Section: Medicine

Original Research Article

THYROID DYSFUNCTION IN ACUTE CORONARY SYNDROME - A CROSS SECTIONAL STUDY

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Abstract

Background: To evaluate the changes in thyroid profile in Acute Coronary Syndromes at the time of admission. **Materials and Methods:** A cross-sectional study was conducted from June 2022 to July 2024 in the Department of Medicine, RIMS, Imphal among 18 years and above patients with Acute Coronary Syndromes. Demographic data like age, sex, BMI, smoking history and comorbidities like diabetes, dyslipidemia, hypertension, etc. of the patients were the independent variables. Dependent variables were euthyroid and hypothyroidism. Data collected were analyzed using SPSS-version-21. Chi-square test and Fisher's exact test were used for proportions. A p-value of <0.05 was taken as significant. **Result:** Out of 82 ACS patients, 65.6% were males and the mean (SD) age was 58.89 (12.27) years. Majority of the patients were above 40 years. Out of 82 patients, 36.6% were overweight and only 11% were obese. 41.5% were hypertensive, 20.7% presented with dyslipidemia and 43.9% presented with diabetes mellitus. Majority (91.5%) of patients had normal thyroid level and 8.5% had hypothyroidism. **Conclusion:** Our study showed that there is a high prevalence of hypothyroidism among the ACS patients. Middle aged people and elderly should go for a regular thyroid profile checkup as the study finding suggests an association between hypothyroidism and ACS. Further study needs to be conducted to rule out causative role.

INTRODUCTION

Thyroid hormones are involved in regulating metabolic processes, cardiovascular function, and overall homeostasis. The interplay between thyroid dysfunction and cardiovascular disease has been a subject of growing interest, given the significant impact of altered thyroid states on cardiac physiology. Both overt and subclinical thyroid dysfunctions are increasingly recognized as important contributors to cardiovascular morbidity and mortality.[1] Hypothyroidism links with diastolic dysfunction, systemic vascular resistance, and atherogenic lipid profiles, whereas hyperthyroidism predisposes individuals to tachyarrhythmias, myocardial remodeling, and hypercoagulability. Cardiovascular diseases (CVD) are a leading cause of morbidity and mortality globally, including in India.[2] Various risk factors for CVDs includes dietary factors, hypertension, diabetes, air pollution, high total cholesterol, tobacco use, Obesity, etc.[3] Even with optimal guidelines based preventive measures, the unrelenting progress of cardiovascular diseases suggests a multi-factorial etiology. Thus, there is a need to explore other components that may augment CVD.

Thyroid hormone receptors are located in myocardial and endothelial tissues. Patients with abnormal thyroid levels exhibit cardiovascular and haematologic manifestations.[4] A slight modification in thyroid function influences ventricular activity, blood cholesterol levels, cardiac performance (rate and rhythm), thereby elevating the risk of cardiovascular disease and mortality.[5] Thyroid hormone causes deranged lipid profile; alter endothelial function, changes in blood pressure and

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affecting cardiac systolic and diastolic activity thereby affecting cardiovascular system.[6] Thyroid dysfunction is quite prevalent in adult population affecting 10–15% of the population.[7]

In addition to overt thyroid dysfunction, recent evidence highlights the significant cardiovascular implications of subclinical thyroid disorders, including subclinical hypothyroidism and subclinical hyperthyroidism.[8] Subclinical hypothyroidism has been associated with early-stage reductions in systolic functions. It also contributes to an atherogenic profile characterized by an unfavorable lipid metabolism and heightened inflammatory activity, which collectively exacerbate cardiovascular riskshand, along with a slight reduction in coronary reserve.[9] These changes can predispose individuals to thromboembolic complications and other adverse cardiovascular events. Notably, both conditions have been independently associated with an increased risk of cardiovascular mortality, underscoring the importance of early detection and management of subclinical thyroid disorders to mitigate long-term cardiovascular outcomes.[10]

Furthermore, the "low T3 syndrome," a condition characterized by reduced levels of triiodothyronine (T3) in the absence of overt thyroid disease, mirrors many of the cardiac abnormalities observed in primary hypothyroidism. These include reduced maximal contraction and relaxation rates of the myocardium, which impair overall cardiac performance, as well as shifts in gene expression, notably alterations in myosin heavy chain isoform expression that contribute to compromised myocardial function. Importantly, low T3 syndrome has emerged as a significant independent predictor of mortality in patients with heart disease, underscoring its role in disease conditions. Its presence often reflects a maladaptive response to severe systemic illness, including cardiovascular events, further emphasizing the importance of monitoring thyroid function in these settings.[11] This study sought to evaluate changes in thyroid hormone profiles in patients presenting with Acute Coronary Syndromes at the time of hospital admission. It also seeks to ascertain the correlation between thyroid dysfunction and various forms of acute coronary syndrome.

Aim: To evaluate the changes in thyroid profile in Acute Coronary Syndrome and to determine the association of thyroid dysfunction with different types of acute coronary syndrome.

MATERIALS AND METHODS

Settings

A hospital based cross sectional study was conducted from June 2022 to July 2024 in the Medicine Department RIMS, Imphal among patients above 18 years of age admitted at Intensive Coronary Care Unit (ICCU) and Medicine Wards with Acute Coronary Syndrome (ACS). The study was initiated after acquiring ethical approval (No. A/206/REB-Comm(SP)/RIMS/2015/881/219/2022) from the research ethics board of the institute. Patients with known thyroid disease and patients using drugs which affect thyroid function (amiodarone, oral contraceptives, corticosteroids and propranolol) were excluded from the study. Convenience sampling technique was used to reach the sample size of 82, calculated from a study by R Gupta et al.[12]

Measurements

A thorough clinical history with physical examination was done with routine investigation and relevant blood investigation and electrocardiogram of all the participants. A structured proforma was used to collect data from the patients and relevant data were also collected from case sheets of the patients from the department. Demographic data like age, sex, BMI, smoking history and comorbidities like diabetes, dyslipidemia, hypertension, etc. of the patients were collected. After informed consent was obtained, blood samples were collected to test for Thyroid Profile on admission. The reference values for thyroid profile were – TSH (0.27 to 4.2μIU/L); T3 (1.3 to 3.1 nmol/L); T4 (66.0 to 181.0 nmol/L); fT3 (2.8 to 7.1 pmol/L) and fT4 (12.0 to 22.0 pmol/L).[13]

Statistical Analysis

The gathered data were compiled and analyzed in SPSS (IBM) version 26. The data were expressed as mean, standard deviation, and percentages. The analysis was performed using either the $\chi 2$ test or Fisher's exact test. P-value < 0.05 was taken as statistically significant.

RESULTS

In the present study, eighty-two (82) patients diagnosed with Acute Coronary Syndrome (ACS) who met the inclusion and exclusion criteria were assessed. The majority (65.6%) of the participants were male. As detailed in [Table 1], the age of the participants ranged from 35 to 93 years, with a mean age of 58.89 ± 12.27 years. The largest proportion of participants (46.3%) were aged between 41 and 60 years, followed by those aged over 60 years (41.5%). Only 12.2% of participants were under 45 years of age. More than half (52.4%) of the participants had normal BMI, whereas more than one third (36.6%) of the participants were overweight. Only 11% of the participants were obese in this study. Almost three-fourth (73.2%) of the participants did not have history of Smoking, while 26.8% gave history of smoking. More than half (58.5%) of the participants did not have history of hypertension, while 41.5% were hypertensive. More than three-fourth (79.3%) of the participants did not have history of dyslipidemia, while 20.7% presented with dyslipidemia. More than half (56.1%) of the participants did not have history of diabetes mellitus, while 43.9% presented with diabetes mellitus.

As shown in [Figure 1] more than half (53.7%) of the participants presented with STEMI, followed by NSTEMI (32.9%) and Unstable Angina (13.4%). In

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[Table 2], majority (91.5%) of patients had normal thyroid level at the time of admission and 8.5% had hypothyroidism. As shown in [Table 3], participants presenting with STEMI had significantly higher proportions of patients with dyslipidemia and diabetes (p value <0.05). No association was seen between type of ACS and history of hypertension and BMI (p value >0.05). As shown in Table 4, 13.2% of NSTEMI + Unstable angina were hypothyroid in comparison to only 4.5% of the STEMI patients but the difference was not significant.

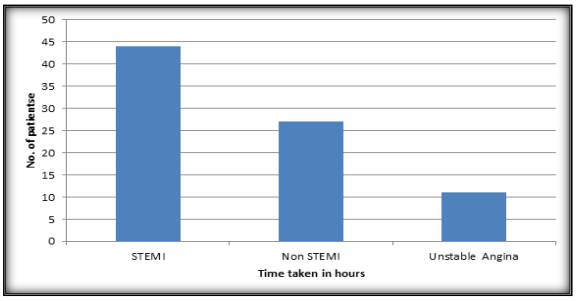

Figure 1: Distribution of Patients according to type of Acute coronary syndrome (N=82)

Table 1: Characteristics of the study population (N=400).

Characteristics		No. of participants, n	Percentages (%)
Gender	Male	54	65.9
	Female	28	34.1
Age in years	Up to 40 years	10	12.2
	41 – 60 years	38	46.3
	> 60 years	34	41.5
BMI	Normal Weight	43	52.4
	Overweight	30	36.6
	Obesity Class I	9	11.0
History of smoking	Yes	22	26.8
	No	60	73.2
Hypertension	Yes	34	41.5
	No	48	58.5
Dyslipidemia	Yes	17	20.7
	No	65	79.3
Diabetes Mellitus	Yes	36	43.9
	No	46	56.1

Table 2: Distribution of the patient according to thyroid hormone profile (N=82).

Sl.no.	Co-morbidities	No. of participants, n	Percentages (%)
1.	Euthyroid	75	91.5
2.	Hypothyroidism	7	8.5

Table 3: Association of ACS with Co-morbidities (N=82).

Co-morbidities		No. of participants, n (%)		P value
		STEMI	Non-STEMI /UA	
Hypertension	Yes	18 (40.9)	16 (42.1)	0.913
	No	26 (59.1)	22 (57.9)	
Dyslipidemia	Yes	14 (31.8)	3 (7.9)	< 0.05
	No	30 (68.2)	35 (92.1)	
BMI	Normal	263 (94.9)	117 (95.1)	0.285
	Overweight	14 (5.1)	6 (4.9)	
	Obesity (Class I)	7 (15.9)	2 (5.3)	
Diabetes	Yes	24 (54.5)	12 (31.6)	< 0.05
	No	20 (45.5)	26 (68.4)	

Table 4: Association of thyroid hormone profile with type of ACS (N=400)

Thyroid hormone profile	No. of participants, n (%)		P value
	STEMI	Non-STEMI /UA	
Euthyroid	37 (84.1)	32 (84.2)	0.988
Hypothyroidism	7 (15.9)	6 (15.8)	

DISCUSSION

The relationship between thyroid dysfunction and cardiovascular diseases, particularly Acute Coronary Syndrome (ACS), has garnered increasing attention in recent years. Thyroid hormones are essential regulators of cardiac function, affecting heart rate, contractility, vascular tone, and lipid metabolism. In this study, we assessed the alterations in thyroid hormone profiles in patients diagnosed with ACS at the time of hospital admission and explored the association between thyroid dysfunction and ACS severity. The present study was set out to examine the association between thyroid dysfunction and Acute Coronary Syndrome. Out of eighty-two (82) patients with Acute Coronary Syndrome (ACS), majority (65.6%) of the respondents were male in this study and their age ranged from 35 to 93 years, with mean age of 58.89±12.27 years and majority (46.3%) were in the age group of 41 to 60 years. Similar findings were reported by Potdar S et al,[14] in their study,

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where male gender constituted 53.3% of their study population and majority (61.6%) of their study population was in the age group of 41 to 60 years of age. Another study by Sah VK et al,[15] also reported similar finding of male preponderance (58%) among their study population of ACS. In contrary to this study finding, they reported majority (62%) of the participants to be more than 60 years of age. Thus, most of the patients with ACS were middle aged population and elderly as shown in this study. Previous literatures support the role of age as an independent risk factor for cardiac disorders, which is in concordance with this study.[16,17]

In the current study, the most common co-morbidity was diabetes, followed by hypertension and dyslipidemia. Patients presenting with STEMI were significantly associated with dyslipidemia and diabetes. The findings align with the study by Chafekar N et al,[18] which identified diabetes mellitus as a significant risk factor in ACS patients with varying thyroid function levels. Literature indicates that diabetes women face a 3–7 times greater risk of developing or succumbing to coronary heart disease compared to non-diabetic women, whereas diabetic males exhibit a 2- to 3-fold increased risk of coronary artery disease relative to non-diabetic men.[18] In a study by Caruana R et al,[19] 42% of their patients with ACS died during follow-up and 21% of the whole cohort had diabetes. Association of dyslipidemia and ACS has been observed in the Colorado Health Fair study.[20] Reduced cholesterol clearance in hypothyroidism lead to hyperlipidemia, probably due to lower hepatic LDL receptors and diminished 7α-hydroxylase levels in the liver.[4] Literatures have reported the association of thyroid function disorders with various clinical entities like deranged lipid profile, insulin resistance, high blood pressure, atherosclerosis, etc.[21] Therefore, they reasoned the rise in cardiovascular mortality among high to normal TSH level in their studies may be due to cardiometabolic disorders happening in subclinical hypothyroidism and overt hypothyroidism.[4,6,22] Various literatures have reported association between overt and sub-clinical hypothyroidism and diastolic high blood pressure, abnormal vascular activity and augmented carotid intima hyperplasia. Hyperlipidaemia and thyroid antibodies are thought to inhibit the production of endothelial nitric oxide synthase, hence restricting vasodilation. Moreover, heightened arterial stiffness and diminished resin state are interrelated aspects contributing to hypertension and vascular dysregulation, attributable to the lack of typical vasodilatory actions of T3.[4]

The prevalence of hypothyroidism in our study was found to be 8.5% on the day of admission, which is significantly higher than what has been reported in studies conducted outside of India, where ACS typically ranges from 2.3% to 6.7%.[23] This discrepancy highlights the potential regional variation in thyroid dysfunction among ACS patients. While factors such as differences in diagnostic criteria, study populations, and geographical influences might contribute to this variation, it is important to note that the prevalence of thyroid dysfunction, particularly hypothyroidism, tends to be higher in the Indian subcontinent compared to Western populations. This has been attributed to various factors, including dietary iodine deficiency, genetic predisposition, and a higher prevalence of autoimmune thyroid diseases in the region.[24] Our study findings are in line with other studies conducted within India, which have reported similar patterns of thyroid dysfunction among patients with cardiovascular diseases, specifically those with ACS. The relatively higher prevalence of hypothyroidism observed in our cohort is consistent with these regional trends, which suggest that thyroid dysfunction may be more common in the Indian population. The higher prevalence of hypothyroidism observed in ACS patients within our study could also reflect an increased awareness and diagnostic capabilities in the region, where thyroid dysfunction is actively monitored in clinical settings. Moreover, we observed a notably higher prevalence of hypothyroidism (13.2%) in the NSTEMI/UA (Non-ST Elevation Myocardial Infarction/Unstable Angina) group compared to the STEMI (ST-Elevation Myocardial Infarction) group, where only 4.5% of patients exhibited hypothyroidism. This finding is significant as it suggests that thyroid dysfunction, particularly hypothyroidism, may be more prevalent in patients with NSTEMI and Unstable Angina compared to those with STEMI. Several studies, including those by Arambam P et al. [24] and Pimentel RC et al,[25] have reported similar observations. These studies have highlighted that thyroid dysfunction, especially hypothyroidism, is more common in patients with less severe forms of myocardial infarction, such as NSTEMI and Unstable Angina, possibly due to the different pathophysiological mechanisms that underlie these types of ACS. In NSTEMI and Unstable Angina, the myocardial ischemia may be more gradual and less complete, which could contribute to a higher prevalence of thyroid dysfunction as a secondary factor. In contrast, STEMI, being associated with more acute and severe ischemia, may involve a different set of risk factors and underlying mechanisms that do not prominently include thyroid dysfunction.

These findings further emphasize the need to consider thyroid dysfunction, particularly hypothyroidism, as an important factor in the clinical management of ACS patients, especially in regions like India where its prevalence is higher. The association between thyroid dysfunction and ACS outcomes warrants further investigation, particularly in understanding how thyroid status might influence the severity and progression of different forms of ACS. Further studies with larger sample sizes and longitudinal follow-up are needed to explore the potential mechanisms linking thyroid dysfunction to

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ACS and its clinical implications for patient management.

CONCLUSION

The prevalence of hypothyroidism among the ACS patients was more than 8%. Males in their middle age and older were affected more with Acute Coronary Syndrome (ACS). Diabetes, followed by hypertension and dyslipidemia were common comorbidities present among ACS patients. Patients presenting with STEMI were significantly associated with dyslipidemia and diabetes. Patients with NSTEMI/UA had a higher prevalence (13.2%) of hypothyroidism than patients with STEMI (4.5%). Middle aged people and elderly should go for a regular thyroid profile checkup as the study finding suggests an association between hypothyroidism and ACS. Further study needs to be conducted to rule out causative role.

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