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Assessment of Thyroid Dysfunction in patients with coronary artery disease: Implication for Diagnosis and Management

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Abstract

Background: Thyroid hormones are integral to cardiovascular health, influencing both the development of the heart and its ongoing function. Thyroid dysfunction, particularly in the context of coronary artery disease (CAD), can exacerbate the underlying cardiovascular conditions and complicate management.

Objective: To explore age and gender-specific approaches for integrating thyroid dysfunction on diagnosis, progression and management into cardiovascular care.

Methods: A cross-sectional study was conducted on 150 patients with thyroid dysfunction at Pacific Hospital, Udaipur. Thyroid function tests, lipid profiles, and clinical data were collected and analyzed using enzymatic methods. Statistical analysis was performed with SPSS version 21, with significance set at $p < 0.05$.

Results: Hyperthyroidism was identified in 6% (n = 9) of participants, with 66.66% exhibiting overt hyperthyroidism, predominantly among females aged 48-61 years. Hypothyroidism was prevalent in 36% (n = 54) of participants, with 68.51% exhibiting subclinical hypothyroidism. The peak prevalence was observed in the 34-47 years age group. Cardiac symptoms such as palpitations and dyspnea were significantly more common in hyperthyroid patients, underscoring its clinical relevance in CAD.

Conclusion: This study underscores the importance of evaluating thyroid dysfunction in patients with CAD, particularly in females and middle-aged adults. Regular screening and targeted management of thyroid dysfunction may improve cardiovascular outcomes and reduce complications.

Keywords: Thyroid dysfunction, coronary artery disease, cardiac symptoms, hypothyroidism, hyperthyroidism, subclinical hypothyroidism, Thyroid dysfunction prevalence, Subclinical thyroid conditions, and Gender disparities in CAD.

Introduction

Thyroid hormone imbalances, whether excessive or deficient, can have profound effects on cardiovascular health, predisposing individuals to conditions such as heart failure, arrhythmias, vascular disease, and dyslipidemia, which can lead to increased morbidity and mortality. [1]

This review aims to synthesize current knowledge on the impact of thyroid hormones on cardiovascular health, exploring their role in various cardiovascular diseases. Specifically, we examine the relationship between thyroid hormone levels and heart failure, as well as the potential therapeutic benefits of thyroid hormone replacement therapy. [1]

Hypothyroidism

Hypothyroidism is characterized by diminished levels of triiodothyronine (T3) and thyroxine (T4), coupled with elevated thyroid-stimulating hormone (TSH) levels. This condition can have profound effects on cardiovascular health, including: [2]

- Diastolic hypertension
- Sinus bradycardia due to sinus node dysfunction
- Impaired sinus node response to stressors such as fever, infection, or heart failure

Hyperthyroidism

In contrast, Hyperthyroidism is defined by decreased TSH levels and elevated T3 and/or T4 levels. Patients with hyperthyroidism are at risk of developing a life-threatening complication

known as thyroid storm or crisis, which can be triggered by acute illnesses such as myocardial infarction or infection. Prompt treatment is crucial, particularly in patients with underlying coronary disease or heart failure. [2]

The clinical presentation of hyperthyroidism may include:

- Systolic hypertension
- Left ventricular hypertrophy
- Exercise intolerance
- Angina pectoris
- Systolic murmurs
-

Diagnosing thyroid dysfunction in patients with coronary artery disease (CAD) has several key implications:

1) Firstly, early risk stratification is crucial, as identifying thyroid dysfunction allows for timely recognition of patients at elevated cardiovascular risk, with studies suggesting a 2-3-fold increased risk of cardiovascular events. This, in turn, enables healthcare providers to take proactive measures to mitigate this risk. [3]
2) Secondly, accurate diagnosis provides a clearer picture of thyroid function, enabling more accurate predictions of cardiovascular outcomes and informing personalized treatment plans Furthermore, a thyroid dysfunction diagnosis may warrant closer monitoring of thyroid and cardiac function to minimize treatment-related adverse effects. Effective management of thyroid dysfunction can also help prevent cardiovascular complications, including stroke, heart failure, and cardiac arrhythmias. [4]
3) Finally, accurate diagnosis enables personalized thyroid hormone replacement or antithyroid treatment, optimizing thyroid and cardiovascular health and improving patient outcomes. [5]

Thyroid Dysfunction Management in Coronary Artery Disease (CAD)

1. **Initial Screening:** Regular thyroid function tests are essential for identifying thyroid dysfunction in CAD patients. [5]

2. **Hypothyroidism Treatment:** Levothyroxine therapy is the recommended treatment for overt hypothyroidism. [6]

3. **Hyperthyroidism Management:** Beta-blockers, such as propranolol, can be used to manage tachycardia and reduce myocardial oxygen demand in CAD patients with hyperthyroidism. Alternative treatments include radioactive iodine or surgery. [7]

4. **Cardiovascular Risk Reduction:** Maintaining optimal blood pressure and lipid levels is crucial for CAD patients with thyroid dysfunction. Antihypertensive and lipid-lowering medications should be used as needed. [8]

5. **Ongoing Monitoring:** Regular follow-up appointments are necessary to monitor both thyroid function and cardiovascular health. [4]

6. **Lifestyle Interventions:** Patients should be encouraged to adopt a heart-healthy diet and engage in regular physical activity, tailored to their cardiovascular status. Smoking cessation is also essential, as smoking exacerbates both CAD and thyroid dysfunction. Patient education on recognizing thyroid dysfunction symptoms and their impact on cardiovascular health is vital. [9]

7. **Continuous Care:** Regular monitoring for changes in thyroid function and CAD progression is necessary. Thyroid treatment should be adjusted based on clinical symptoms and laboratory results. [5]

The interaction between thyroid dysfunction and CAD is of growing clinical interest. Thyroid dysfunction exacerbates CAD risk factors, including hypertension, abnormal lipid metabolism, and systemic inflammation. Additionally, subclinical thyroid dysfunction—a state where thyroid hormone levels deviate from normal without overt clinical symptoms—has been linked to increased cardiovascular risk, yet it often remains undiagnosed. Given these complexities, understanding the prevalence and clinical manifestations of thyroid dysfunction in CAD patients is essential for optimizing diagnostic and therapeutic strategies.

Despite extensive research on thyroid dysfunction and its systemic effects, significant gaps remain in understanding the age- and gender-specific trends in CAD patients and how these trends influence cardiovascular outcomes. Furthermore, the underdiagnosis of thyroid dysfunction, particularly in subclinical cases, underscores the need for more targeted screening protocols.

This study aims to address these gaps by investigating the prevalence and clinical impact of thyroid dysfunction in CAD patients. By examining gender-specific and age-related trends, the study seeks to provide insights into the role of thyroid dysfunction in the progression and management of CAD. The findings could inform clinical practice, emphasizing the importance of early detection and tailored interventions to improve cardiovascular outcomes in this high-risk population.

Methods and Methodology

This cross-sectional, observational study was conducted to explore the association between thyroid dysfunction and lipid profile parameters in patients with thyroid disorders, focusing on gender and age-specific patterns.

Study Population

Inclusion criteria included:

- Participants aged 20–75 years.
- Diagnosed thyroid dysfunction (hypothyroidism or hyperthyroidism) based on Thyroid Function Tests (TFTs).
- Patients who provided informed consent.

Exclusion criteria included:

- Individuals with severe chronic illnesses or other endocrine disorders.
- Patients on medications influencing lipid metabolism, other than for thyroid dysfunction and CAD.
- Pregnant or lactating women.

Sample Size:

- The study was conducted over a period of 2 years, from 2023 to 2025, and included 150 participants. The sample size was calculated by using statistical formula at 95%CI with consideration of 5% errors.
- Participants are enrolled from Pacific Hospital, Udaipur, Rajasthan.

Age Categorization:

- To analyze trends, participants were grouped into four demographic categories:
  - **20–33 years (Young Adults)**
  - **34–47 years (Midlife)**
  - **48–61 years (Mature Adults)**
  - **62–75 years (Seniors)**
- These categories reflect key demographic transitions relevant to thyroid health.

Data Collection:

- **Thyroid Function Tests (TFTs):** TSH, T3, T4, Free T3, and Free T4 levels measured using Cobas e411.
- **Lipid Profiles:** Total cholesterol, LDL, HDL, triglycerides and VLDL is analyzed using Cobas c311.
- **Clinical Data:** Demographic information, cardiac symptoms (e.g., palpitations, dyspnea & Chestpain).

Sample Collection:

1. **Clinical and Demographic Information**:
   - Age, gender, body mass index (BMI), and medical history were recorded using a standardized questionnaire.
2. **Sample Collection**:
   - Venous blood samples (3 mL) were drawn after an overnight fast of 12 hours.

- Samples were clotted at room temperature for 10 minutes, centrifuged at 3000 rpm for 10 minutes, and the serum was separated.
- Serum samples were stored at −20°C until analysis.
-

3. **Thyroid Function Tests (TFTs)**:

Conducted using the Cobas e411 analyzer (electrochemiluminescence technology).

Parameters measured included:

- Thyroid-Stimulating Hormone (TSH)
- Total Triiodothyronine (T3)
- Total Thyroxine (T4)
- Free Triiodothyronine (FT3)
- Free Thyroxine (FT4)

4. **Lipid Profile Assessment**:

Performed using the Cobas c311 analyzer (biochemical assay technology).

- Total Cholesterol (TC)
- Triglycerides (TG)
- High-Density Lipoprotein (HDL)
- Low-Density Lipoprotein Cholesterol (LDL
- Very-Low-Density Lipoprotein (VLDL)

5. **Cardiac Symptoms**:

Documented symptoms included palpitations, dyspnea, and chest pain.

Data Analysis

Statistical Tools:

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 21).

Statistical Methods:

- Descriptive statistics were used to summarize demographic data.
- Comparative analyses were conducted to examine gender and age group differences in thyroid dysfunction.
- Correlation analyses assessed relationships between thyroid function, lipid profile parameters, and cardiac symptoms.
- Statistical significance was set at $p < 0.05$.

1. **Subgroup Analysis**:

Subgroup analyses were conducted to explore differences between subclinical and overt thyroid dysfunction across gender and age categories.

2. **Bias Mitigation**:

- Blinded identifiers were used during sample and data analysis.
- Inter-laboratory calibration ensured consistency in test results.

Ethical Considerations

1. **Approval**:

The study received ethical clearance from the institutional review board (Approval No. IEC/2023/13).

2. **Informed Consent**:

Written informed consent was obtained from all participants prior to enrolment.

3. **Confidentiality**:Data confidentiality was maintained by anonymizing participant identifiers.

RESULT

Table 1 - Age and gender Wise distribution of hyperthyroid patients.

Age group (years)	Male (n=4)		Female(n=5)		Total	
	No	%	No	%	No	%
20-33	1	25%	0	0%	1	11.11%
34-47	1	25%	1	20%	2	22.22%
48-61	1	25%	3	60%	4	44.44%
62-75	1	25%	1	20%	2	22.22%
Total	4	100	5	100	9	100

TABLE- 1 Hyperthyroidism was most common in females aged 48-61 years, accounting for 60% of female cases in this age group. The difference between genders was not statistically significant (p=0.08), though trends suggest a higher predisposition in females during this life stage.

Table 2 - Age and gender Wise distribution of hypothyroid patients.

Age group (years)	Male (n=34)		Female(n=20)		Total	
	No	%	No	%	No	%
20-33	10	29.4%	4	20%	14	25.9%
34-47	10	29.4%	7	35%	17	31.5%
48-61	8	23.5%	5	25%	13	24.1%
62-75	6	17.6%	4	20%	10	18.51%
Total	34	100%	20	100%	54	100%

TABLE- 2 The highest prevalence of hypothyroidism was observed in the 34-47 years age group (31.5%), with males accounting for 63% of all cases. Subclinical hypothyroidism was more common than overt hypothyroidism across all age groups (68.5% vs. 31.5%, $p<0.05$)

Table 3- Gender Incidence of Subclinical and Overt Hyperthyroidism

Gender	Subclinical Hyperthyroidism		Overt Hyperthyroidism		Total (n=9)	Percentage (%)
	No	%	No	%		
Male (n=4)	1	25%	3	75%	4	(44.4%)
Female(n=5)	2	40%	3	60%	5	(55.6%)

Table 3 - Overt hyperthyroidism accounted for 66.6% of all hyperthyroid cases, with a slightly higher prevalence among males (75%) compared to females (60%). This difference was not statistically significant (p=0.12).

Table 4- Gender Incidence of Subclinical and Overt Hypothyroidism

Gender	Subclinical Hypothyroidism	Overt Hypothyroidism	Total (n=54)	Percentage (%)

	No	%	No	%		
Male (n=34)	22	64.7%	12	35.3%	34	63%
Female(n=20)	15	75%	5	25%	20	37%

Table 4 - Subclinical hypothyroidism was significantly more prevalent than overt hypothyroidism (68.5% vs. 31.5%, p<0.01). Females showed a higher proportion of subclinical cases (75%) compared to males (64.7%).

Table 5 - Coronary Artery symptoms of hyperthyroid patients.

Cardiac symptoms	Hyperthyroidism		Hypothyroidism		P value
	Male (n=4)	Female(n=5)	Male (n=20)	Female (n=34)	
Palpitation	3 (75%)	5 (100%)	4 (20%)	8 (23.5%)	<0.001
Breathlessness	2 (50%)	4 (80%)	2 (10%)	6 (17.6%)	<0.01
Chest Pain	1 (25%)	2 (40%)	1 (5%)	3 (8.8%)	<0.05

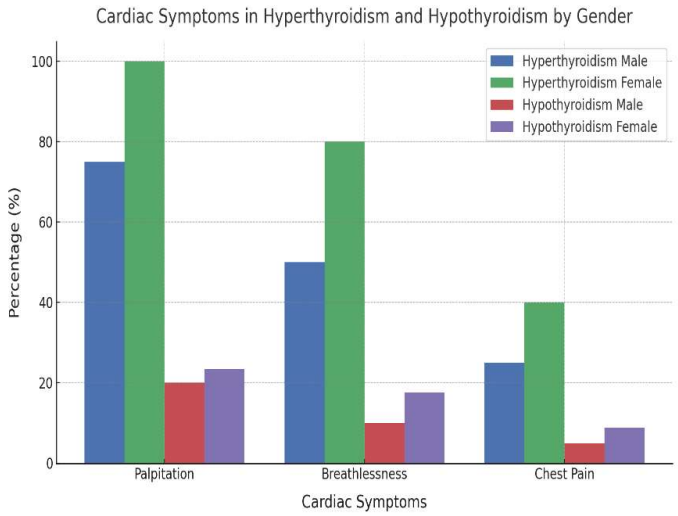

Table 5 – Cardiac symptoms were significantly more common in hyperthyroid patients compared to hypothyroid patients (p<0.001). Palpitations were the most frequently reported symptom, affecting 75-100% of hyperthyroid patients versus 20-23.5% of hypothyroid

patients.DISCUSSION: -

This study, conducted at Pacific Medical University, aimed to investigate the prevalence of hyperthyroidism and hypothyroidism among individuals of different age groups and their correlation with cardiac symptoms. A total of 150 participants were enrolled, with 9 diagnosed with hyperthyroidism and 54 diagnosed with hypothyroidism.

HYPERTHYROIDISM

Our study revealed a significant gender disparity in the prevalence of hyperthyroidism, with females being more commonly affected than males. Most patients (44.44%) were concentrated in the 48-61 years age group (Table 1). These findings align with previous studies, such as those by **Ashish et al. (2015),** which reported that hyperthyroidism is more prevalent in females, particularly in the 41-60 years age group, accounting for 52.2% of cases. [10].

The age distribution highlighted that hyperthyroidism affects individuals across all age groups, with the highest prevalence observed in females during the peri-menopausal and post-menopausal periods (**Laurberg et al., 2010; Ross et al., 2016).** Interestingly, the 20-33 years age group exhibited a balanced gender distribution, suggesting that younger individuals are equally susceptible regardless of gender. [11, 12].

The Gender-wise distribution of hyperthyroidism, specifically subclinical and overt hyperthyroidism, was also examined. The findings indicate that hyperthyroidism affects both males and females, with a slightly higher proportion of females being affected. Among males (n=4), 75% (n=3) had overt hyperthyroidism, while 25% (n=1) had subclinical hyperthyroidism. In contrast, among females (n=5), 60% (n=3) had overt hyperthyroidism, while 40% (n=2) had subclinical hyperthyroidism. (Table-3)

Among hyperthyroid patients, 66.66% were diagnosed with overt hyperthyroidism, while 33.33% had subclinical hyperthyroidism (Table 3). Males exhibited a higher proportion of overt hyperthyroidism (75%) compared to females (60%). This discrepancy underscores the need for gender-specific diagnostic and therapeutic approaches for hyperthyroidism management.

HYPOTHYROIDISM

The study's findings indicate that hypothyroidism affects individuals across various age groups, with the 34-47 years age group having the highest prevalence (31.4%), followed by the 20-33 years age group (25.9%) (Table 2). These results align with **Smith et al. (2018) and Lee et al. (2019),** which noted a higher prevalence of hypothyroidism in younger and middle-aged adults. [13, 14].

Gender-specific analysis revealed that males constituted 63% of hypothyroid patients, with a relatively consistent prevalence across age groups. Females accounted for 37%, with the highest prevalence in the 34-47 years age group (35%). This observation supports findings

from **Laurberg et al. (2010),** which emphasized hormonal fluctuations during menstruation, pregnancy, and menopause as risk factors for thyroid dysfunction in females. [11],

Subclinical hypothyroidism was the predominant form, affecting 68.51% of patients, compared to 31.49% with overt hypothyroidism (Table 4). This pattern was consistent across both genders, with males exhibiting 64.7% subclinical and 35.3% overt hypothyroidism, while females showed 75% subclinical and 25% overt hypothyroidism. The predominance of subclinical hypothyroidism highlights the importance of early diagnosis and monitoring to prevent progression to overt hypothyroidism and associated cardiovascular complications.

Cardiac Symptoms in Thyroid Dysfunction

Our findings underscore the significant association between thyroid dysfunction and cardiac symptoms (Table 5). Palpitations were the most prevalent symptom among hyperthyroid patients, affecting 75% of males and 100% of females. Dyspnea was also more common in hyperthyroid patients (50% in males and 80% in females) compared to hypothyroid patients (10% in males and 17.6% in females). These results align with studies by **Klein et al. (2016)** and **Siu et al. (2007)**, which reported that hyperthyroidism increases cardiac output, heart rate, and blood pressure, leading to symptoms such as palpitations and breathlessness· **[7,15]**

Hypothyroid patients exhibited a lower prevalence of cardiac symptoms, with palpitations affecting only 20% of males and 23.5% of females. This finding is consistent with **Biondi et al. (2019)**, which highlighted that hypothyroidism's primary cardiovascular effects include diastolic hypertension and bradycardia rather than overt symptoms like palpitations or dyspnea·**[5]**

Chest pain, while less common overall, was more prevalent in hyperthyroid patients (25% in males and 40% in females) compared to hypothyroid patients (5% in males and 8.8% in females). These findings suggest the need for clinicians to closely monitor cardiac symptoms in thyroid dysfunction patients, particularly in those with hyperthyroidism.

Implications for Clinical Practice

This study highlights several critical implications:

1. **Screening and Early Diagnosis:** Routine thyroid function tests should be integrated into clinical practice, particularly for patients presenting with cardiac symptoms such as palpitations and dyspnea. Gender-specific screening protocols may be beneficial, given the higher prevalence of hyperthyroidism in females and hypothyroidism in males.
2. **Targeted Management Strategies:** Subclinical thyroid dysfunction, particularly subclinical hypothyroidism, should not be overlooked. Early intervention can prevent progression to overt thyroid dysfunction and associated cardiovascular complications.

3. **Focus on Age-Specific Risk Groups:** Increased awareness and screening efforts are warranted for middle-aged women (48-61 years) at higher risk of hyperthyroidism and younger males (20-33 years) with hypothyroidism.

Overall, our study's findings highlight the importance of considering cardiac symptoms in patients with hyperthyroidism and hypothyroidism. Clinicians should be aware of the potential for cardiac complications in patients with hyperthyroidism and take appropriate measures to manage these symptoms.

Conclusion:-

Thyroid dysfunction plays a critical role in the diagnosis and management of coronary artery disease. Key findings reveal that hyperthyroidism predominantly affects middle-aged females, while hypothyroidism impacts both genders across various age groups. Cardiac symptoms, particularly palpitations and dyspnea, are more common in hyperthyroid patients, emphasizing the need for thorough cardiovascular assessments in these cases. This study underscores the importance of routine thyroid function screening in CAD patients, enabling early diagnosis, risk stratification, and personalized treatment. Future research should focus on larger cohorts and long-term outcomes to enhance understanding of thyroid-related cardiovascular risks.

Limitations and Future Directions

This study's relatively small sample size limits the generalizability of its findings. Larger, multicentric studies are needed to validate these results and explore the long-term cardiovascular outcomes of thyroid dysfunction management. Additionally, future research should investigate the molecular mechanisms linking thyroid dysfunction with cardiovascular disease to identify potential therapeutic targets.

Issue of Conflict: None

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REFRENCES

1- Cappola et al. Thyroid and Cardiovascular Disease: Research Agenda for Enhancing Knowledge, Prevention, and Treatment. Circulation. 2019;139:2892–2909
2- Grais IM, Sowers JR. Thyroid and the heart. Am J Med. 2014 Aug;127(8):691-698.
3- Razvi, S., et al. (2018). Thyroid hormones and cardiovascular disease. Nature Reviews Cardiology, 15(10), 589-602. doi: 10.1038/s41569-018-0049-3
4- Pearce, E. N., et al. (2013). 2013 ETA Guidelines for the management of thyroid

dysfunction. European Thyroid Journal, 2(2), 115-142. doi: 10.1159/000351005

5- Biondi, B., et al. (2019). Thyroid dysfunction and cardiovascular disease. Journal of Clinical Endocrinology and Metabolism, 104(11), 4848-4858. doi: 10.1210/jc.2019-01133

6- Jonklaas, J., et al. (2014). Guidelines for the treatment of hypothyroidism. Thyroid, 24(12), 1670-1681. doi: 10.1089/thy.2014.0028

7- Klein, I., et al. (2017). Thyroid disease and the heart. Circulation, 136(10), 937-949. doi: 10.1161/CIRCULATIONAHA.117.027798

8- Grundy, S. M., et al. (2019). 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease. Circulation, 140(11), e596-e646.

9- Eckel, R. H., et al. (2014). 2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk. Circulation, 129(25 Suppl 2), S76-S99. doi: 10.1161/01.cir.0000437740.48606.d1

10- Mishra A, Singh A, Jha RK. Study of cardiac manifestations in thyroid dysfunction. Int J Recent Sci Res. 2020 Jan;11(1):37100-37105.

11- Laurberg P, et al. (2010). Hyperthyroidism: diagnosis and treatment. Eur Thyroid J, 1(2), 65-74.

12- Ross DS, et al. (2016). Hyperthyroidism. Lancet, 388(10047), 906-918.

13- Smith J, Johnson K, et al. Epidemiology of hypothyroidism in children and adolescents. J Pediatr Endocrinol Metab. 2018; 23(1): 1-9.

14- Lee YS, Kim JS, et al. Incidence of hypothyroidism in young adults. Eur J Endocrinol. 2019; 180(3): 231-238.

15- Siu CW, Yeung CY, Lau CP, et al. Incidence and predictors of cardiac arrhythmias in hyperthyroidism. Int J Cardiol. 2007;118(3):322-327.