

A study on Cardiovascular manifestation in thyroid dysfunction patients attending a tertiary care hospital- A cross-sectional study

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Introduction: Normal levels of thyroid hormones are very essential for the normal functioning of the heart. Cardiovascular dysfunction was a frequent finding in patients having either hypothyroidism or hyperthyroidism. Both hypothyroidism and hyperthyroidism can implicate changes in cardiac functions like cardiac contractility, myocardial oxygen consumption, cardiac output, blood pressure, and systemic vascular resistance. Most often cardiac abnormalities reverse to normal once the euthyroid state is achieved.

Objective: To find out the various cardiac abnormalities occurring in thyroid diseases.

Methodology: A hospital-based cross-sectional study was conducted in V.M.K.V. Medical College Hospital, Salem. A total of 100 patients who had thyroid gland dysfunction were included in the study. The study period was between January to May 2023. Baseline information on the basic Laboratory Tests, Serum Electrolytes, Fasting lipid profile, FT4, FT3, and TSH, and Radiological variables were collected in these patients. ECG and 2D ECHO were performed on these patients to analyze the presence of any cardiac disorders.

Results: In hyperthyroid patients, the most common cardiovascular symptoms were palpitation (78.0%), followed by marked Dyspnea (34.0%) and the commonest ECG finding was found to be Sinus tachycardia (46.0%) followed by atrial fibrillation (28.0%) while Echocardiographic evaluation showed systolic dysfunction in 18.0% and Chamber enlargement in 18.0% of patients followed by Diastolic dysfunction in 12.0% of patients. In hypothyroid patients, the commonest cardiovascular symptoms were Dyspnea (52.0%) followed by palpitation (30.0%) and ECG changes showed sinus bradycardia in 36.0% of the patients, followed by Low voltage complexes in 22.0% while commonest echocardiographic changes were Pericardial effusion (22.0%) followed by Diastolic dysfunction (12.0%) and Left ventricular hypokinesia in 14.0% of patients.

Conclusion: Cardiovascular manifestations are common in patients with thyroid disease and may be the only manifestation of thyroid disease. Early recognition and initiation of thyroid disorders' treatment may help lower heart changes as it is a reversible cause of cardiac manifestation.

Keywords: Hyperthyroidism, Hypothyroidism, Electrocardiogram, Echocardiography

INTRODUCTION:

The role of the thyroid hormone is very crucial in maintaining the normal function of the heart. In the case of both hypothyroidism and hyperthyroidism, cardiovascular abnormalities were a more frequent finding. Both hypothyroidism and hyperthyroidism can cause changes in the cardiovascular system by affecting the blood pressure, increasing myocardial oxygen demand even at rest, altering effective cardiac contractility, and altering the cardiac output and systemic vascular resistance¹.

Circulatory levels of thyroid hormones have a major profound effect on the numerous metabolic processes almost in all vital tissues and in the body, every vital tissue is affected to a much greater or to a lesser extent in thyroid hormone-related disorders, the heart is more particular, in being highly sensitive².

The cardiovascular system has always been one of the most important targets of the thyroid hormone. Decreased thyroid function has been linked to numerous heart diseases like the increased incidence of coronary atherosclerosis, acute myocardial infarction and which may progress to congestive cardiac failure³.

The various Cardiovascular signs found in hyperthyroidism include resting tachycardia, prominent widening of pulse pressure, a marked increase in the cardiac output, and impaired cardio-respiratory function with impaired exercise capacity⁴. For elderly patients with hyperthyroid predominantly, the worsening of persistent angina pectoris as well as symptoms and signs of congestive cardiac failure may predominate most of the clinical scenarios and usually may mask the more classical manifestations of the endocrine disorder itself⁵. Various long-term follow-up studies have mainly revealed that there may be an increase in the mortality rate in those patients with a history of uncontrolled overt hyperthyroidism, as well as in those with a history of long-term uncontrolled subclinical hyperthyroidism⁶. The aim of the study is to find out the various cardiac abnormalities occurring in thyroid diseases.

Methodology:

A hospital-based cross-sectional study was conducted in V.M.K.V. MEDICAL COLLEGE HOSPITAL, in the Department of General Medicine. A total of 100 patients who had thyroid gland dysfunction were included in the study. The study period was between January 2021 to May 2023. Patients who presented to OPD and were diagnosed with either hyperthyroid or hypothyroid according to their serum levels of FT3, FT4 and TSH levels, and those who fulfilled the inclusion and exclusion criteria were selected for the study. All the patients underwent Clinical evaluation, basic Laboratory Tests like CBC, RFT, LFT, Serum Electrolytes, Fasting lipid profile (which included Serum Triglycerides, LDL, HDL, Total Cholesterol), FT4, FT3, and TSH and Radiological variables were done in these patients. ECG and 2D ECHO were performed in these patients to analyze the presence of any cardiac disorders.

INCLUSION CRITERIA:

1. Age > 18 years
2. All patients with overt hyperthyroidism of any etiology.
3. All patients with overt hypothyroidism of any etiology.

4. All patients with subclinical hyperthyroidism and hypothyroidism of any etiology.

EXCLUSION CRITERIA:

1. Patients with
 - Hypertension,
 - Diabetes mellitus
 - Coronary artery disease
 - Chronic kidney disease on treatment.
 - Pregnancy
2. Patients on antiarrhythmic drugs.

STATISTICAL ANALYSIS:

The data was entered in MS EXCEL 2019 and analyzed using SPSS Statistics 16.0. Quantitative variables were expressed in mean standard deviation and qualitative variables were expressed in proportions. To find the significance in qualitative categorical data Chi-Square test and Fisher's Exact were used.

Results:

A total of 100 patients with thyroid abnormalities who presented to the OPD in VMKVMCH, Salem included in the study. Out of 100 patients, 50 patients had hyperthyroidism and the other 50 had hypothyroidism.

HYPERTHYROID PATIENTS

The age group of the hyperthyroid patients in this study ranges between 18-70 years. The majority of the patients belonged to the age group of 35-60 years (56.0%), followed by 18-35 years (42.0%). Most of them were females with 38 out of 50 patients. In the present study on hyperthyroidism, the commonest of the symptoms were found to be excessive weight loss, oligomenorrhea, easy fatigability, generalized excessive sweating, insomnia and decreased sleep, tremors, eye signs, and increased appetite. In the present study, the most common cardiovascular symptoms were palpitation (78.0%), followed by marked Dyspnea (34.0%) and chest pain (4.0%). The commonest cardiovascular signs were found to be resting tachycardia (54.0%) followed by wide pulse pressure and non-pitting pedal edema (14.0%). The commonest ECG finding was found to be Sinus tachycardia (46.0%) followed by atrial fibrillation (28.0%), RV hypertrophy (10.0%), RBBB (10.0%), non-specific ST-T changes (8.0%) and left ventricular hypertrophy (8.0%). The Echocardiographic evaluation showed systolic dysfunction in 18.0% and Chamber enlargement in 18.0% of patients followed by Diastolic dysfunction in 12.0%, Regurgitant lesion in 6.0%, and Pulmonary hypertension in 4.0% of patients.

HYPOTHYROID PATIENTS

In this study, 50 hypothyroid patients participated, of which 16 patients presented with subclinical hypothyroidism and 34 patients with overt hypothyroidism.

The age group of the hypothyroid patients in this study ranges between 17-60 years with the maximum number of hypothyroid patients belonging to the age group 20-45 years (58.0%). Most of them were females with 32 out of 50 patients. In this current study on hypothyroidism, the commonest

cardiovascular symptoms were Dyspnea (52.0%) followed by palpitation (30.0%) and 14.0% of patients had chest pain. Pedal Edema was seen in about 36.0% of the patients and sinus bradycardia was predominately seen in 46.0% of patients. ECG changes showed sinus bradycardia in 36.0% of the patients, followed by Low voltage complexes in 22.0%, ST-T changes in 12.0%, Long QT in 4.0%, Ectopics in 6.0%, Prolonged PR in 2.0%, and RBBB in 4.0% patients. The commonest echocardiographic changes were Pericardial effusion (22.0%) followed by Diastolic dysfunction (12.0%), Left ventricular hypokinesia in 14.0%, and LVH in 2.0% of patients.

Table 1: Comparison of Signs and symptoms of the cardiovascular system with other studies

Variables		Present study	Osman et al. ⁹	Zarger et al. ¹⁰
Symptoms of the cardiovascular system	Palpitation	78.0%	73.0%	69.4 %
	Dyspnoea	34.0%	60.0%	-
	Chest pain	4.0%	25.0%	-
Sign of cardiovascular system	Tachycardia	54.0%		63.5%
	Wide pulse pressure	14.0%	30.0%	
	Pedal edema	14.0%	5.0%	

Table 2: ECG changes and ECHO findings of the hyperthyroid patients (n=50)

Variables		Frequency (n)	Percentage (%)
ECG changes	Sinus tachycardia	27	54.0%
	Atrial fibrillation	12	24.0%
	ST-T changes	12	24.0%
	LVH	3	6.0%
	RVH	7	14.0%
	RBBB	7	14.0%
ECHO	Systolic dysfunction	5	10.0%
	Chamber enlargement	12	24.0%
	Diastolic dysfunction	5	10.0%
	Regurgitant lesion	5	10.0%
	Pulmonary hypertension	4	8.0%

Figure 1: Cardiovascular signs and symptoms of hypothyroid patients (n=50)

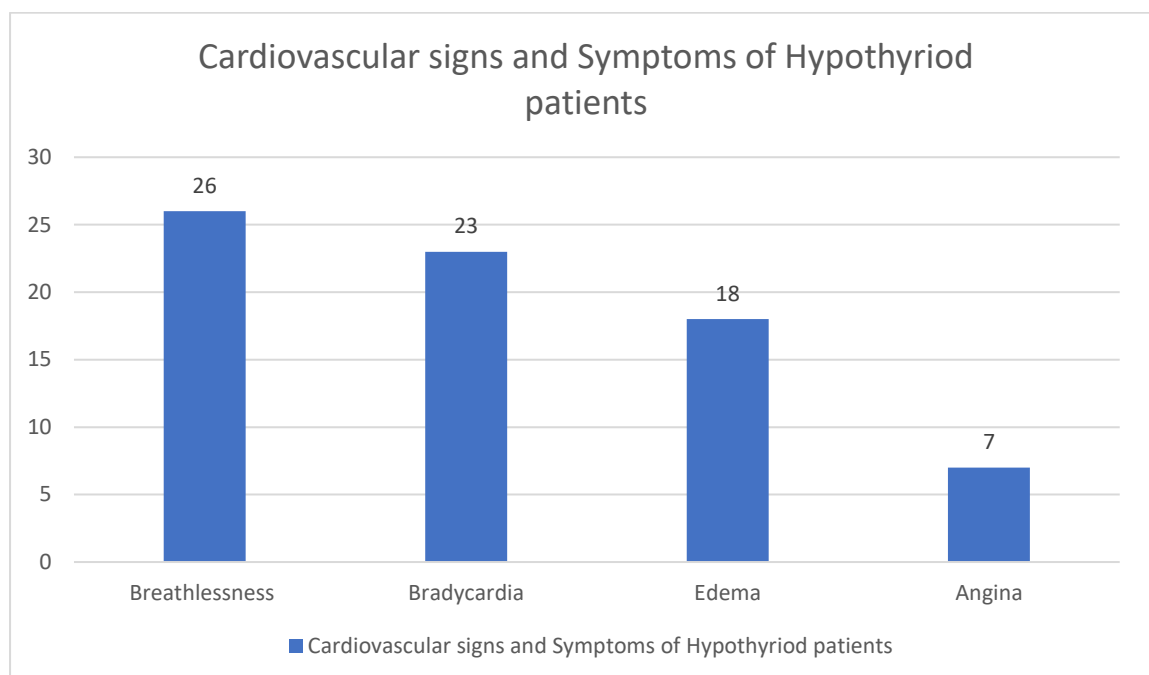


Table 3: ECG changes and ECHO findings of the hypothyroid patients (n=50)

Variables		Frequency (n)	Percentage (%)
ECG changes	Low voltage complex	24	48.0%
	Sinus bradycardia	23	46.0%
	ST-T changes	15	30.0%
	Ectopics	8	16.0%
	Prolonged PR	6	12.0%
	Long QT	4	8.0%
	RBBB	2	4.0%
ECHO	Pericardial effusion	22	44.0%
	Left ventricular hypokinesia	13	26.0%
	Diastolic dysfunction	8	16.0%
	LVH	1	2.0%

Discussion:

Among the various common diseases in the endocrine system, abnormalities of thyroid glands involving both structural or anatomical abnormality and dysfunction of the gland were the most common. Hyperthyroidism may cause numerous alterations in the cardiovascular system, which may be due to the increased circulatory demands, which result from hypermetabolism and the necessity to dissipate away the excess heat produced⁷. Tachycardia is more common in the majority of hyperthyroidism patients. Various cardiac arrhythmias like Atrial fibrillation, ventricular tachycardia, supraventricular tachycardia, and Atrial flutter were one of the most common causes of intensive care unit admissions. Cardiac failure in overt hyperthyroidism patients was caused by numerous factors including ischemia, atrial fibrillation, and supraventricular tachycardia.⁸

Hyperthyroidism:

In the present study, the most common cardiovascular symptoms were palpitation (78.0%), followed by marked Dyspnea (34.0%) and chest pain (4.0%). The commonest cardiovascular signs were found to be resting tachycardia (54.0%) followed by wide pulse pressure and non-pitting pedal edema (14.0%). Similarly, a study by Osman et al⁹ reported that palpitation (73.0%), followed by marked Dyspnea (60.0%) and chest pain (25.0%) were the most common cardiovascular symptoms. Zarger et al¹⁰ study found that tachycardia (63.5%) followed by palpitation was the most common cardiovascular signs of hyperthyroid patients.

Tachycardia is primarily caused as a result of the combination of more rapidly happening diastolic depolarization and shortening of the action potential which happens in the sinoatrial cells¹¹.

In the current study, the commonest ECG finding was found to be Sinus tachycardia (46.0%) followed by atrial fibrillation (28.0%) and RV hypertrophy (10.0%). The Echocardiographic evaluation showed systolic dysfunction in 18.0% and Chamber enlargement in 18.0% of patients followed by Diastolic dysfunction in 12.0% of patients.

Zarger et al¹⁰ study observed that Sinus tachycardia (63.5%) followed by atrial fibrillation (8.9%) and LVH (5.4%) were the most common ECG changes. Ansari et al¹² study reported that Chamber enlargement (19.1%) and systolic dysfunction (2.1%) were the most common Echo findings in the study. Similarly, a study by Mulatu HA et al¹³ found that the common Echo findings were systolic dysfunction (39.0%) followed by Pulmonary hypertension (41.0%) and Regurgitant lesions (23.0%). The results of this study correlates with the present study.

Hypothyroidism:

In the present study, the commonest cardiovascular symptoms were Dyspnea (52.0%) followed by palpitation (30.0%) and 14.0% of patients had chest pain. Pedal Edema was reported in about 36.0% of the patients. Similarly, a study by Al-Farttoosi et al¹⁴ observed that breathlessness (75.0%) was followed by bradycardia (47.2%) and angina (11.1%). Several postulated potential mechanisms at the cellular level by which the presence of chronic low-functioning thyroid may lead to the development of cardiac failure have been identified¹⁵.

In the current study, ECG changes showed sinus bradycardia in 36.0% of the patients, followed by Low voltage complexes in 22.0% and ST-T changes in 12.0%. The commonest echocardiographic changes were Pericardial effusion (22.0%) followed by Diastolic dysfunction (12.0%) and Left ventricular hypokinesia in 14.0% of patients.

Al-Farttoosi et al¹⁴ study found that sinus bradycardia (47.2%), followed by Low voltage complexes in 33.3%, ST-T changes in 27.8% and Prolonged PR in 19.5% of patients were the most common Echo findings, results correlate with this study. In contrast, a study by Agarwal et al¹⁶ reported that Low voltage

complex (15.0%) was the most common Echo finding followed by ST-T changes (10.0%).

Conclusion:

TH regulation consists of an integrated network of both nuclear and extra-nuclear processes to maintain myocardial tissue homeostasis and heart function. Hyperthyroidism may result in increased mortality from the increase in the incidence of circulatory diseases which is precipitated by the underlying thyroid disorder and the occurrence of life-threatening arrhythmias in these patients. Hemodynamic changes like narrow pulse pressure, prolonged circulation time, and decreased tissue perfusion were more common in hypothyroid patients. Since cardiovascular manifestations are common in patients with thyroid disease and may be the only manifestation of thyroid disease, it is suggested that all patients with thyroid disorders be checked for cardiovascular manifestations. In addition, thyroid function tests should be performed in all patients with unexplained cardiovascular disease.

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