfunction affected 7.5% of patients.^[6] Additionally, hypothyroid people have lower systolic function indices, according to research by Forfar JC, et al. and other scientists.^[7]

Also in research conducted by George Kahaly MD,^[8] it was revealed that a notable and reversible decline occurred in the ability of the heart muscles to contract, as well as a compromised ability of the heart to relax during the diastolic phase, in individuals with short-term hypothyroidism.

A study by Roberto et al,^[9] also suggested fractional shortening in ejection fraction in patients with subclinical hypothyroidism. In similar, hypothyroidism patients had reduced contractility in a study by Elizabeth et al.^[10] In our study, the proportion of patients with overt hypothyroidism having left ventricular diastolic dysfunction was 56%, and those with subclinical hypothyroidism having left ventricular diastolic dysfunction was 28.57%. Overall diastolic dysfunction of the left ventricle was present in 43.48% of the patients in our study. Our study employed the E/A ratio, deceleration time, and iso-volumetric relaxation time to assess the diastolic function. A prolonged IVRT, a prolonged deceleration time, an altered E/A ratio and diastolic dysfunction were observed in 43.48% of the patients. The E/A ratio, Dt, and IVRT did not significantly differ between the patients with overt and subclinical hypothyroidism in our study.

A study by Selvamuthukumaran et al,^[11] found that diastolic dysfunction, which was defined by changes in the E/A ratio, prolonged IVRT, and extended DT, affected 51% of hypothyroidism patients. The primary type of diastolic dysfunction seen was characterized by poor relaxation.

A study conducted by Bijaya Kumar Behera,^[12] and colleagues revealed that 20% of patients exhibited cardiovascular symptoms. There was pericardial effusion in 26.7% of the cases. Four study participants had systolic dysfunction, while 26.6% of the group had diastolic dysfunction.

Diastolic dysfunction is linked to subclinical hypothyroidism, according to a study by Ravi Sankar MS.^[13]

CONCLUSION

We conclude that hypothyroidism is associated with diastolic dysfunction of the left ventricle, and the diastolic function parameters do not vary significantly between overt and subclinical hypothyroidism. Overt hypothyroidism patients had Ejection Fraction lower when compared to patients with subclinical hypothyroidism, and the difference was statistically significant. However the reduction was not severe enough to cause LV dysfunction. So, early detection and treatment are essential.

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