

Relationship of Preoperative Thyroid Status with Outcomes of Patients Undergoing Cardiac Surgery Under Cardiopulmonary Bypass

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ABSTRACT

INTRODUCTION: Symptoms of hypothyroidism are often subtle and are easily overlooked specially in patients with a heart disease and symptoms are thought to be from the existing cardiac condition. There is a consensus that patients with known hypothyroidism should have thyroid screening before any major surgery including cardiac surgery and if indicated should be made euthyroid before surgery.

AIMS AND OBJECTIVES: To study the correlation of thyroid function test status with postoperative course and outcome (total duration of hospital, duration of ICU stay, hours of mechanical ventilation and in hospital mortality).

MATERIAL AND METHODS: This prospective study recruited 151 patients who underwent cardiac surgery under cardiopulmonary bypass, TSH was measured and compared with outcome in these patients.

RESULTS: Hours of mechanical ventilation (35.20 ± 20.1 Vs 110.61 ± 71.9 hours), ICU stay (3.3 ± 2.30 vs 5.9 ± 5.56 days) and hospital stay (16.7 ± 4.21 days vs 21.1 ± 6.95 days) was significantly less in euthyroid than patients whose TSH was raised before surgery, also postoperative in hospital mortality was more in patients with raised TSH preoperatively.

CONCLUSION: We concluded that patients with Subclinical hypothyroidism (SCHT) and Overt Hypothyroidism (OH) planned for cardiac surgery on cardiopulmonary bypass should be treated and those on levothyroxine replacement

should have fair control before undergoing surgery.

KEYWORDS: Subclinical Hypothyroidism [SCHT], Overt Hypothyroidism [OH], Cardiopulmonary Bypass, Atrial Fibrillation [AF].

I. INTRODUCTION

The incidence of hypothyroidism and subclinical hypothyroidism [SCHT] depends on many factors; the commonest are iodine deficiency and autoimmune thyroiditis. Although some may regard the treatment of SCHT unnecessary, others may look to this point cautiously with adjusted doses and strict follow-up because of fear of poor compliance of the patients or drug interactions and even sometimes overdose, which is common in clinical practice increasing the risk of atrial fibrillation [AF] and osteoporosis [1]. There is no debate on the treatment of overt hypothyroidism (OH) among physicians but the question is to treat or not to treat the subclinical cases. The subclinical states may be treated with a daily single dose of thyroxine which requires monitoring of the thyroid hormones in the blood over several months. The TSH range defining SCHT remains elusive, the upper limit of $10 \mu\text{IU/ml}$, which has been quoted in the literatures, is not met in most patients of SCHT, as most of them (75%) have values less than this (average of 7

$\mu\text{IU/ml}$) [2]. SHT has an incidence of 8–10% and may increase up to 20–30% after the age of 60 in female individuals. It may be also referred as borderline hypothyroidism, biochemical hypothyroidism or early-aged pituitary syndrome. Irrespective of the name, those patients may not be noticed clinically, as they complain of general nonspecific symptoms like lethargy, easy fatigue or constipation. The diagnosis is only confirmed on the basis of laboratory findings of high TSH and normal levels of T3 and T4 [3]. Symptoms of hypothyroidism are often subtle and are easily overlooked specially in patients with a heart disease and symptoms are thought to be from the existing cardiac condition. There is a consensus that patients with known hypothyroidism should have thyroid screening before any major surgery including cardiac surgery and if indicated should be made euthyroid before surgery [4,5,6].

II. AIMS AND OBJECTIVES

- 1) To study the status of thyroid function test in patients planned for cardiac surgery under cardiopulmonary bypass.
- 2) To study the correlation of thyroid function test status with postoperative course and outcome (total duration of hospital, duration of ICU stay, hours of mechanical ventilation and in hospital mortality)

III. MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Anaesthesiology and Critical Care, SKIMS, Soura J&K for a period of two years. Prior to proceeding with the study, institutional ethical committee clearance was sought for this observational study. A proper informed consent was taken from all the patients included in the study. This study included 151 patients, of any age, either sex, planned for cardiac surgery under cardiopulmonary bypass (like Valve replacement, valve repairs, CABG, myxoma excision, congenital Heart Diseases like ASD, VSD,

TOF). In these patients following data was collected and analyzed statistically:

- Preoperative TSH was measured, The patients were prospectively divided into two groups on the basis of TSH:-

1. Normal thyroid function test (Group 1)
2. Abnormal thyroid function test (Group 2).

Group 1 included those patients with TSH < 6.5 $\mu\text{IU/ml}$ and group 2 included those patients with TSH > 6.5 $\mu\text{IU/ml}$. Patients with TSH between 6.5 -10 $\mu\text{IU/ml}$ were taken as having Subclinical hypothyroidism [SHT] while those patients having a TSH value of above 10 $\mu\text{IU/ml}$ were taken as overt hypothyroidism [OH].

- Hours of mechanical ventilation, days of stay in ICU, days of hospital stay were noted.
- In hospital mortality was noted

INCLUSION CRITERIA:

Patients undergoing cardiac surgery using cardio pulmonary bypass for cardiovascular diseases.

EXCLUSION CRITERIA:

Patients who received drugs preoperatively known to affect serum thyroid hormone concentration like glucocorticoids, amiodarone, high dose of vasopressors/inotropes (dopamine or dobutamine $\geq 15\mu\text{g/kg/min}$; epinephrine or norepinephrine $\geq 1.0\mu\text{g/kg/min}$). patients of renal or hepatic failure (creatinine ≥ 3.5 mg/dL and bilirubin ≥ 6.0 mg/dL respectively). Patients already labelled as hypothyroid and receiving levothyroxine supplementation.

STATISTICAL ANALYSIS

The standard statistical tests like student t test, Chi-square test, have been used to analyse the statistical data.

All the results obtained, have been discussed on 5% level of significance i.e. p value < 0.05, considered significant.

IV. RESULTS

The mean length of ICU stay was 3.68 ± 3.29 days [Table 1]. Mean length of ICU stay in our patients with TSH $< 6.5 \mu\text{IU/ml}$ was shorter (3.3 ± 2.30 days) as compared to patients with TSH $> 6.5 \mu\text{IU/ml}$ (5.9 ± 5.56 days) and this relation was statistically significant (p value = 0.003) [Table 1].

The mean length of hospital stay was 15.50 ± 6.49 days [Table 1]. The mean length of hospital stay in our patients with TSH $< 6.5 \mu\text{IU/ml}$ was shorter (16.7 ± 4.21 days) as compared to patients with TSH > 6.5

$\mu\text{IU/ml}$ (21.1 ± 6.95 days) and this relation was statistically significant (p value 0.002) [Table 1].

The mean duration of mechanical ventilation in our study was 25.79 ± 51.30 hours [Table 2]. The mean duration of mechanical ventilation in our patients with TSH $< 6.5 \mu\text{IU/ml}$ was significantly shorter as compared to patients with TSH $> 6.5 \mu\text{IU/ml}$ (35.20 ± 20.1 Vs 110.61 ± 71.9 hours) and this relation was statistically significant (p value < 0.001) [Table 2].

Parameter	TSH $> 6.5 \mu\text{IU/ml}$ (Group 1)		TSH $< 6.5 \mu\text{IU/ml}$ (Group 2)		P-value
	Mean	SD	Mean	SD	
Mechanical Ventilation (Hours)	71.9	110.61	20.1	35.20	$< 0.001^*$
ICU Stay (Days)	5.9	5.56	3.3	2.30	0.003*
Hospital Stay (Days)	21.1	6.95	16.7	4.21	0.002*

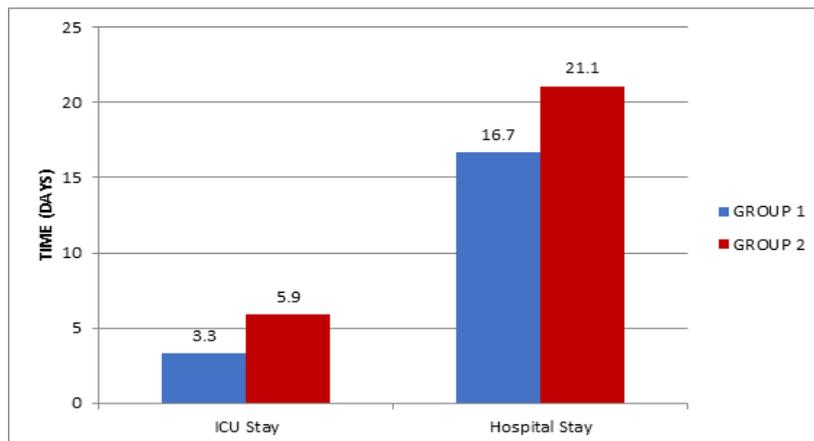


Fig 1a: Comparison of ICU stay and hospital stay between two groups.

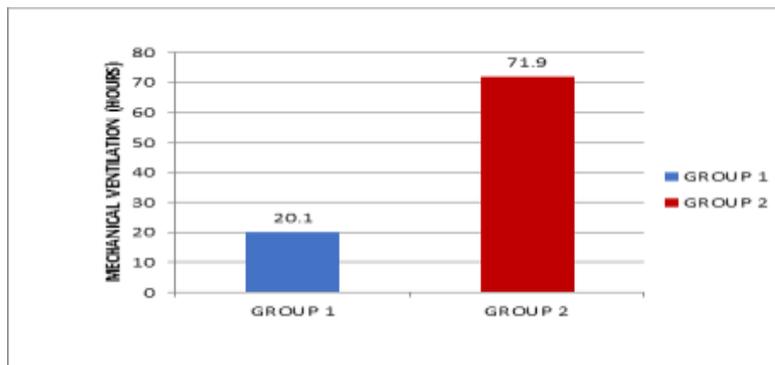


Fig 1b: Comparison of mechanical ventilation between two groups

Out of 151 patients, 17 died. Among the 17 that died, 1 had SCHT and 3 had Overt Hypothyroidism [OH]. However the percentage of mortality was more in patients with elevated TSH.

The mortality was 14.3% and 37.5% in SCH and OH respectively which was higher than rest of the patients (p value 0.051).

Table 2: In-Hospital Mortality in study subjects in Relation to TSH

		Dx			Total (n=151)
		Normal (n=136)	SCH (n=7)	OH (n=8)	
Outcome	Survived	123	6	5	134
		90.4%	85.7%	62.5%	88.7%
	Died	13	1	3	17
		9.6%	14.3%	37.5%	11.3%

P= 0.051

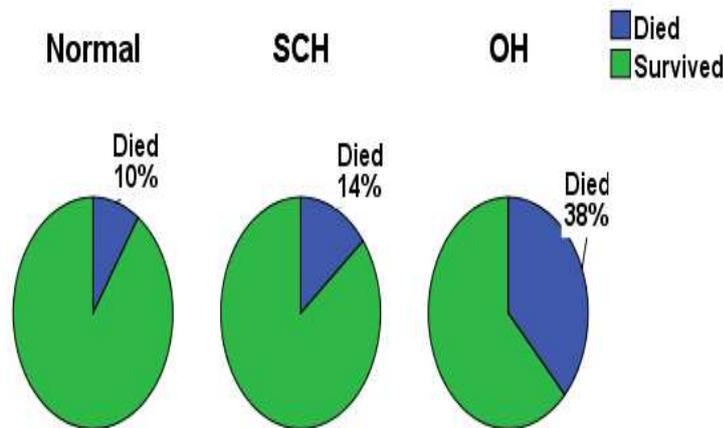


Fig 12: In-Hospital Mortality in study subjects in Relation to TSH

V. DISCUSSION

The incidence of perioperative morbidity associated with undiagnosed or untreated hypothyroidism is not well established. However, major complications have been reported in intraoperative recognition of hypothyroidism which includes depression of myocardial function, decreased hypoxia and hypercapnia ventilator responses, abnormal baroreceptor function, and reductions in plasma volume which led to increased in hospital morbidity and mortality [7].

ICU Stay and Hospital Stay

In our study the ICU stay and Hospital stay was significantly increased in patient with supranormal TSH. Our results are in accordance with study conducted by Jyrala *et al* [8]. In his study he found that the mean ICU stay in patients with SCHT patients was 5.1 ± 10.3 days as compared to euthyroid patients whose ICU stay was 3.2 ± 6.5 days (p value 0.09). These parameters are comparable to our study. However in his study these changes were not statistically significant.

Mahmoud *et al* [9] in his study also reported that patients who had SCHT and were

supplemented with preoperative dose of thyroxine had a shorter ICU stay as compared to patients who had SCHT and did not receive thyroxine (1.3 ± 0.5 days Vs 3.9 ± 1.3 days, $P < 0.006$). The total hospital stay was shorter in those patients who received preoperative dose of thyroxine as compared to those patients who had SCHT and did not receive preoperative dose of thyroxine it (4.9 ± 0.5 days Vs 9.1 ± 0.6 days; $P < 0.001$).

Our findings were consistent with study conducted by Bettendorf *et al* [10] found that patients with lower T3 had a significantly longer ICU stay as compared to normal patients ($p < 0.0001$). The total hospitalization period was also longer in patients with lower T3 as compared to normal patients ($p < 0.06$).

Hours of Mechanical Ventilation

The Patients with SCHT and OH in our patients had significantly more hours of mechanical ventilation than euthyroid patients. These results are similar to Mahmoud *et al* [9] who reported that patients who had SCHT and were supplemented with preoperative dose of thyroxine required shorter periods of

mechanical ventilation as compared to patients who had SCHAT and did not receive thyroxine (3.7 ± 0.5 hours Vs 19.1 ± 1.4 hours; $P < 0.06$).

Our results are also comparable to study conducted by Bettendorf *et al* [10] who found that patients with lower T3 required significantly longer periods of mechanical ventilation and oxygen supplementation than patients with normal T3 ($p < 0.0001$).

Babazadeh *et al* [11] also reported that hypothyroid patients required more hours of mechanical ventilation than euthyroid patients (47.7 ± 43.40 hours Vs 24.2 ± 41.22 hours; p value 0.019).

Inhospital Mortality in the Study

Subjects in Relation to TSH

In our study, there were a total of 151 patients among which 17 died. Among the 17 that died, 1 had SCHAT and 3 had OH. The results showed that the mortality was significantly more in patients with TSH > 6.5 μ IU/ml than in patients with TSH < 6.5 μ IU/ml. The mortality was 14.3% and 37.5% in SCHAT and OH respectively which was higher than rest of the patients with normal TSH in whom it was 9.6 %, although not statistically significant (p value 0.051).

Jyrala *et al* [8] reported that the occurrence of mortality was significantly (p value < 0.05) more in patients with SCHAT than in euthyroid patients undergoing cardiac surgeries. The mortality was 12.2 % in SCHAT patients than in euthyroid patients in whom it was only 4.1 %. Similar significant results were found in our study.

Our study is comparable with the another study conducted by Jyrala *et al* [12] who reported that 7.5% patients with hypothyroidism died as compared to 4.5% patients who were euthyroid who underwent cardiac patients under CPB and these results were statistically significant.

In study conducted by Park *et al* (13), 5% patients died in euthyroid group and 5.6% in SCHAT group.

VI. CONCLUSION

We concluded that patients with SCHAT and OH planned for cardiac surgery on cardiopulmonary bypass should be treated and those on levothyroxine replacement should have fair control before undergoing surgery. New guidelines for preoperative thyroid screening are needed for patients planned for cardiac surgery on cardiopulmonary bypass.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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