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A Cross-Sectional Study to Assess Thyroid Dysfunction in Patients with Heart Disease in a Tertiary Care Hospital in South India.

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Abstract

Background: Thyroid hormones have an important role in maintaining cardiovascular homeostasis and influence heart rate, myocardial contractility, vascular resistance, lipid metabolism, and cardiac rhythm. Both hypothyroidism and hyperthyroidism can produce clinically important cardiovascular manifestations. Thyroid dysfunction may therefore coexist with established cardiovascular disease and potentially influence its clinical course. ***Aim:*** To determine the prevalence and pattern of thyroid dysfunction among patients with heart disease attending a tertiary care hospital in South India and to assess its association with sex and different types of cardiovascular disease. ***Materials and Methods:*** A hospital-based cross-sectional observational study was conducted among 150 adult patients with clinically diagnosed heart disease. Demographic and clinical information was collected using a structured proforma. Thyroid function was assessed by serum thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4). Participants were classified as euthyroid, subclinical hypothyroid, overt hypothyroid, subclinical hyperthyroid, or overt hyperthyroid according to laboratory reference ranges. Categorical variables were analysed using the Chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant. ***Results:*** Of the 150 patients, 90 (60.0%) were male and 60 (40.0%) were female, with a mean age of 59.2 ± 12.6 years. Thyroid dysfunction was identified in 34 patients (22.7%). It was more common among females than males [20/60 (33.3%) vs. 14/90 (15.6%)]. Subclinical hypothyroidism was the most frequent abnormality, occurring in 19 patients (12.7%), followed by overt hypothyroidism in 7 (4.7%), subclinical hyperthyroidism in 5 (3.3%), and overt hyperthyroidism in 3 (2.0%). Hypothyroidism, including subclinical and overt disease, accounted for 26 (76.5%) of all thyroid dysfunction cases. Thyroid dysfunction was most frequent among patients with heart failure [11/35 (31.4%)] and coronary artery disease [14/68 (20.6%)]. Female sex was significantly associated with thyroid dysfunction ($\chi^2 = 5.52$, $p = 0.019$). ***Conclusion:*** Thyroid dysfunction was relatively common among patients with heart disease, with hypothyroidism, particularly subclinical hypothyroidism, being the predominant abnormality. Thyroid dysfunction was more frequent among female patients and was particularly common among those with heart failure. Assessment of thyroid function may be useful in selected patients with cardiovascular disease, especially those with heart failure, unexplained arrhythmias, or clinical features suggestive of thyroid disease.

Keywords: Thyroid dysfunction; hypothyroidism; hyperthyroidism; cardiovascular disease; heart failure; coronary artery disease; TSH; South India.

INTRODUCTION

Thyroid hormones are important regulators of cardiovascular physiology. They influence myocardial contractility, heart rate, cardiac output, systemic vascular resistance, vascular reactivity, and lipid metabolism. Consequently, even relatively modest alterations in thyroid function can produce measurable cardiovascular effects. Both excess and deficiency of thyroid hormones may therefore have important clinical consequences in patients with established cardiovascular disease.[1,2]

Hypothyroidism is generally associated with reduced cardiac contractility, impaired ventricular relaxation, increased systemic vascular resistance, and abnormalities of lipid metabolism. These changes may contribute to diastolic dysfunction, hypertension, endothelial dysfunction, and atherosclerotic cardiovascular disease. Hyperthyroidism produces a contrasting cardiovascular phenotype, including increased heart rate, cardiac output, myocardial contractility, and systolic blood

pressure. Thyroid hormone excess is also associated with an increased risk of atrial arrhythmias, particularly atrial fibrillation.[1,2]

Subclinical thyroid dysfunction deserves particular attention because patients may have few or no classical symptoms. Subclinical hypothyroidism is characterised by an elevated serum TSH concentration with normal circulating thyroid hormone levels, whereas subclinical hyperthyroidism is characterised by a low or suppressed TSH concentration with normal thyroid hormone levels. Although the clinical significance of mild thyroid abnormalities remains an area of continuing investigation, observational studies have demonstrated associations between more marked subclinical thyroid dysfunction and cardiovascular outcomes.[3,4]

Large prospective studies have suggested that the cardiovascular risk associated with subclinical hypothyroidism may become more apparent at higher TSH concentrations. In an individual-participant meta-analysis involving more than 55,000 adults, TSH concentrations of 10 mIU/L or greater were associated with a higher risk of coronary heart disease events and coronary heart disease mortality. [4] Similarly, subclinical hyperthyroidism has been associated with increased risks of atrial fibrillation, coronary heart disease mortality, and total mortality, particularly when TSH is markedly suppressed. [5]

The relationship between thyroid dysfunction and heart failure is also clinically relevant. Thyroid hormones influence myocardial contractility and vascular resistance, while severe systemic or cardiovascular illness may itself alter thyroid hormone metabolism. This bidirectional relationship makes interpretation of thyroid function particularly important in patients with heart failure.[2,6]

Cardiovascular disease is a major health problem in India, and patients attending tertiary care hospitals frequently have multiple cardiovascular risk factors such as hypertension, diabetes mellitus, dyslipidaemia, and smoking. Thyroid dysfunction may coexist with these conditions and can potentially modify cardiovascular risk or clinical presentation.

The reported prevalence of thyroid dysfunction among patients with cardiovascular disease varies between populations. Differences in age, sex, iodine status, comorbidities, diagnostic criteria, and the spectrum of cardiovascular disease studied may contribute to this variation. There is a need for additional data from tertiary care hospitals in South India.

The present study was therefore undertaken to determine the prevalence and pattern of thyroid dysfunction among patients with heart disease and to examine its association with sex and different cardiovascular diagnoses.

MATERIALS AND METHODS

Study Design and Setting

A hospital-based cross-sectional observational study was planned in the Department of General Medicine/Cardiology at Velammal Medical College Hospital and Research Institute, Madurai.

Study Period

The study period was from January 2024 to January 2026.

Study Population

Adult patients with a clinically established diagnosis of heart disease attending the outpatient or inpatient services of the study hospital were considered for enrolment.

Sample Size

A sample size of 150 patients was used.

Inclusion Criteria

Patients were eligible if they were aged 18 years or older, had a clinically or investigation-confirmed diagnosis of heart disease, and were willing to participate.

Exclusion Criteria

Patients were excluded if they were pregnant, had thyroid malignancy, had undergone recent thyroid surgery or radioiodine treatment, were taking medications known to substantially interfere with thyroid function testing, had severe acute systemic illness associated with significant non-thyroidal illness according to the study protocol.

Data Collection

Demographic and clinical information was collected using a structured proforma. Variables included age, sex, presenting complaints, cardiovascular diagnosis, diabetes mellitus, hypertension, dyslipidaemia, smoking history, previous cardiac disease, medication history, electrocardiographic findings, and echocardiographic findings.

Cardiovascular Assessment

The diagnosis of cardiovascular disease was established on the basis of clinical assessment and relevant investigations, including electrocardiography, echocardiography, cardiac biomarkers, coronary angiography, and other investigations as clinically indicated.

Patients were classified according to their principal cardiovascular diagnosis as coronary artery disease, heart failure, hypertensive heart disease, valvular heart disease, cardiomyopathy, or cardiac arrhythmia.

Thyroid Function Assessment

Serum TSH, FT3, and FT4 were measured using the electro chemiluminescence assay using Cobas e 411 analyzer (Roche) in the Department of Biochemistry. Thyroid status was classified according to the laboratory reference ranges as follows: Thyroid status| Definition TSH are 0.4-4.2 mIU/L, FT4 is 0.8-2.0 ng/dL and FT3 is 50.0-180.0 ng/dL. Different categories of thyroid function were defined as: Euthyroid (FT4 = 0.8-2.0 ng/dL, FT3 = 50-180 ng/dL & TSH = 0.4-4.2 mIU/L), overt hyperthyroidism (TSH < 0.4 mIU/L, FT4 > 2.0 ng/dL or/& FT3 >180 ng/dL), subclinical hyperthyroidism (TSH < 0.4 mIU/L, FT4 = 0.8-2.0 ng/dL & FT3 = 50-180 ng/dL), overt hypothyroidism (TSH > 4.2 mIU/L with FT4 < 0.8 ng/dL or TSH > 10 mIU/L), subclinical hypothyroidism (TSH = 4.2-10 mIU/L, FT4 = 0.8-2.0 ng/dL & FT3 = 50-180 ng/dL).

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 150 patients were included in the study population. The mean age was 59.2 ± 12.6 years. There were 90 (60.0%) male and 60 (40.0%) female participants. Hypertension was present in 91 (60.7%) patients, diabetes mellitus in 56 (37.3%), and dyslipidaemia in 48 (32.0%).

Table 1: Baseline characteristics of study participants

Characteristic	Number (%) / Mean ± SD
Total patients	150 (100%)
Age, years	59.2 ± 12.6
Male	90 (60.0%)
Female	60 (40.0%)
Diabetes mellitus	56 (37.3%)
Hypertension	91 (60.7%)
Dyslipidaemia	48 (32.0%)
Current/past smoking	43 (28.7%)
Previous cardiac disease	61 (40.7%)

Coronary artery disease was the most common cardiovascular diagnosis, accounting for 68 (45.3%) patients, followed by heart failure in 35 (23.3%).

Table 2: Distribution of cardiovascular diagnoses

Cardiovascular Diagnosis	Number (n)	Percentage (%)
Coronary artery disease	68	45.3
Heart failure	35	23.3
Hypertensive heart disease	18	12.0
Valvular heart disease	12	8.0
Cardiomyopathy	9	6.0
Arrhythmia	8	5.3
Total	**150**	**100.0**

Thyroid dysfunction was identified in 34 of 150 patients, giving an overall prevalence of 22.7%. Subclinical hypothyroidism was the most common abnormality.

Table 3: Pattern of thyroid dysfunction

Thyroid Status	Number (n)	Percentage (%)
Euthyroid	116	77.3
Subclinical hypothyroidism	19	12.7
Overt hypothyroidism	7	4.7
Subclinical hyperthyroidism	5	3.3
Overt hyperthyroidism	3	2.0
Total	**150**	**100.0**

Overall, hypothyroidism accounted for 26 of the 34 cases of thyroid dysfunction (76.5%).
Thyroid dysfunction was more common among female participants. It was present in 20 of 60 females (33.3%) compared with 14 of 90 males (15.6%).

Table 4: Association between sex and thyroid dysfunction

Sex	Euthyroid, n (%)	Thyroid Dysfunction, n (%)	Total, n
Male	76 (84.4)	14 (15.6)	90
Female	40 (66.7)	20 (33.3)	60
Total	**116 (77.3)**	**34 (22.7)**	**150**

The association between female sex and thyroid dysfunction was statistically significant ($\chi^2 = 5.52$, $p = 0.019$). The estimated odds ratio for thyroid dysfunction among females compared with males was approximately 2.70.
The highest prevalence of thyroid dysfunction was observed among patients with heart failure.

Table 5: Thyroid dysfunction according to cardiovascular diagnosis

Cardiovascular Diagnosis	Total, n	Thyroid Dysfunction, n	Prevalence (%)
Coronary artery disease	68	14	20.6
Heart failure	35	11	31.4
Hypertensive heart disease	18	3	16.7
Valvular heart disease	12	3	25.0
Cardiomyopathy	9	2	22.2
Arrhythmia	8	1	12.5
Total	**150**	**34**	**22.7**

DISCUSSION

The present study evaluated thyroid dysfunction among 150 patients with established heart disease in Velammal Medical College and Hospital in South India. Thyroid dysfunction was identified in 22.7% of participants. The principal finding was the predominance of hypothyroidism, particularly subclinical hypothyroidism, among patients with cardiovascular disease.

Thyroid hormones have extensive effects on cardiovascular physiology. Their influence on myocardial contractility, heart rate, systemic vascular resistance, vascular function, and lipid metabolism provides a physiological basis for the association between thyroid dysfunction and cardiovascular disease. [1,2]

In the present study, subclinical hypothyroidism was the most frequent abnormality, accounting for 19 (12.7%) patients. Overt hypothyroidism was present in a further 7 (4.7%), meaning that hypothyroidism overall accounted for 76.5% of thyroid dysfunction. This predominance is clinically relevant because even subclinical hypothyroidism has been associated with cardiovascular risk in observational studies, although the magnitude of risk varies according to TSH concentration and patient characteristics.[3,4]

The Thyroid Studies Collaboration reported that the risk of coronary heart disease events and coronary heart disease mortality was particularly increased among individuals with TSH concentrations of 10 mIU/L or greater.[4] These findings support the concept that the degree of biochemical thyroid dysfunction may be important when assessing cardiovascular implications.

A further important finding was the higher prevalence of thyroid dysfunction among female patients. Thyroid disorders are known to occur more frequently among women, and the female predominance observed in this study is therefore biologically plausible. In the present dataset, thyroid dysfunction was found in 33.3% of female patients compared with

15.6% of male patients. The association was statistically significant (p = 0.019), with an estimated odds ratio of approximately 2.70.

Heart failure had the highest prevalence of thyroid dysfunction in the present study, affecting 31.4% of patients. Thyroid hormones play an important role in myocardial contractility and vascular haemodynamics, and thyroid abnormalities may influence the development or clinical expression of heart failure. Conversely, severe systemic illness and heart failure can alter peripheral thyroid hormone metabolism and produce non-thyroidal illness patterns.[2,6] Therefore, the presence of an abnormal thyroid profile in a patient with severe heart failure should be interpreted in the context of the overall clinical condition.

Coronary artery disease represented the largest cardiovascular subgroup, comprising 45.3% of the study population. Thyroid dysfunction was present in 20.6% of these patients. Hypothyroidism may influence atherosclerotic risk through dyslipidaemia, increased vascular resistance, endothelial dysfunction, and other metabolic effects. Previous epidemiological studies have reported associations between subclinical hypothyroidism and coronary heart disease, although results have not been entirely consistent.[4,7]

Hyperthyroid states were less frequent than hypothyroid states in the present study. Nevertheless, their cardiovascular significance should not be underestimated. Subclinical hyperthyroidism has been associated with an increased risk of atrial fibrillation and cardiovascular mortality, particularly when TSH is markedly suppressed.[5] In clinical practice, thyroid dysfunction may therefore be relevant in patients presenting with otherwise unexplained tachycardia or arrhythmia.

The findings should, however, be interpreted cautiously. The study was cross-sectional and therefore cannot establish whether thyroid dysfunction contributed to the development of cardiovascular disease or simply occurred concurrently. In addition, non-thyroidal illness and medications may influence thyroid hormone concentrations, particularly among hospitalised patients.

Despite these limitations, the relatively high proportion of thyroid dysfunction observed in this cohort suggests that thyroid assessment may have a role in selected patients with cardiovascular disease. Particular consideration may be given to patients with heart failure, unexplained arrhythmias, dyslipidaemia, or symptoms suggestive of thyroid disease.

Large prospective studies involving multiple centres and detailed follow-up are required to determine whether identification and treatment of thyroid dysfunction improves cardiovascular outcomes.

CONCLUSION

Thyroid dysfunction was observed in 22.7% of patients with heart disease in this cohort of 150 patients. Hypothyroidism, particularly subclinical hypothyroidism, constituted the majority of thyroid abnormalities.

Female patients had a significantly higher prevalence of thyroid dysfunction than male patients. The prevalence was also highest among patients with heart failure, followed by those with valvular heart disease and cardiomyopathy. These findings are consistent with the established physiological relationship between thyroid hormones and cardiovascular function.

The presence of thyroid dysfunction in patients with cardiovascular disease may have clinical implications. Hypothyroidism can contribute to dyslipidaemia, increased systemic vascular resistance, impaired myocardial relaxation, and other cardiovascular abnormalities. Conversely, hyperthyroidism may increase cardiac workload and predispose patients to tachyarrhythmias. Subclinical abnormalities may be particularly difficult to recognise clinically because classical symptoms can be absent or nonspecific.

Routine thyroid testing in every patient with cardiovascular disease cannot be justified solely on the basis of this cross-sectional study. However, thyroid function assessment may be particularly useful in patients with heart failure, unexplained deterioration in cardiac function, unexplained tachycardia or arrhythmia, dyslipidaemia, or clinical features suggestive of thyroid disease.

The present findings also highlight the importance of considering sex differences when evaluating thyroid dysfunction among cardiovascular patients. The higher prevalence observed among women suggests that female patients with cardiovascular disease may warrant particular clinical attention to thyroid status.

Ultimately, the relationship between thyroid dysfunction and cardiovascular disease is complex and potentially bidirectional. A single abnormal thyroid profile, particularly in a severely ill hospitalised patient, should not automatically be interpreted as primary thyroid disease because non-thyroidal illness may alter thyroid hormone concentrations.

Prospective multicentre studies with larger sample sizes, repeated thyroid function measurements, detailed assessment of cardiovascular severity, medication use, comorbidities, and long-term cardiovascular outcomes are needed. Such studies would help determine the prognostic importance of thyroid dysfunction and whether appropriate recognition and treatment can improve outcomes in patients with cardiovascular disease.

LIMITATIONS OF THE STUDY

1. The cross-sectional design prevents determination of a temporal or causal relationship between thyroid dysfunction and cardiovascular disease.
2. The study was conducted at a single tertiary care centre, which may limit the generalisability of the findings to other regions and healthcare settings.
3. The sample size was relatively small, particularly for individual cardiovascular diagnostic subgroups.
4. Non-thyroidal illness may influence thyroid hormone concentrations, especially among patients with severe heart failure or other acute illnesses.
5. Medication-related effects on thyroid function, including the effects of drugs commonly used in cardiovascular disease, may act as confounding factors.
6. The study did not include longitudinal follow-up to determine whether thyroid dysfunction was associated with subsequent cardiovascular events or mortality.

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