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A STUDY ON THYROID PROFILE IN ACUTE MYOCARDIAL INFARCTION PATIENTS: A CROSS SECTIONAL STUDY IN A TERTIARY CARE CENTRE

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Abstract-

Introduction- Thyroid hormone, namely thyroid releasing hormone, plays a critical role in maintaining cardiovascular system function, homeostasis and cardiac hemodynamics. This raises the risk of cardiovascular death, coronary artery disease, and hypertension. However, the relationship between abnormal thyroid function and cardiovascular consequences is still unclear. Thus, this study was done to look at any potential differences in thyroid profile in acute coronary syndromes.

Material and method- The current study was a prospective cross-sectional hospital based study conducted on acute myocardial infarction (AMI) patients. After applying exclusion and inclusion criteria, a total of 200 AMI patients were enrolled with consent from all the participants. Following a 12-hour overnight fast, serum T3, T4 and TSH levels and other biochemical markers were measured using commercial kits. A complete data regarding demographical, clinical and physical examination along with electrocardiogram were noted. Statistical analysis was carried out by SPSS software considering p-value less than 0.05 as statistically significant.

Result- The present study showed male dominance with 51-60years age group to be more prone to AMI in both the genders. There was a significant correlation between patients' age and gender with the incidence of AMI. The subclinical hypothyroidism (SCH) was observed in 16% and euthyroid was seen in 84% AMI patients. The most common comorbidity associated with AMI was hypertension along with STEMI as the major type of MI found in both SCH and euthyroid group. Males and age group 51-60years were seen to be more affected in both SCH and euthyroid group. The association between the demographic and clinical profile of AMI patients with the type of thyroid dysfunction was not significant.

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Conclusion- The findings of this study suggest that hypothyroidism and AMI may be related, predicting greater risk of thrombosis and hemorrhage in moderate and severe hypothyroidism respectively. Therefore, thyroid hormones should be monitored in middle-aged population for an early detection of cardiac involvement and for better care of AMI patients.

Keywords- Thyroid, ACS, myocardial infarction, subclinical hypothyroidism, euthyroid etc.

Introduction-

Any set of clinical symptoms consistent with an acute myocardial infarction (MI) is referred to as acute coronary syndrome (ACS). It is further divided into unstable angina (UA), non-ST-elevated myocardial infarction (NSTEMI), and ST-elevated myocardial infarction (STEMI).[1] ACS has high global morbidity and mortality rates so it has emerged as a major public health concern.[2] Thyroid hormone, namely thyroid releasing hormone (TRH), plays a critical role in maintaining cardiovascular (CV) system function, homeostasis and cardiac hemodynamics.[3] Serum cholesterol levels, heart rate, rhythm, and ventricular function are all impacted by a little alteration in thyroid status, primarily insufficient amounts, which can result in hyperlipidemia and ventricular arrhythmias. On the other hand, atrial arrhythmias are caused by an overabundance of thyroid hormone. This raises the risk of CV death, coronary artery disease (CAD), and hypertension.[4] However, the relationship between abnormal thyroid function and CV consequences is still unclear.[5] In light of this, the American Heart Association (AHA) advises that thyroid function be evaluated in all heart failure patients.[6] It was formerly thought that cardiovascular system (CVS) disease primarily affected higher-income countries. However, the current situation confirms that the prevalence of CVS disease is worrisomely rising in low- and middle-income nations, like India.[7]

Patients with ACS have been shown to have an aberrant thyroid profile in numerous examinations.[8] Recent research has identified subclinical hypothyroidism (SCH) and hyperthyroidism as clinical conditions that negatively impact the CVS[9] and raise the risk of CV death.[10] The condition known as "low T3 syndrome" or "Euthyroid sick syndrome" is the most common one among people suffering from ACS. In addition to elevated levels of serum reverse triiodothyronine (rT3), which can be seen in acute or chronic illnesses, these patients have a profile of low serum triiodothyronine (T3) and/or free triiodothyronine (fT3), normal thyroxine (T4), and normal thyroid stimulating hormone (TSH).[11,12] Notably, this illness has been noted to emerge quickly following open heart surgery[11] and in numerous cases of acute myocardial infarction (MI),[13,14] and severe chronic heart failure. The characteristic feedback regulatory mechanism of thyroid homeostasis is altered in this situation. Similar alterations in cardiac function (reduced maximal rate of contraction and relaxation) and gene expression are brought about by this syndrome as in primary hypothyroidism. This syndrome represents one of the leading causes of death in people with heart disease.[15] Furthermore, many studies have discovered that hypothyroidism may pose a risk for coronary artery disease (CAD).[16] When the underlying thyroid condition is targeted with medicine, cardiac abnormalities usually show promise for recovery.[3] So studying the frequency of thyroid dysfunction and how it affects patients' health outcomes among those with ACS is crucial. It is important to remember,

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nevertheless, that despite the abundance of research on this subject, there is still a sizable vacuum in the knowledge of how thyroid hormone imbalances affect hospitalized patients' ACS symptoms. Thus, the purpose of this study was to look at any potential differences in the thyroid hormone profile in ACS.

Material and Method-

The current study was a prospective cross-sectional hospital based study conducted between August 2015 and August 2017, on acute myocardial infarction (AMI) patients visiting outpatient department or hospitalized at MLN Medical College and its affiliated S R N Hospital in Uttar Pradesh, India. The study was conducted in compliance with the moral guidelines for using human subjects in research. After receiving ethical approval from the institutional ethics committee, data collecting got underway. Every study participant signed an informed consent form, available in both Hindi and English language. The goal of the study was fully disclosed to the volunteers, as part of appropriate clinical practice. A total of 200 adult AMI patients over the age of 18years, both male and female were chosen for the study. All patients with AMI, regardless of whether they were euthyroid or SCH, were included based on TSH levels from 6-10μIU/ml) and normal T4 values between 4.9-12.5 μg/dl. Patients with drug-induced hypothyroidism, known thyroid diseases, chronic autoimmune thyroiditis and cases with thyroid stimulating hormone (TSH) levels >20mU/L or <4.5mU/L were excluded from the study. Based on the results of their thyroid function tests, patients were divided into two groups. Group A: with TSH Level >4.5-9.9mU/L and Group B: with TSH Level >10-20mU/L. Following a 12-hour overnight fast, blood samples were taken from each participant to measure biochemical markers. Using commercial kits, the enzyme-linked immunosorbent assay (ELISA) method was used to evaluate the levels of T3, T4, and TSH in serum. The typical ranges for TSH, T3, and T4 are 0.39–5.95μIU/ml, 55–200ng/dl and 4.9–12.5μg/dl, respectively. A complete data regarding demographic clinical and physical examination along with electrocardiogram were noted of the enrolled patients. Descriptive analysis and the chi-square test were used in the statistical analysis carried out by SPSS software. A p-value less than 0.05 was deemed statistically significant.

Result-

The study was conducted on 200 AMI patients for around 2 years i.e. from August 2015 to August 2017. 146 (73%) of the total cases were men, and 54 (27%) were women, for a male to female ratio of 2.703:1 as clearly visible from table 1. The age distribution of cases is shown in figure 1. As can be observed, 83(41.5%) cases belonged to 51-60years, 56(28%) were in the 61-70years, 47(24%) cases were in 40-50years age group, and rest 14(7%) were older than 70.

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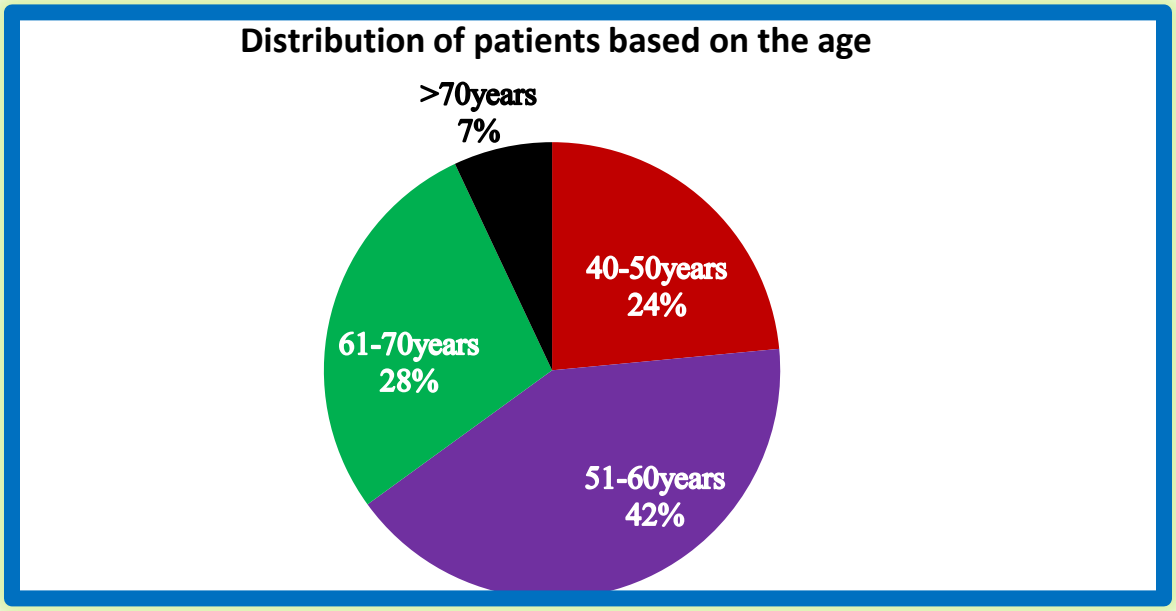

Figure 1-Distribution of patients based on the age

Figure 2 depicts distribution of patients based on the type of thyroid dysfunction. Out of 200 patients, 32(16%) had SCH and rest 168(84%) were euthyroid. None of the patients suffered from subclinical hyperthyroidism or had low fT4 levels with normal fT3 and TSH levels.

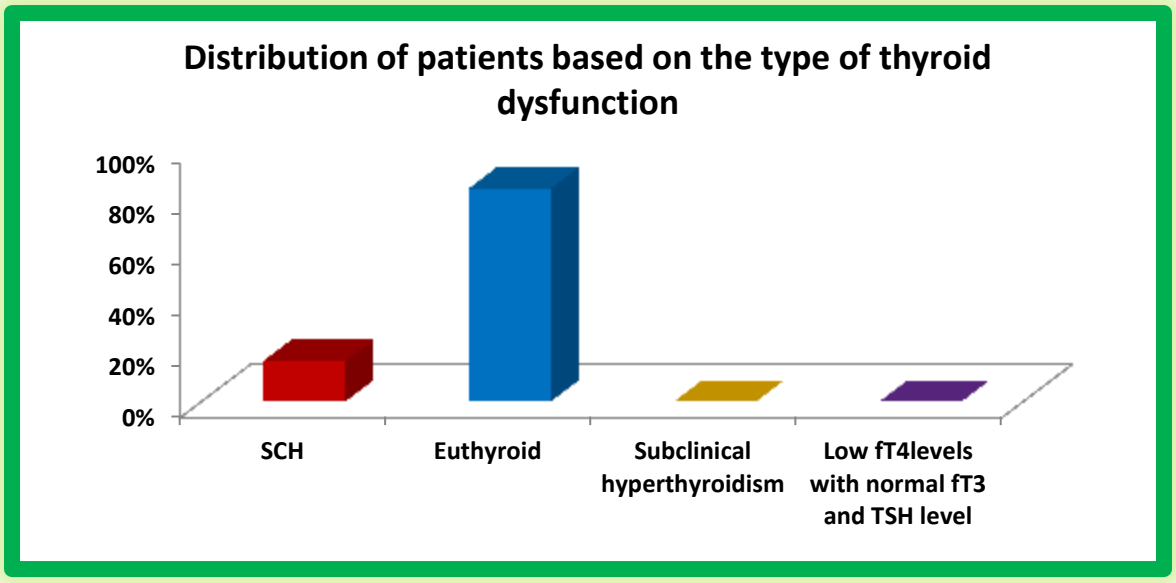

Figure 2- Distribution of patients based on type of thyroid dysfunction

As clearly visible from clinical profile of AMI patients in table 1, the majority of AMI patients had hypertension i.e. 105(52.5%) and 92(46.0%) had diabetes as associated comorbidity. The major thyroid dysfunction suffered by enrolled AMI patients was SCH and euthyroid i.e. 32(16.0%) and 168(84.0%) respectively. None of the patients experienced subclinical

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hyperthyroidism or had low fT4 levels with normal fT3 and TSH levels. The type of MI suffered by the patients was STEMI and NSTEMI with 155(77.5%) and 45(22.5%) cases respectively.

Table 1- Demographic and clinical profile of AMI patients

Patients		n (%)
Total		200(100.0)
Male		146(73.0)
Female		54(27.0)
Medical history	Diabetes	92(46.0)
	Hypertension	105(52.5)
Type of Thyroid Dysfunction	SCH	32(16.0)
	Euthyroid	168(84.0)
Type of MI	STEMI	155(77.5)
	NSTEMI	45(22.5)

The correlation between age and gender in AMI patients is displayed in Table 2. The 40-50years age group consisted of 36(18.0%) males and 11(5.5%) females. In 51-60yeasrs age group, the percentage of men and women was 52(26.0%) and 31(15.5%) respectively. There were 8(4.0%) female and 48(24.0%) AMI male patients in the 61–70years age group. Males and females were 10(5.0%) and 4(2.0%) respectively, in the age group older than 70years. The patients' gender was shown to be significantly ($p<0.05$) associated with AMI.

Table-2 Association of gender with age groups of MI patients

Gender	Age group in years n(%)				Total	Chi square	p-value
	40-50	**51-60**	**61-70**	**>70**			
Male	36(18.0)	52(26.0)	48(24.0)	10(5.0)	146	9.429	**0.024**
Female	11(5.5)	31(15.5)	8(4.0)	4(2.0)	54		
Total	47(23.5)	83(41.5)	56(28.0)	14(7.0)	200		

Table 3 depicts association of demographic and clinical profile of AMI patients with the type of thyroid dysfunction. AMI patients enrolled in our study had SCH and euthyroid as thyroid dysfunction. Out of 32(16%) SCH patients, 21(65.6%) were males and 11(34.4%) were females. Further out of 168(84%) euthyroid patients, 125(74.4%) and 43(25.6%) were males and females respectively. In present study, the association of gender with the type of thyroid dysfunction was non-significant (p-value>0.05). SCH patients had 8(25.0%), 14(43.8%), 9(28.1%) and 1(3.1%) patients in the age group of 40-50, 51-60, 61-70 and >70years. Whereas age group 40-50, 51-60, 61-70 and >70years in our study was comprised of 39(23.2%), 69(41.2%), 47(28.0%) and 13(7.7%) number of euthyroid patients. The association of age group with the type of thyroid dysfunction in present study was also not significant (p-value>0.05). 14(43.8%) SCH patients suffered from diabetes and 19 (59.4%) had hypertension. The diabetes comorbidity was seen in 78(46.4%) and hypertension in 86(51.9%) euthyroid patients. The type of MI seen in current

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study was STEMI and NSTEMI with 21(65.6%) and 11(34.4%) SCH patients respectively. However 134(33.5%) and 34(8.5%) euthyroid patients experienced STEMI and NSTEMI respectively. In current study, the association of type of thyroid dysfunction with medical history (associated comorbidity) and type of MI was also seen to be non-significant (p-value>0.05).

Table 3- : Association of demographic and clinical profile of AMI patients with the type of thyroid dysfunction.

Variable		Type of Thyroid Dysfunction n(%)		Chi-square	p-value
		SCH	Euthyroid		
Gender	Male	21(65.6)	125(74.4)	1.051	0.305
	Female	11(34.4)	43(25.6)		
Age group in years	40-50	8(25.0)	39(23.2)	0.900	0.825
	51-60	14(43.8)	69(41.2)		
	61-70	9(28.1)	47(28.0)		
	>70	1(3.1)	13(7.7)		
Medical History	Diabetes	14(43.8)	78(46.4)	0.291	0.589
	Hypertension	19(59.4)	86(51.9)		
Type of MI	STEMI	21(65.6)	134(33.5)	3.081	0.079
	NSTEMI	11(34.4)	34(8.5)		

Discussion-

Our study was a descriptive study, which included 200 AMI patients hospitalized or visiting MLN Medical College and its affiliated S R N Hospital in Uttar Pradesh, India between August 2015 and August 2017. The study was done to assess the thyroid profile in AMI patients as despite the abundance of research on this subject, there is still a sizable vacuum in the knowledge of how thyroid hormone imbalances affect hospitalized patients' ACS symptoms. It has been recently revealed that a frequent clinical issue known as SCH is linked to increased risks of heart attacks, heart failure, irregularities in lipid metabolism, and neuropsychiatric disorders. Males were shown to be more affected by AMI than females in our study. This is consistent with a research by Okuyan Ertugrul and colleagues.[17] According to a study by Vijay Kumar Sah et al., males (58%) were more likely than females (42%), to have MI.[11] Our findings are consistent with theirfindings.

Similar to our study, the National Institute for Public Health in Denmark found male sex as a risk factor for MI. Other risk factors were higher blood pressure, higher cholesterol, and greater rates of smoking in men.[18] A nationwide health and nutrition evaluation survey conducted similar research and found similar results.[19] These results might be explained by elevated stress levels, cigarette smoking, and/or other tobacco product use. Our research runs counter to a study by Lerner DJ and Kannel WB that found women were more likely to arrive with unusual

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conditions such congestive heart failure (CHF) or paroxysmal dyspnea.[20] The patients' gender in current study was shown to be significantly associated with AMI. In our research, patients of 51–60years age range (41.5%) mainly suffered with AMI, which is nearly corroborated by research of Ng M et al. that found women of 50–59years and men of 40–49years age range had higher incidence of AMI. The imbalance in the evolving risk factors for AMI i.e. obesity and diabetes, for instance, are on the rise in society, could account for these astounding findings.[21] This runs counter to a research by Vijay Kumar Sah et al. that found people over 60years mainly to experience CV issues.[11]

In the present study we observed that more male patients followed by female patients belonging to age group of 51-60years (26%) were more prone to MI. The reason behind it may be attributed to comorbid conditions like diabetes, smoking, coronary atherosclerosis in males and menopause and hyperlipidemia in females.[22] Our data is supported by study of Altaf Hussain Banday et al. who reported age group 46-60years (40.2%) to be more prone to MI mainly in males followed by females. Vijay Kumar Sah et al also found the same findings but the prone age group was >60years.[11] Our results show that age is an important factor of sex-based differences in MI presentation, which is especially relevant because women are older than men when they get presented with an ACS. The present study revealed SCH and euthyroid as the common thyroid dysfunctions seen in AMI patients. SCH affected 16% of AMI patients and 84% patients being euthyroid. Our finding is strongly in agreement with the study by Mohammed Mansour Helmy et al. as they also found proportion of euthyroid patients to be higher (81%) than that of SCH patients. The Cooper and Biondi study, also revealed SCH incidence in AMI patients to range from 4% to 20%. This broad variation can be explained by variations in the techniques used for clinical, biochemical & demographical examination of the study population.[23] The main comorbidity associated with AMI patients enrolled in current study was hypertension (52.5%) than followed by diabetes (46%). Which is supported by the study of Hairong Huang et al.[24] In our analysis, we found that, AMI patients mainly suffered from STEMI (77.5%) than NSTEMI (22.5%). This is in concordance with the research done by Vijay umar Sah et al.[11] Further in our study the variables were compared between the groups based on types of thyroid dysfunction and the association between the demographic and clinical profile of AMI patients with the type of thyroid dysfunction was analyzed. When SCH and euthyroid groups were compared, it was observed that males were more prone to both the thyroid dysfuctions. However, the Colorado study's findings, showed that 4-21% women and 3-16% AMI men[25] being affected with SCH. When different age groups were compared between SCH and euthyroid patients, results were comparable among the groups however it was seen that both the thyroid dysfunctions mainly affects 51-60years of age group followed by 61-70years age group. Our findings, however, conflict with those of the NHANES III[26] and the Whickham Survey,[27] which indicated a higher prevalence of SCH in the elderly population. The common comorbidity associated with both the dysfunctions in our study was hypertension followed by diabetes having nearly comparable prevalence. Further STEMI was more common type of AMI suffered by SCH and euthyroid patients followed by NSTEMI in our study. These findings were in accordance

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with the findings done by Tuzun D et al.[28] and Vijay kumar Sah et al. [11] However, the results of a study by Mathur P et al. contradicted our findings, reporting a greater prevalence of NSTEMI than STEMI in both the groups.[29] The association between the demographic and clinical profile of AMI patients with the type of thyroid dysfunction in present study was not significant. More research is needed to support these findings because there aren't many statistics on the relationship between the variables and the type of thyroid dysfunction seen in AMI patients.

Conclusion-

Keeping in view of increasing trend of MI, which carries a high mortality rate, primary preventive activities should focus on the risk factors. Physicians should be encouraged to educate the people about the risks of diabetes, hypertension and smoking. Public health awareness campaigns should be initiated and should focus on primary prevention and secondary level of prevention by early diagnosis and effective treatment of diabetes and hypertension. The findings of this study suggest that hypothyroidism and MI may be related. Research has revealed that having an abnormal thyroid status increases the risk of CAD and CV death. These findings suggest that there is greater risk of thrombosis, and hence of MI, in moderate hypothyroidism, and greater risk of hemorrhage in severe hypothyroidism. Therefore, for an early detection of cardiac involvement, thyroid hormone levels should be monitored in the middle-aged population as a whole. Which may result in better care of AMI patients. In light of the aforementioned, extensive research is required to elucidate the impact of SCH on myocardial infarction from both an etiology and predictive perspective.

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