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Research Article

ASSESSMENT OF THYROID FUNCTION IN PATIENTS ADMITTED IN ICU IN A TERTIARY CARE HOSPITAL IN WEST BENGAL

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ABSTRACT

Introduction: Thyroid function abnormalities are common in ICU patients, often presenting as non-thyroidal illness syndrome (NTIS) without primary thyroid disease. These changes are difficult to interpret but may reflect illness severity.

Aims and Objectives: To assess thyroid function status in patients admitted to the ICU of a tertiary care hospital in West Bengal and to describe the pattern of thyroid hormone alterations in critically ill patients.

Materials and Methods: This was a prospective, single-centre, hospital-based study conducted in the ICU of Midnapore Medical College & Hospital from 1st April 2021 to 31st March 2022. The study included 240 patients admitted to the ICU during the study period, and relevant clinical and laboratory parameters were recorded and analysed.

Results: The study population had a mean age of 44.15 ± 11.24 years, with most patients in the 41–50 years group (35.4%), and a male predominance (58.3%). Sepsis was the most common diagnosis (33.8%) and low FT3 was the most frequent thyroid abnormality (47.9%). Mortality was 29.6%, with non-survivors showing significantly higher APACHE scores, lower GCS, and markedly reduced FT3 levels, while other variables were not significantly associated with outcome.

Conclusion: Thyroid function abnormalities are common in ICU patients, with NTIS being the predominant pattern. These changes are more related to severity of illness rather than primary thyroid disease, highlighting the need for cautious interpretation of thyroid function tests in critically ill patients.

KEYWORDS: ICU, Thyroid Function Tests, Non-thyroidal Illness Syndrome, Critical Illness, Tertiary Care Hospital.

Introduction

Intensive Care Unit–acquired weakness (ICUAW) is a frequent complication of critical illness characterized by diffuse, symmetrical muscle weakness developing during ICU stay. It affects more than 50% of critically ill patients and is associated with important adverse outcomes such as difficulty in weaning from mechanical ventilation, prolonged ICU and hospital stay, and increased mortality risk[1]. ICUAW encompasses a spectrum of neuromuscular disorders including critical illness myopathy (CIM), critical illness polyneuropathy (CIP), and critical illness neuromyopathy[2]. The development of ICUAW is multifactorial. Early identification of risk factors is essential for prevention and management. Established risk factors include sepsis, prolonged ICU stay, prolonged mechanical ventilation, hyperglycemia, immobility, and high-dose corticosteroid therapy[3]. These factors contribute to muscle protein breakdown, impaired neuromuscular transmission, and metabolic derangements, ultimately worsening

functional outcomes in critically ill patients. Thyroid dysfunction has also been implicated in neuromuscular impairment in critically ill patients. Thyroid hormones are essential for normal muscle metabolism, energy regulation, and neuromuscular function. Altered thyroid status may therefore reduce the threshold for development of myopathy and contribute to ICUAW[4].

In sepsis and critical illness, profound metabolic changes occur involving all organ systems, leading to hypermetabolism, increased energy expenditure, hyperglycemia, and progressive skeletal muscle catabolism[5]. A common endocrine alteration in critically ill patients without pre-existing thyroid disease is non-thyroidal illness syndrome (NTIS), also known as euthyroid sick syndrome (ESS)[6]. NTIS is defined as abnormal thyroid hormone levels in the absence of intrinsic thyroid or hypothalamic-pituitary dysfunction, occurring in the setting of acute or chronic systemic illness. This condition is generally reversible following recovery from the underlying illness[7]. ESS is typically characterized by decreased triiodothyronine (T3) levels with normal or low thyroxine (T4) and normal thyroid-stimulating hormone (TSH) levels[8]. Based on severity, ESS may present as low T3 syndrome in moderately ill patients, low T4 syndrome in severely ill patients with poor prognosis, and low TSH patterns. These are considered part of a continuum reflecting increasing severity of illness rather than distinct disease entities[9].

The most consistent thyroid abnormality in critical illness is reduced serum T3. Under normal physiology, most T3 is produced by peripheral conversion of T4 via 5'-deiodinase, while a smaller fraction is directly secreted by the thyroid gland. In critical illness, decreased activity of 5'-deiodinase leads to reduced conversion of T4 to T3 and impaired clearance of reverse T3 (rT3), resulting in low T3 and elevated rT3 levels. Several mechanisms contribute to inhibition of 5'-monodeiodination in NTIS. These include exogenous glucocorticoid therapy, circulating inhibitors such as free fatty acids, medications like amiodarone and high-dose propranolol, and inflammatory cytokines including tumor necrosis factor-alpha, interleukin-6, and interferon-alpha, along with activation of nuclear factor kappa B (NF-κB). Thyroxine (T4) levels may also decrease in more severe or prolonged illness, while free T4 levels remain variable depending on assay methods and disease severity. In advanced cases, a combined low T3 and low T4 state is associated with worse prognosis. TSH levels in NTIS may also fluctuate, showing transient suppression or elevation, reduced response to TRH, loss of circadian rhythm, and altered glycosylation affecting biological activity. These changes further complicate interpretation of thyroid function tests in critically ill patients[10].

Given these dynamic and complex hormonal changes, thyroid function abnormalities observed in ICU patients may reflect physiological adaptation or illness severity rather than primary thyroid disease. Therefore, serial assessment of thyroid profile during ICU stay may provide better insight into disease progression and outcomes. In this study, thyroid function tests are measured on day 1 and day 7 of ICU admission, and changes in thyroid hormone levels are correlated with disease severity and clinical outcomes to evaluate their prognostic significance in critically ill patients. To assess thyroid function status in patients admitted to the ICU of a tertiary care hospital in West Bengal and to describe the pattern of thyroid hormone alterations in critically ill patients.

Materials and Methods

This prospective, single-centre, hospital-based study was conducted in the Intensive Care Unit (ICU) of Midnapore Medical College & Hospital, West Bengal, from 1st April 2021 to 31st March 2022 to assess thyroid function among critically ill patients. A total of 240 patients admitted to the ICU with systemic diseases were included in the study. Adult patients aged more than 18 years who fulfilled the inclusion criteria were enrolled consecutively after obtaining appropriate consent. Patients with known thyroid disorders such as hypothyroidism, hyperthyroidism, or thyroid swelling, pregnant women, patients taking drugs known to alter thyroid function such as Rifampicin, Ketoconazole, and Amiodarone, and those with a history of iodine contrast exposure within 8 weeks prior to blood collection were excluded from the study. Relevant demographic and clinical data were recorded, and blood samples were collected from all eligible participants for assessment of thyroid function parameters using standard laboratory methods.

Statistical Analysis

All recorded data was analyzed with suitable diagrams, figures, tables, and findings were discussed in details to draw appropriate conclusion using standard statistical analysis. Data was summarized by routine descriptive statistics, namely mean and standard deviation for numerical variables that are normally distributed, median and interquartile range for skewed numerical variables and counts and percentages for categorical variables.Baseline characteristics between the two groups were compared using unpaired Student's t-test for continuous variables and Fisher's exact test for categorical variables. A p value<0.05 was considered as statistically significant. Analysis was performed using software SPSS version 23.0.

Results

The majority of patients in the study population belonged to the 41–50 years age group, accounting for 35.4% of the total participants, followed by the 31–40 years age group comprising 25.8% of patients. Patients aged 51–60 years constituted 20%, while those aged 18–30 years and more than 60 years represented 11.3% and 7.5% respectively. The mean age of the study population was 44.15 ± 11.24 years, indicating that most ICU admissions occurred among middle-aged individuals (Table 1, Figure 1).

Table 1: Age Distribution of Study Population

Age Group (years)	Frequency (n)	Percentage (%)
18–30 years	27	11.3
31–40 years	62	25.8
41–50 years	85	35.4
51–60 years	48	20
>60 years	18	7.5
Mean age ± SD	44.15 ± 11.24 years	

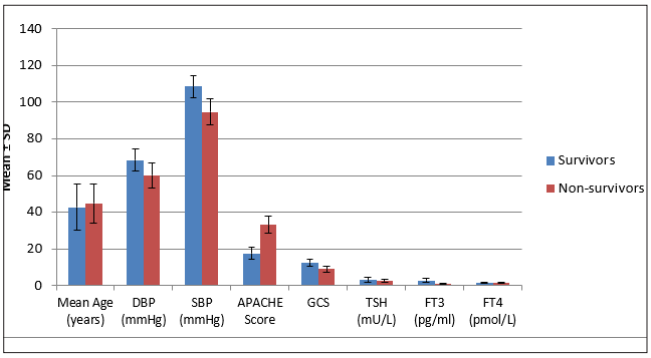

Figure 1.Age-wise Distribution of Patients

Male patients constituted 58.3% of the study population, whereas females accounted for 41.7%. Sepsis was the most common underlying illness observed in 33.8% of patients, followed by respiratory failure in 25.8%, congestive cardiac failure in 20%, acute renal failure in 12.1%, and diabetic ketoacidosis in 8.3% of patients. Among thyroid function abnormalities, low FT3 levels were the most common finding and were present in 47.9% of patients. Low FT4 levels were observed in 12.1%, while low TSH and high TSH levels were found in 2.9% and 2.1% of patients respectively. No thyroid function abnormality was detected in 35% of patients (Table 2).

The mean age was significantly higher among non-survivors compared to survivors (44.74 ± 10.60 years vs 42.77 ± 12.64 years; $p = 0.01$). Non-survivors had markedly higher APACHE scores than survivors (32.97 ± 4.66 vs 17.59 ± 3.16; $p < 0.0001$), indicating greater severity of illness. Glasgow Coma Scale (GCS) scores were significantly lower among non-survivors (8.97 ± 1.62 vs 12.45 ± 1.93; $p = 0.05$). Serum FT3 levels were also significantly lower in non-survivors compared to survivors (1.19 ± 0.13 pg/ml vs 2.83 ± 1.07 pg/ml; $p < 0.0001$). However, differences in diastolic blood pressure, systolic blood pressure, TSH, and FT4 levels between the two groups were not statistically significant (Table 3).

Table 2: Distribution of Gender, Illness, and Thyroid Function Test Abnormalities in Study Population

		Frequency (n)	Percentage (%)
Gender	Male	140	58.3
	Female	100	41.7
Illness	Sepsis	81	33.8
	Respiratory Failure	62	25.8
	Congestive Cardiac Failure	48	20
	Acute Renal Failure	29	12.1
	Diabetic Ketoacidosis	20	8.3
Thyroid Function Test Abnormality	Low FT3 (ng/dl)	115	47.9
	Low FT4 (ng/dl)	29	12.1
	Low TSH (mIU/L)	7	2.9
	High TSH (mIU/L)	5	2.1
	No Abnormality	84	35

Table 3: Comparison of Clinical and Laboratory Parameters between Survivors and Non-survivors

	Survivors (n = 168) Mean ± SD	Non-survivors (n = 72) Mean ± SD	p-value
Mean Age (years)	42.77 ± 12.64	44.74 ± 10.60	0.01
DBP (mmHg)	68.45 ± 6.20	60.16 ± 6.88	0.833
SBP (mmHg)	108.45 ± 6.20	94.75 ± 7.25	0.205
APACHE Score	17.59 ± 3.16	32.97 ± 4.66	<0.0001
GCS	12.45 ± 1.93	8.97 ± 1.62	0.05
TSH (mU/L)	2.96 ± 1.28	2.54 ± 0.73	0.205
FT3 (pg/ml)	2.83 ± 1.07	1.19 ± 0.13	<0.0001
FT4 (pmol/L)	1.30 ± 0.34	1.21 ± 0.28	0.347

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Among survivors, males constituted 65.1% whereas females accounted for 34.9%. In contrast, among non-survivors, females constituted 64.8% while males represented 35.2%. The association between gender and mortality outcome was found to be statistically significant (p = 0.001) (Table 4).

Table 4: Association between Gender and Mortality Outcome

Gender	Survivors (n = 168)	Non-survivors (n = 72)	p-value
Male	110 (65.1%)	25 (35.2%)	0.001
Female	59 (34.9%)	46 (64.8%)	

Out of 240 patients admitted to the ICU, 169 patients (70.4%) survived while 71 patients (29.6%) did not survive, indicating a mortality rate of 29.6% among critically ill patients included in the study (Table 5, Figure 2).

Table 5: Outcome of Study Population (Survivors vs Non-survivors)

Outcome	Frequency (n)	Percentage (%)
Survivors	169	70.4
Non-survivors	71	29.6

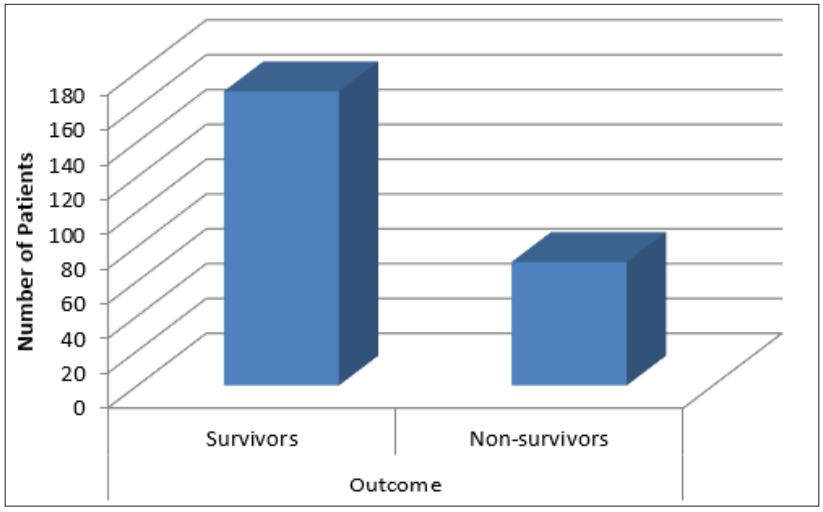

Figure 2. Outcome of Study Population (Survivors vs Non-survivors)

Discussion

In the present study, the mean age of the patients was 44.15 ± 11.24 years, with the majority belonging to the 41–50 years age group (35.4%). This reflects a predominance of middle-aged individuals requiring intensive care support. Similar age distributions have been reported in previous ICU-based studies, where critically ill patients are commonly concentrated in the fourth and fifth decades of life due to the combined burden of infectious diseases, metabolic disorders, and cardiovascular instability[11-13]. This age-related vulnerability may be attributed to reduced physiological reserve and increased prevalence of comorbid conditions in this age group. In the current study, males constituted 58.3% of the population, while females accounted for 41.7%. A similar male predominance has been documented in several ICU cohorts, which may be explained by higher exposure to risk factors such as smoking, alcohol consumption, occupational hazards, and delayed healthcare-seeking behavior among males[14].

Sepsis was the most common diagnosis (33.8%), followed by respiratory failure (25.8%), which is consistent with global ICU admission trends where sepsis remains a leading cause of critical illness and mortality[15]. Thyroid function abnormalities were highly prevalent in this study, with low FT3 being the most frequent abnormality (47.9%). This pattern strongly suggests the presence of non-thyroidal illness syndrome (NTIS), also known as euthyroid sick syndrome, which is commonly observed in critically ill patients. NTIS is characterized by decreased peripheral conversion of T4 to T3 and is strongly associated with disease severity[16]. In our study, 35% of patients had no thyroid abnormality, indicating that thyroid dysfunction is not universal but strongly associated with severity of illness. The comparison between survivors and non-survivors revealed that APACHE II score was significantly higher in non-survivors (32.97 ± 4.66 vs 17.59 ± 3.16, $p < 0.0001$), indicating that disease severity is a strong predictor of mortality. This finding is consistent with established literature where APACHE scoring systems are widely validated for mortality prediction in ICU patients[17].

Similarly, GCS was significantly lower in non-survivors

(8.97 ± 1.62 vs 12.45 ± 1.93, p = 0.05), reinforcing the importance of neurological status as an independent prognostic marker in critically ill patients[18]. Among thyroid parameters, FT3 showed a significant reduction in non-survivors (1.19 ± 0.13 vs 2.83 ± 1.07, p < 0.0001), while TSH and FT4 did not show significant differences. This supports previous studies demonstrating that low FT3 is the most sensitive indicator of NTIS and is strongly associated with increased mortality in ICU patients[19]. The lack of significant association of TSH and FT4 further highlights that FT3 is the most clinically relevant thyroid parameter in critical illness prognostication. In this study, gender was significantly associated with mortality (p = 0.001), with females showing a higher proportion of non-survivors. While some studies have reported higher ICU mortality among males due to higher disease burden, other studies have shown variable results depending on underlying comorbidities and disease patterns. This inconsistency suggests that gender may interact with other clinical factors rather than acting as an independent predictor. Overall mortality in the present study was 29.6%, which is comparable to reported ICU mortality rates ranging between 20% and 40% in similar tertiary care settings[20].

The observed mortality reflects the severity of illness in the study population, particularly in patients with high APACHE scores and low GCS. Importantly, the strong association of FT3 with mortality suggests that thyroid function, particularly FT3 levels, may serve as an adjunct prognostic biomarker in critically ill patients alongside established scoring systems.

Conclusion

The present study demonstrates that middle-aged patients constitute the majority of ICU admissions, with sepsis being the most common underlying illness. Mortality was significantly associated with higher APACHE II scores and lower GCS, indicating that disease severity and neurological status are strong predictors of outcome. Among thyroid parameters, only FT3 showed a significant association with mortality, suggesting that low FT3 may serve as a useful prognostic biomarker in critically ill patients, reflecting the presence of non-thyroidal illness syndrome. Other thyroid parameters, including TSH and FT4, did not show significant correlation with outcome. Overall, the study highlights that integration of clinical severity scores with FT3 levels may improve risk stratification and prognostication in ICU patients.

Conflict of Interest

None

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