

Prognosis of Patients with Preexisting Acute Coronary Syndrome and Thyroid Stimulating Hormone Abnormalities Undergoing Percutaneous Coronary Intervention Surgery



Abstract— Background: Percutaneous coronary intervention (PCI) is one of the treatment strategies used in Acute Coronary Syndrome (ACS). Many factors influence prognosis in acute coronary syndrome. Thyroid hormones play a critical role in cardiac and vascular physiology, and hypothyroidism has significant cardiovascular consequences, even if hormone levels are only slightly altered. This study aims to explore prognosis in patients with ACS and preexisting thyroid stimulating hormone defects (TSH) who undergo PCI surgery. **Methods:** The TSH was an independent indicator of 1-year all-cause mortality in euthyroid patients with ACS who underwent PCI. A retrospective cohort study was conducted by review of records of all patients who had TSH abnormalities and underwent PCI between 2017 and 2021 in the Department of Medicine at King Abdulaziz University Hospital in Jeddah, Saudi Arabia. **Results:** We reviewed records of up to 500 coronary care unit patients with TSH levels above 4 mIU/L or below 0.4 mIU/L who had PCI procedures. The study included 152 adult patients. Out of those, 94(61.8%) had a successful procedure, while 58(38.2%) developed complications including recurrence, requiring coronary artery bypass grafting, heart failure, and death. **Conclusion:** TSH level has a strong relation with prognosis in patients undergoing PCI. Controlling thyroid hormone levels minimizes postoperative complications. More studies are needed to help us improve patient health.

Keywords: Percutaneous Coronary artery Intervention, Thyroid Stimulating Hormone, Acute Coronary Syndrome

Background:

In a patient with myocardial infarction, percutaneous coronary intervention (PCI) is an effective procedure for opening the infarcted artery,⁽¹⁾ as well as for non-ST elevation myocardial infarction and unstable patients with unstable angina.^(2,3) Compared with thrombolytic therapy in treating acute myocardial infarction, PCI shows lower mortality rates and lower rates for nonfatal reinfarction and readmission for heart failure and ischemia.⁽⁴⁾ However, despite the use of novel treatment methods, patients with acute myocardial infarction (AMI) have poor prognosis.⁽⁵⁾

Many factors influence prognosis in acute coronary syndrome (ACS), one factor being thyroid hormones. During different critical illnesses, the natural thyroid homeostasis is known to shift, a disorder that has been related to disease severity and increased mortality.⁽⁶⁾

Thyroid hormones play a critical role in cardiac and vascular physiology, and hypothyroidism has significant cardiovascular consequences.⁽⁷⁾ The increased or decreased action of thyroid hormone on the heart and vascular system, causes many symptoms and signs in patients with overt hyperthyroidism and hypothyroidism.⁽⁸⁾

Hypothyroidism is a severe, widespread endocrine condition that affects people all over the world.⁽⁹⁾ It affects between 4% and 10% of the population, with subclinical hypothyroidism affecting as much as 10% of the population in some studies.⁽⁷⁾

The condition may be caused by a decline in thyroid hormone production or a defect in the thyroid hormone receptor activity machinery. It may be acquired or congenital, occurring at birth or developing progressively due to multiple congenital defects.⁽⁹⁾ According to several studies, the

incidence of spontaneous hypothyroidism ranges between 1% and 2%, and females—more commonly older women—are 10 times more likely than males to contract the disease. In Europe, the prevalence of overt hypothyroidism ranges from 4% to 5%, whereas the prevalence of subclinical hypothyroidism ranges from 4% to 15%.⁽¹⁰⁾

The thyroid hormones' primary target is the cardiovascular system, which is harmed even if hormone levels are only slightly altered. Hypothyroidism has been linked to a reduction in cardiac output due to impaired vascular smooth muscle relaxation and reduced availability of endothelial nitric oxide. Increased arterial stiffness causes a cascade effect, leading to increased systemic vascular resistance.⁽⁷⁾

In acute myocardial infarction a drop in serum triiodothyronine (T3) is induced, while serum thyroxine (T4) remains virtually constant or decreases. The reduced serum T3 has been related to greater myocardial injury, poorer cardiac function, higher thrombus burden, and worse prognosis. A recent study also found a link between free T4 and poor outcomes in patients with ACS.⁽⁶⁾ In another study, the FT3/FT4 ratio was an independent indicator of 1-year all-cause mortality in euthyroid patients with acute myocardial infarction who underwent PCI.⁽⁶⁾

Studies have shown other factors influencing prognosis. Worse outcomes after PCI have been seen in women compared with men and attributed to several factors, including advanced age and a higher prevalence of comorbidities. The different clinical picture of ACS in women is likely to lead to ischemia misdiagnosis or delayed identification, which may explain the poor clinical results. Women are also less likely than men to be referred for revascularization for coronary artery disease and to undergo the guideline-recommended therapies.⁽¹¹⁾

The one-year mortality after PCI according to a study conducted at Leiden University, where 43% of patients 4-days after non-ST elevation myocardial infarction had a PCI while in the hospital, was 10%.⁽²⁾ In a different study, complete ST-segment resolution occurred in 219 of 496 patients (44.2%) who received conventional PCI, while 201 in the same group (40.5%) had no persistent ST-segment deviation, and 79 (15.9%) had no pathologic Q waves on ECG. Furthermore, significant bleeding occurred in 18 of 531 patients (3.4%), death occurred in 21 (4.0%), reinfarction occurred in 10 (1.9%), target-vessel revascularization occurred in 31 (5.8%), and major adverse cardiac events occurred in 50 (9.4%) patients at 30 days.⁽¹⁾

According to our review of the literature, there are no studies that mention correlation between PCI and abnormal thyroid hormone levels.

This study aims to explore prognosis in patients with preexisting thyroid stimulating hormone (TSH) defects and ACS who undergo PCI surgery.

Methods:

A retrospective cohort study was conducted through the review of medical records of all coronary care unit patients who had TSH abnormalities and underwent PCI between 2017 and 2021 at King Abdulaziz University Hospital (KAUH) in Jeddah, Saudi Arabia. Adult patients who were received at KAUH with ACS and TSH levels above 4 mIU/L or below 0.4 mIU/L and underwent PCI were included in the study. Acute coronary syndrome patients with normal TSH levels were excluded. Statistical analysis was performed using IBM SPSS Statistics (Version 25). This study was approved by the institutional review board at King Abdulaziz University.

Results:

The goal of this study was to see how prognosis varied based on a variety of factors in patients with abnormal TSH levels who had PCI operations. This study included 152 adult coronary care unit patients operated on between 2017 and 2021 at KAUH. The majority of the patients (59.2%) were over the age of 60 years, while 36.2% were between the ages of 41 and 60, and only 4.6% were between the ages of 20 and 40. The ratio of women to men was almost equal: the sample contained 77 women (50.7%) and 75 men (49.3%), shown in Table 1.

Among the patients, 103 had TSH levels above 4 mIU/L (67.8%), and 49 had TSH levels below 0.4 mIU/L (32.2%).

Out of the 152 patients who underwent PCI operations, 94 (61.8%) had a successful procedure, while 58 (38.2%) developed complications including recurrence, requiring CABG, heart failure, and death. Look at table 2

Table 1. Patients Who Underwent Percutaneous Coronary Intervention Between 2017 and 2021 at KAUH

	Age (years)			Total
	20 - 40	41 - 60	Above 60	
Men	6	29	40	75
Women	1	26	50	77
Total	7	55	90	152

Table 2. Characteristics of patients who underwent PCI and had TSH abnormalities

	No. (%)
Gender	
<i>Male</i>	75 (49.3%)
<i>Female</i>	77 (50.7%)
Age (years)	
<i>Above 60</i>	90 (59.2%)
<i>41 – 60</i>	55 (36.2%)
<i>20 – 40</i>	7 (4.6%)
BMI (kg/m²)	
<i>Below 18.5</i>	3 (2%)
<i>18.5 – 24.9</i>	27 (17.8%)
<i>25 – 29.9</i>	66 (43.4%)
<i>30 – 34.9</i>	32 (21.1%)
<i>35 – 39.9</i>	16 (10.5%)
<i>40 and Above</i>	8 (5.3%)
Associated risk factors	
<i>Diabetes mellitus</i>	106 (69.7%)
<i>Hypertension</i>	94 (61.8%)
<i>Smoking</i>	24 (15.8%)
Myocardial infarction	115 (75.7%)
PCI procedure	
<i>Successful</i>	94 (61.8%)
<i>Complicated</i>	58 (38.2%)

<i>Recurrence</i>	44 (28.9%)
<i>Required CABG</i>	6 (3.9%)
<i>Heart failure</i>	6 (3.9%)
<i>Death</i>	2 (1.3%)

PCI: Percutaneous coronary intervention

Data Analysis:

There was no statistically significant difference in TSH levels between the male and female patients who underwent PCI (Table 3).

Table 3. TSH levels in patients undergoing PCI

	TSH (mIU/L)		Total
	Below 0.4	Above 4	
Men	27	48	75
Women	22	55	77
Total	49	103	152

We observed that the PCI procedures were complicated in 16 (32.6%) of the patients with TSH levels below 0.4 mIU/L and 42 (40.7%) of those with TSH levels above 4 mIU/L (Table 4).

We also noticed that the number of patients who developed recurrence among those with TSH levels above 4 mIU/L was 38 out of 103 (36.9%), while that number was 6 from 49(12.2%) among the patients who had TSH levels below 0.4 mIU/L (Table 4).

Table 4. PCI procedure outcome according to TSH abnormality

TSH (mIU/L)		PCI procedure outcome		Total
		Successful	Complicated	
)	Below 0.4	33	16	49
	Above 4	61	42	103
Total		94	58	152

Discussion:

Acute coronary syndrome is a critical illness that has a considerable impact on thyroid gland homeostasis, with serious consequences in terms of morbidity and death.⁽¹²⁾

Patients with normal TSH levels (> 0.4 mIU/L and < 4.00 mIU/L) were excluded from this study, and all patients who were admitted to the coronary care unit at KAUH who had a PCI procedure with abnormal TSH levels (< 0.4 mIU/L and > 4.00 mIU/L) were included.

After review of patient records, 152 patients were found to have abnormal TSH levels: 103(67.8%) had TSH levels above 4 mIU/L, and 49(32.2%) had TSH levels below 0.4 mIU/L.

We found that PCI procedures were complicated in 16 (32.6%) patients with TSH levels below 0.4 mIU/L and 42 (40.7%) patients with levels above 4 mIU/L (Table 4). Studies show that a slight change in thyroid status affects ventricular function and serum cholesterol levels and leads to increasing weight. ⁽¹²⁾ We observed that 91 of 103 (88%) hypothyroidism patients had BMIs higher than normal, an expected result of the effects of thyroid hormone on body weight.

In a study by Cerillo et al of 806 consecutive CABG patients, 19 (2.3%) died, and 64 (7.8%) experienced major complications during hospitalization. Median reverse T3 level was higher in the group that progressed to death, with a significant difference ($P = 0.0001$)⁽¹³⁾. The percentage of deaths in our sample was close to their result; 2 of 152 patients (1.3%). We assume that patients with cardiac illness and thyroid disorders have a low mortality rate.

In our sample, 44 (28.9%) patients developed ACS recurrence. In one study recurrence developed in 169 of 2201 (7.7%) randomized stable patients, and the 7-year reinfarction event rate, by the occluded artery trial definition, was 7.4% ⁽¹⁴⁾. The elevated levels of TSH had an effect on the recurrence rate among patients with ACS.

Our study shows that thyroid disorder, especially high TSH, is an important predictor of prognosis in critically ill patients in the CCU. In fact, high TSH did increase the predictability of complications in our sample.

Limitations of this study include the relatively small percentage of patients with thyroid function test abnormalities among the coronary care unit patients at KAUH during the period reviewed. Also, the definition we used for thyroid disease (TSH values < 0.4 mIU/L and > 4.00 mIU/L) reduced the prevalence of thyroid disorder in our sample.

Conclusion:

Thyroid stimulating hormone level has a strong correlation with prognosis in patients undergoing PCI and should be considered while the patient is admitted before the procedure. Controlling thyroid hormone levels minimizes postoperative complications. More studies are needed to help us improve patients' health.

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