Original Article

ISSN (O): 2663-8290; ISSN (P): 2663-8282

Thyroid Function Abnormalities in Critically Ill Patients

Kajal[1], Vishvanayak[2], Vinod Kumar Singh[3], Hare Krishna[4], Anubhav Lalit[1], Satyam Leekha[1]

[1]Postgraduate Student, Department of General Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India, [2]Professor, Department of General Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India, [3]Professor & Head, Department of General Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India, [4]Associate Professor, Department of Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India.

Abstract

Background: To study the alterations in thyroid hormone levels in critically ill patients. **Subjects and Methods:** Fasting venous blood samples were collected on admission to ICU from all critically ill patients and were subjected for thyroid hormone analysis by VIDAS-ELISA. They were also be evaluated for body temperature, blood pressure, pulse rate, respiratory rate, and impairment of consciousness on the Glasgow coma scale. Arterial blood gas analysis, complete blood count, liver function test, renal function test was interpreted, and the APACHE II score was calculated. Course and the outcome of these patients were followed in the hospital. **Result:** Maximum patient belong to 41-50 years age group (n=34, 34%) Maximum patients were male (n=69, 69%) and rest were females (n=31, 31%). 42 (42%) patients required Ventilator assistance. The mean APACHE-II score was significantly higher among non-survivors compared with survivors (25.52 ± 6.84 vs. 14.06 ± 5.71, P < 0.01). The mean value of TSH was 3.27±6.91. The mean value of FT3 was 3.42±0.36. The mean value of FT4 was 14.79±1.17. A total of 22 patients (22%) succumbed to their illness during ICU admission. The mean level of both FT3 and FT4 were lower in non-survivors (2.98, 13.39) as compared to survivors (3.82,15.71). The mean level of TSH was lower in non-survivors (2.63) as compared to survivors (4.07). **Conclusion:** FT3 and FT4 was lesser in non-survivors as compared to survivors with significant difference. Although TSH level was lower in non-survivors as compared to survivors, but there was not statistically significant difference.FT3 and FT4 were the best independent predictors of ICU mortality.

Keywords: Thyroid, Anti-thyroid drugs, Critically ill patients

Corresponding Author: Kajal, Postgraduate Student, Department of General Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India.
E-mail: kajalmed2011@gmail.com

Received: 29 September 2021 **Revised: 28 November 2021** **Accepted: 06 December 2021** **Published: 31 December 2021**

Introduction

Despite significant improvements in the care of critically ill patients over the past decades,[1,2] proper management of endocrinologic problems in the ICU continues to challenge clinicians. Whether it is the use of glucocorticoids,[3] defining appropriate blood glucose levels,[4] or accurately distinguishing between subclinical preexistent thyroid dysfunction or acute illness-induced dysfunction,[5]certain conditions such as sepsis, starvation, bone marrow transplantation, and myocardial infarction affect thyroid function and the degree of thyroid dysfunction seems to correlate with disease severity in critically ill patients.[6–8] During Sepsis and other critical illnesses, there is state of stress which results in hypermetabolism, increased energy expenditure, hyperglycemia and muscle loss.[9,10] Critical illness is often associated with alterations in thyroid hormone concentrations in patients with no previous intrinsic thyroid disease.[11–13] Alterations in the thyroid hormones' peripheral metabolism, in TSH regulation, in the binding of thyroid hormone to transport protein and in receptor binding and intracellular uptake appear to be the cause of changes in blood thyroid hormone levels. The severity of illness correlates with the reduction in total serum T3 levels. The primary cause of these hormonal changes is the release of cytokines such as IL-6. The most common hormone pattern in sick euthyroid syndrome (SES) is a decrease in total and unbound T3 levels (low T3 syndrome) with normal levels of T4 and TSH. APACHE II score was used to assess the severity of illness of these patients and prognosticate the outcome.

Due to variation in studies and availability of scanty data in this part of our country and demographic profile of patients too is different in patients of this region, this hospital based observational study was being conducted to evaluate the thyroid hormone levels in critically ill patients admitted to ICU.

AIM

- To study the alterations in thyroid hormone levels in critically ill patients.

OBJECTIVE

- Thyroid profile (FT3, FT4 &TSH) will be carried out in critically ill patients admitted to the ICU of TMMC&RC
- The results of thyroid profile will be used to ascertain the prognosis of these patients as assessed by APACHE II score.

Subjects and Methods

Inclusion criteria

- All adult patients of both sexes admitted to medical Intensive Care Unit (MICU).

Exclusion criteria

- Known case of thyroid diseases such as hyperthyroidism, hypothyroidism and thyroid tumors
- Thyroid swelling found by physical examination when admitted to the ICU
- Pregnancy
- Patients receiving massive blood transfusion or on drugs known to interfere with thyroid hormone metabolism.

Results

Table 1: Age distribution among the study subjects

Age Group (in years)	N	%
<30	23	23
31-40	28	28
41-50	34	34
>50	15	15
Total	100	100

This prospective hospital-based study was carried out at Department of Internal Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, U.P., India, over a period of twelve months, after the approval of The Research Committee and The Ethical committee. This study was carried out including 100 cases of critically ill patients admitted and treated in the intensive care unit (ICU), after considering the inclusion and exclusion criteria. The written informed consent for clinical examination & lab investigations was obtained either from patient or attendant. In the present trail maximum patient belong to 41-50 years age group (n=34, 34%), followed by 31-40 years age group (n=28, 28%), <30 years age group (n=23,23%) and least no. of patients were in >50 years age group (n=15, 15%). [Table 1]

Table 2: Gender distribution among the study subjects

Gender	N	%
Male	69	69
Female	31	31
Total	100	100

In the present trail out of 100 patients admitted to medical ICU who were found eligible for enrollment in our study, maximum patients were male (n=69, 69%) and rest were females (n=31, 31%). [Table 2, Figure 1]

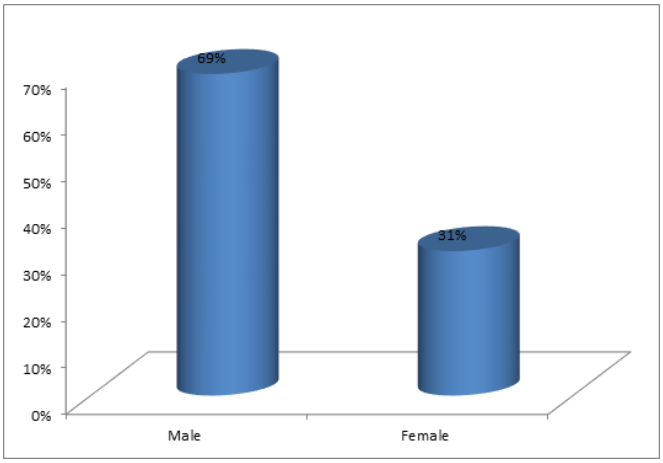

Figure 1: Gender distribution among the study subjects

Table 3: Co-morbidities among the study subjects

Co-morbidities	N	%
Diabetes	46	46
Hypertension	39	39
Diabetes+Hypertension	15	15

In the present study, when history regarding comorbidities was recorded, 46 (46%) patients gave history of Diabetes, 39 (39%) patients gave history of Hypertension. Whereas 15 (15%) patients gave history of both Diabetes and Hypertension [Table 3, Figure 2].

Out of 100 patients included in study, 42 (42%) patients required Ventilator assistance, whereas 58 (58%) patients didn't require Ventilator. [Figure 3]

In the present study, the mean APACHE-II scores was18.37 ± 9.04. [Table 4]

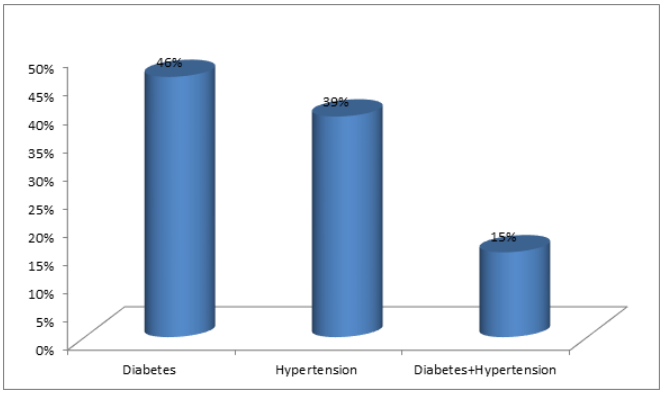

Figure 2: Co-morbidities among the study subjects

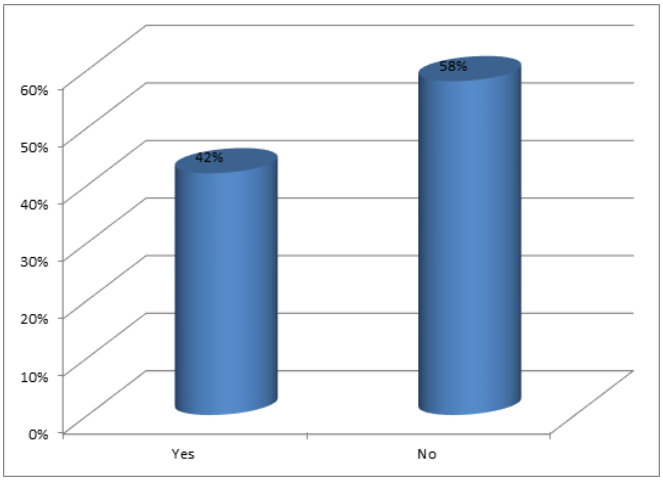

Figure 3: Ventilator requirement among the study subjects

Table 4: Mean APACHE-II score among the study subjects

APACHE-II Score	N
Mean	18.37
SD	9.04

Table 5: Thyroid profile among the study subjects

Thyroid Profile	Mean	SD
TSH	3.27	6.91
FT3	3.42	0.36
FT4	14.79	1.17

In present study, thyroid function test was performed. The mean value of TSH was 3.27±6.91. The mean value of FT3 was 3.42±0.36. The mean value of FT4 was 14.79±1.17. [Table 5, Figure 3]

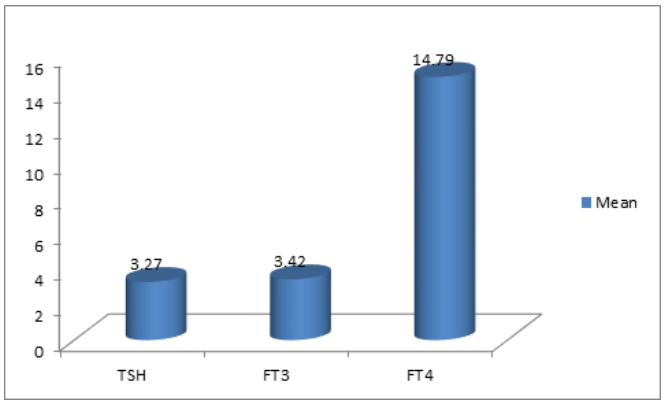

Figure 4: Thyroid profile among the study subjects

Table 6: Outcome among the study subjects

Outcome	N	%
Survivor	78	78
Non-survivor	22	22
Total	100	100

Of the total 100 patients involved in study, a total of 22 patients (22%) succumbed to their illness during ICU admission. 78 patients were survivors. [Table 6, Figure 5]

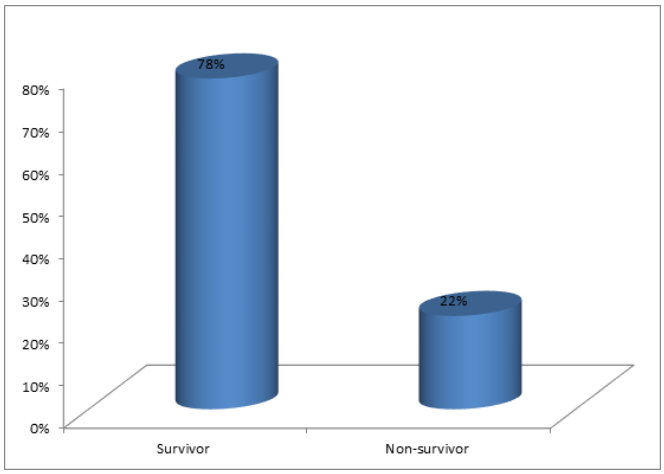

Figure 5: Outcome among the study subjects

In present study, of the total 78 survivors, 25 patients (32.05%) required Ventilator assistance and 53 patients

Table 7: Outcome among the study subjects according to Ventilator requirement

Ventilator	Survivor		Non-survivor		p value
	N=78	%	N=22	%	
Yes	25	32.05	17	77.27	0.007*
No	53	67.95	5	22.73	

*: statistically significant

(67.95%) didn't required Ventilator. And among the non survivors, 17 (77.27%) required Ventilator assistance and 5 patients (22.73%) didn't required Ventilator. The p value was statistically significant. [Table 7, Figure 6]

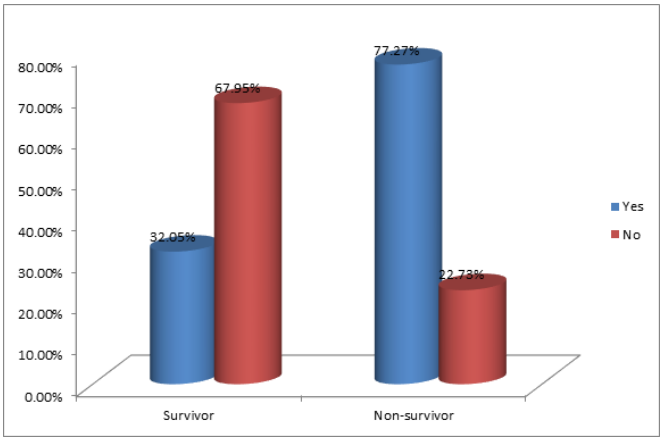

Figure 6: Outcome among the study subjects according to Ventilator requirement

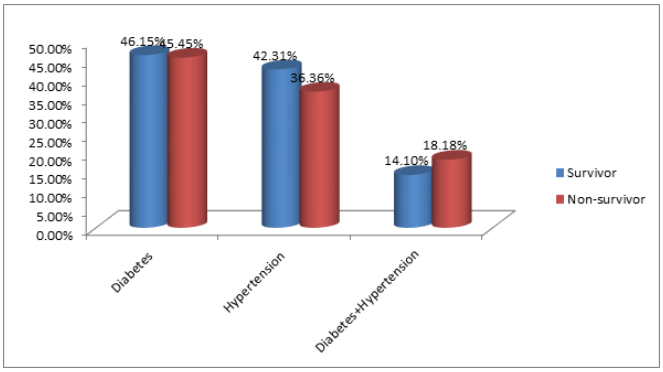

Figure 7: Outcome among the study subjects according to Co-morbidities

When the Co-morbidities were considered in survivors, Diabetes was present in 36 (46.15%) patients, Hypertension was present in 33 (42.31%) patients. Whereas Diabetes and Hypertension both was present in 11 patients (14.10%). In non-survivors, Diabetes was present in 10 (45.45%) patients, Hypertension was present in 8 (36.36%) patients. Whereas Diabetes and Hypertension both was present in 4 patients (18.18%). The p value was not significant. [Figure 7]

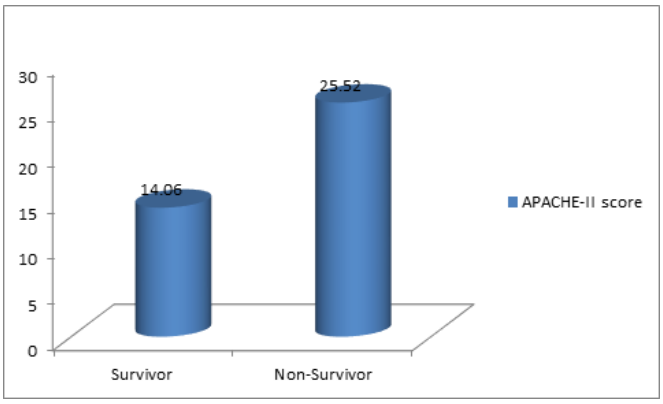

Figure 8: Outcome among the study subjects according to APACHE-II score

The mean APACHE-II score was significantly higher among non-survivors compared with survivors (25.52 ± 6.84 vs. 14.06 ± 5.71, P < 0.01). [Figure 8]

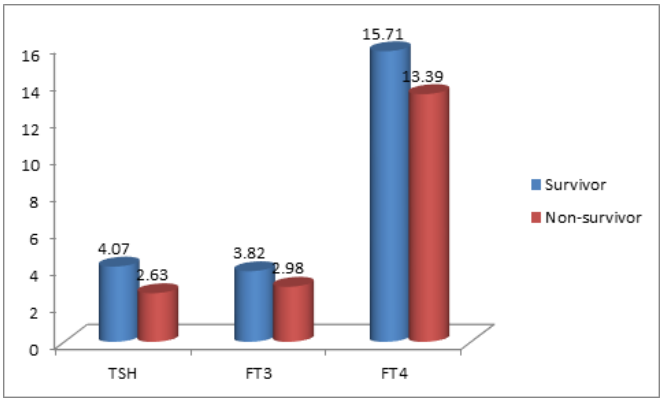

Figure 9: Outcome among the study subjects according to thyroid profile

The mean level of both FT3 and FT4 were lower in non-survivors (2.98, 13.39) as compared to survivors (3.82,15.71),

the p value was statistically significant (P < 0.01). The mean level of TSH was lower in non-survivors (2.63) as compared to survivors (4.07), but p value was not statistically significant. [Figure 9]

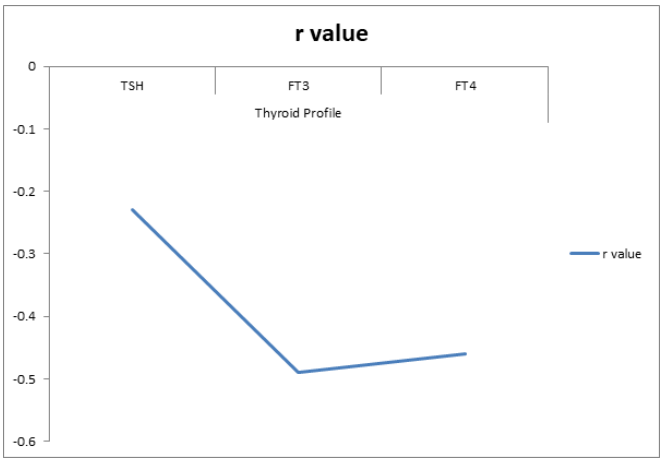

Figure 10: Correlation between thyroid profile and APACHE-II score

In our study, APACHE II score which is calculated within 24 hours of ICU admission is compared with thyroid function tests which is taken on day 1. The results obtained with this comparison is that on day 1 levels of FT3 and FT4 were significantly correlated with APACHE II scores whereas TSH level was not statistically significant. [Figure 10]

Discussion

This prospective hospital -based study was carried out at Department of Internal Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, U.P., India, over a period of twelve months, after the approval of The Research Committee and The Ethical committee. This study was carried out including 100 cases of critically ill patients admitted and treated in the intensive care unit (ICU), after considering the inclusion and exclusion criteria. In the present trail maximum patient belong to 41-50 years age group (n=34, 34%), followed by 31-40 years age group (n=28, 28%), <30 years age group (n=23,23%) and least no. of patients were in >50 years age group (n=15, 15%). According to findings of Suresh, et al., [2017],[14] majority (49%) of study population belonged to the geriatric age group with average age of 59 years. The majority (55%) of the study population were males. In the present trail out of 100 patients admitted to medical ICU who were found eligible for enrollment in our study, maximum patients were male (n=69, 69%) and rest were females (n=31, 31%). 46 (46%) patients gave history of Diabetes, 39 (39%) patients gave history of Hypertension, whereas 15 (15%) patients gave history of both Diabetes and Hypertension. According to findings of Suresh, et al.,[14] (2017) the most common chronic disease was hypertension (30%) followed by diabetes mellitus (23%). Out of 100 patients included in study, 42 (42%) patients required Ventilator assistance, whereas 58 (58%) patients didn't required Ventilator. In the present study, the mean APACHE II scores was18.37 ± 9.04. Results were in accordance with findings of Gutch, et al., (2018),[15] according to which mean APACHE II scores was significantly higher among non- survivors compared with survivors (25.00 ± 9.75 vs. 14.83 ± 5.95, P < 0.001). The mean value of TSH was 3.27±6.91. The mean value of FT3 was 3.42±0.36. The mean value of FT4 was 14.79±1.17. A result was in accordance with findings of Gutch, et al., (2018),[14] according to which the levels of both fT3 and fT4 were lower in non-survivors as compared to survivors (P < 0.001). Of the total 100 patients involved in study, a total of 22 patients (22%) succumbed to their illness during ICU admission. 78 patients were survivors. In present study, of the total 78 survivors, 25 patients (32.05%) required Ventilator assistance and 53 patients (67.95%) didn't required Ventilator and among the non survivors, 17 (77.27%) required Ventilator assistance and 5 patients (22.73%) didn't required Ventilator. In non-survivors, Diabetes was present in 10 (45.45%) patients, Hypertension was present in 8 (36.36%) patients whereas, Diabetes and Hypertension both was present in 4 patients (18.18%). The mean APACHE II score was significantly higher among non-survivors compared with survivors (25.52 ± 6.84 vs. 14.06 ± 5.71, P < 0.01). The mean level of both FT3 and FT4 were lower in non-survivors (2.98, 13.39) as compared to survivors (3.82,15.71), the p value was statistically significant (P < 0.01). The mean level of TSH was lower in non-survivors (2.63) as compared to survivors (4.07), but p value was not statistically significant. In our study, APACHE II score which is calculated within 24 hours of ICU admission is compared with thyroid function tests which is taken on day1. The results obtained with this comparison is that on day 1 levels of FT3 and FT4 were significantly correlated with APACHE II scores whereas TSH level was not statistically significant.

Conclusion

In our study, FT3 and FT4 was lesser in non-survivors as compared to survivors with significant difference. Although TSH level was lower in non-survivors as compared to survivors, but there was not statistically significant difference.

Hence, we found that FT3 and FT4 were the best independent predictors of ICU mortality.

In addition, combining FT3, FT4 levels, and APACHE II scores increased the likelihood of predicting mortality in ICU patients.

The concept of relative thyroid insufficiency in critically ill patients warrants further research with larger sample size.

References

1. Teboul JL, Saugel B, Cecconi M, Backer D, Hofer D, Monnet CK. Less invasive hemodynamic monitoring in critically ill patients. Intensive Care Med. 2016;42(9):1350–1359. Available from: https://doi.org/10.1007/s00134-016-4375-7.
2. Heung M, Yessayan L. Renal Replacement Therapy in Acute Kidney Injury: Controversies and Consensus. Crit Care Clin. 2017;33(2):365–78. Available from: https://doi.org/10.1016/j.ccc.2016.12.003.
3. Mesotten D, Vanhorebeek I, Van den Berghe G. The altered adrenal axis and treatment with glucocorticoids during critical illness. Nat Clin Pract Endocrinol Metab. 2008;4(9):496–505. Available from: https://doi.org/10.1038/ncpendmet0921.
4. Yamada T, Shojima N, Noma H, Yamauchi T, Kadowaki T. Glycemic control, mortality, and hypoglycemia in critically ill patients: a systematic review and network meta-analysis of randomized controlled trials. Intensive Care Med. 2017;43(1):1–15. Available from: https://doi.org/10.1007/s00134-016-4523-0.
5. Morell-Garcia D, Bauca JM, Elorza MA, Barcelo A. Two-step thyroid screening strategy in the critical patient. Clin Biochem. 2016;49(12):925–928. Available from: https://doi.org/10.1016/j.clinbiochem.2016.05.013.
6. Plikat K, Langgartner J, Buettner R, Bollheimer LC, Woenckhaus U, Scholmerich J. Frequency and outcome of patients with nonthyroidal illness syndrome in a medical intensive care unit. Metabolism. 2007;56(2):239–244. Available from: https://doi.org/10.1016/j.metabol.2006.09.020.
7. Tas A, Koklu S, Beyazit Y, Kurt M, Sayilir A, Yesil Y. Thyroid hormone levels predict mortality in intensive care patients with cirrhosis. Am J Med Sci. 2012;344(3):175–179. Available from: https://doi.org/10.1097/maj.0b013e318239a666.
8. Kumar E, Mccurdy MT, Koch CA, Hamadah A, Fülöp T, Gharaibeh KA, et al. Impairment of thyroid function in critically ill patients in the intensive care units. Am J Med Sci. 2018;355(3):281–285. Available from: https://doi.org/10.1016/j.amjms.2017.06.026.
9. Plank LD, Connolly AB, Hill GL. Sequential changes in the metabolic response in severely septic patients during the first 23 days after onset of peritonitis. Ann Surg. 1998;228(2):146–158. Available from: https://doi.org/10.1097/00000658-199808000-00002.
10. Fong Y, Marono MA, Moldawer LL, Wei H, Calvano SE, Kenney JS, et al. The acute splanchnic and peripheral tissue metabolic response to endotoxin in humans. J Clin Invest. 1990;85(6):1896–1904. Available from: https://doi.org/10.1172/jci114651.
11. Alverdy JC. Hypermetabolism and Nutritional Support in Sepsis. Surg Infect (Larchmt). 2018;19(2):163–167. Available from: https://dx.doi.org/10.1089/sur.2017.313.
12. Degroot LJ. Non-thyroidal illness syndrome is functional central hypothyroidism, and if severe, hormone replacement is appropriate in light of present knowledge. J Endocrinol Invest. 2003;26(12):1163–1170. Available from: https://doi.org/10.1007/bf03349151.
13. Adler SM, Wartofsky L. The nonthyroidal illness syndrome. Endocrinol Metab Clin North Am. 2007;36(3):657–672. Available from: https://doi.org/10.1016/j.ecl.2007.04.007.
14. Suresh M, Srivastava NK, Jain AK, Nandy P. Thyroid dysfunction in critically ill patients in a tertiary care hospital in Sikkim, India. Thyroid Res Pract. 2017;14:58–62.
15. Gutch M, Kumar S, Gupta KK. Prognostic value of thyroid profile in critical care condition. Indian J Endocr Metab. 2018;22(3):387–91. Available from: https://doi.org/10.4103/ijem.ijem_20_18.

How to cite this article: K, V, Singh VK, Krishna H, Lalit A, Leekha S. Thyroid Function Abnormalities in Critically Ill Patients. Acad. J Med. 2021;4(2):67-72.

DOI: dx.doi.org/10.47008/ajm.2021.4.2.12

Source of Support: Nil, **Conflict of Interest:** None declared.