

Study on Assessment of Thyroid Status among Critically Ill Patients Admitted in a Tertiary Care Hospital

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Abstract

Introduction: Any acute severe illness can cause abnormalities of circulating TSH or thyroid hormone levels in the absence of underlying thyroid disease.

AIM: To assess thyroid status among critically ill patients admitted in a tertiary care hospital.

Material & Methods: A hospital based cross sectional study was done among 100 critically ill patients admitted to Katuri Medical College and Hospital, Chinakondrupadu, Guntur. All critically ill patients aged above 18 years admitted to Intensive Care Unit, Emergency ward and patients suffering from Acute renal failure, Acute Respiratory failure, Congestive cardiac failure, Diabetic ketoacidosis, Septicemia and Advanced HIV infection were included. 3ml of early morning sample containing plain clotted blood were collected and sent for T3, T4, TSH estimation. The hormone estimation was done by chemiluminescence assay.

Results: In the study, of 100 critically ill patients out of which 16 patients had acute renal failure, 18 patients had acute respiratory failure, 18 patients had congestive Cardiac failure, 16 patients had Diabetic ketoacidosis, 18 patients had Sepsis and 14 patients had Advanced HIV. Among 100 patients, 60% had low T3, 26% had low T4, 10% had high T4 and 4% had low TSH.

Conclusions: Abnormalities in thyroid function were more common in critically ill non thyroidal illness patients.

Introduction

Any acute severe illness can cause abnormalities of circulating TSH or thyroid hormone levels in the absence of underlying thyroid disease. The most striking abnormality detected in critically ill euthyroid patients is a highly significant reduction in the mean total serum triiodothyronine (T3) level. Critical illness is often associated with alterations in thyroid hormone concentrations in patients with no previous intrinsic thyroid disease.¹ Changes in parameters of

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Table 1: Thyroid abnormalities in different clinical conditions

Clinical condition	Thyroid abnormality N (%)
Acute Renal Failure (n=16)	Low T3 -- 06 (37.5%)
	Low T4 -- 04 (25%)
Acute Respiratory Failure (n=18)	Low T3 -- 10 (55.6%)
	Low T4 -- 08 (44.4%)
Congestive Cardiac Failure (n=18)	Low T3 -- 10 (55.6%)
	Low T4 -- 04 (22.2%)
	High TSH -- 02 (11.12%)
Diabetic Ketoacidosis (n=16)	Low T3 -- 10 (62.5%)
	Low T4 -- 06 (37.5%)
	High TSH -- 02 (12.5%)
Septicemia (n=18)	Low T3 -- 16 (88.9%)
	Low T4 -- 12 (66.7%)
	Low TSH -- 02 (11.1%)
Advanced HIV (n=14)	Low T3 -- 08 (57.1%)
	Low T4 -- 04 (28.5%)

thyroid function are very common but any acute severe illness can cause abnormalities of circulating TSH or thyroid hormone levels in the absence of underlying thyroid disease.²⁻³

Assessment of thyroid function in ICU:

The nonthyroidal illness syndrome, also known as the low T3 syndrome or euthyroid sick syndrome, describes a condition characterized by abnormal thyroid function tests encountered in patients with acute or chronic systemic illnesses. The laboratory parameters of this syndrome include low serum levels of triiodothyronine (T3) and high levels of reverse T3, with normal or low levels of thyroxine (T4) and normal or low levels of thyroid-stimulating hormone (TSH).⁴

This condition may affect 60 to 70% of critically ill patients. The changes in serum thyroid hormone levels in the critically ill patient seem to result from alterations in the peripheral metabolism of the thyroid hormones, in TSH regulation, in the binding of thyroid hormone to transport-protein and in receptor binding and intracellular uptake. Medications also have a very important role in these alterations.⁴

The decreased 5'-monodeiodinase activity is often not recognized because measurement of serum T3 is rarely utilized as a screening test for thyroid function (nor should it be). The serum T3 value should be high (or high-normal) in hyperthyroidism but low (or low-normal) in non thyroidal illness. Rarely, a very sick patient with hyperthyroidism will have a low serum

T3 concentration.⁵

The severity of illness correlates well with the reduction in total serum T3 level. The major 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. Low T3 is an important marker of mortality in critically ill patients. T4 and TSH did not vary between survivors and non survivors.⁶

The enhanced sensitivity and specificity of TSH assays have greatly improved laboratory assessment of thyroid function. The use of immune chemiluminometric assays (ICMAs) for TSH is sensitive enough to discriminate between the lower limit of the reference range and the suppressed values that occur with thyrotoxicosis. The finding of an abnormal TSH level must be followed by measurements of circulating thyroid hormone levels to confirm the diagnosis of hyperthyroidism (suppressed TSH) or hypothyroidism (elevated TSH). Radioimmunoassays are widely available for serum total T4 and total T3.

Aim

To assess thyroid status among critically ill patients admitted in a tertiary care hospital.

Material and Methods

A hospital based cross sectional study was done among 100 critically ill patients admitted to Katuri Medical College and Hospital, Chinakondrupadu, Guntur.

Inclusion Criteria

All critically ill patients aged above 18 years admitted to Intensive Care Unit, Emergency ward and patients suffering from Acute renal failure, Acute Respiratory failure, Congestive cardiac failure, Diabetic ketoacidosis, Septicemia and Advanced HIV infection were included.

Exclusion Criteria

History s/o thyroid illness, clinically evident thyroid enlargement, or signs of thyroid disease

Patients receiving massive blood transfusion or having steroid or dopamine therapy and drugs known to interfere with thyroid hormone metabolism.

Methodology

Informed written consent was taken from the study participants prior to the start of the study. Demographic data, History, Clinical examination and details of investigations were done and recorded in the study proforma.

3ml of early morning sample containing plain clotted blood were collected and sent for T3, T4, TSH estimation. The hormone estimation was done by chemiluminescence assay.

Statistical Methods: Data entry was done using Microsoft excel 2010 version and analysis using EPI INFO version 7. Data was presented in percentages and proportions. Results on continuous measurements are presented on Mean + SD (Min-Max) and results on categorical measurements are presented in Number (%).

Results

The mean age of the study population was 45.74±16.65 years with majority (26%) from 31-40 years age group. Male & female sex ratio was 1.6.

Out of 100 patients 48 (48%) were found to have fever, 18 (18%) breathlessness, 16 (16%) had vomiting, 6(6%) had cough.

With regards to co morbid conditions, 28 (28%) were found to be hypertensive and 72 (72%) had diabetes mellitus. 14 patients (14%) were HIV Reactive.

The mean systolic and diastolic blood pressure was 120.29±25.86 and 76.32±14.25 mm Hg respectively. The mean pulse rate was 101.38±14.09, mean respiratory rate 24.30±6.21 and mean temperature 37.67±0.54. APACHE score found that 40 Patients (40%) had APACHE Score >15, 38 Patients (38%) had 11-15 and 22 Patients (22%) had 6- 10.

On investigations, the mean haemoglobin (%) was 11.04±3.10, mean platelets were 2.10±1.01 lakh and the mean random sugar level was 190.40±131.79. 16 cases had ketone bodies in urine.

Out of 100 critically ill patients, 54% had abnormal serum sodium, 44% had abnormal serum potassium and 8 % had abnormal serum chloride.

With regards to renal parameters, serum urea was >40 mg/dl in almost half the cases (48%). Among 100

critically ill Patients, 16 patients (16%) expired.

Thyroid function tests

Among 100 patients, 60% had low T3, 26% had low T4, 10% had high T4 and 4% had low TSH.

The mean T3 was 0.63 ± 0.42 , T4 5.38 ± 2.01 and TSH was 3.25 ± 2.10 .

Thyroid function tests in different clinical conditions among the critically ill patients (Table 1).

Out of 16 Patients of Acute Renal failure, 37.5% had low T3, 25% had low T4 and 100% had normal TSH. Out of 18 Patients of Acute Respiratory failure, 55.56% had low T3, 44.44% had low T4 and 100% had normal TSH. Among the 18 patients with congestive cardiac failure, 55.56% had low T3, 22.2% had low T4 and 11.12% had high TSH.

Out of 16 patients with diabetic ketoacidosis, 62.5% had low T3, 37.5% had low T4, 12.5% had high TSH. Among the 18 patients with septicemia, 88.89% had low T3, 66.66% had low T4 and 11.11% had low TSH.

14 patients with advanced HIV, 57.14% had low T3, 28.5% had low T4, 57.14% had high T4 and 100% had normal TSH.

Discussion

Critical illness is often associated with alterations in thyroid hormone concentrations in patients with no previous intrinsic thyroid disease. The metabolic support of the critically ill patient is a relatively new target of active research and little is as yet known about the effects of critical illness on metabolism.

In our study, of 100 critically ill patients out of which 16 patients had acute renal failure, 18 patients had acute respiratory failure, 18 patients had congestive Cardiac failure, 16 patients had Diabetic ketoacidosis, 18 patients had Sepsis and 14 patients had Advanced HIV. T3, T4 and TSH analysis were done, 60 Patients (60%) had low T3 level, 40 (40%) patients had normal T3, 36 patients (36%) had low T4, 64 patients (64%) had normal T4 level and TSH was low in 4 patients (4%), 76

patients (76%) had normal TSH and 20 patients (20%) slightly high Mean \pm SD 3.25 ± 2.10 .

Study by Kiran Bhat et al (2016)¹⁷ observed that (59.1%) of the patients showed abnormality in one or more than one parameter of thyroid function tests. And low fT3 (50%) was the commonest abnormality followed by high TSH (12.4%), low TSH (8.8%) and low fT4 (4.7%) concentration.

In present study of 18 patients of sepsis, 16 patients (88.89%) had low serum T3 level, low T4 level with high APACHE score with death of 6 patients. And TSH is normal in 10 (55.55%) patients. All sepsis patients had low Hb% with total count more than 13670 cells/cumm. It indicates that among sepsis, with low T3 and T4, high APACHE score favor more death rate.

Joseph et al. reported that, 21/110 (19.0%) patients had abnormal thyroid function at diagnosis of T1DM. Of these, 16 had normal thyroid function on reassessment after 45 (3–540) days. Abnormalities of thyroid function occurred were more common in children with diabetic ketoacidosis (DKA) than those who did not have DKA (9/29, 31.0% vs 12/81, 14.8%, $p < 0.025$). At the end of the observation period, five (4.5%) patients had minor abnormalities of thyroid function not requiring treatment and three (2.7%) were treated.⁸

In our study of 14 advanced HIV patients, 8 patients (57.14%) had low T3, 4 patients (28.58%) had low T4 level, total 8 deaths including 6 HIV with tuberculosis, 2 with HIV with acute GE. In 2 patients both Hb% & TC were low, in 4 patients low Hb% and high TC level, in 2 patients normal Hb% and high TC with APACHE score.

Palanisamy P et al (2010)⁹ did a study on 150 HIV positive subjects divided into groups based on CDC criteria to investigate level of serum lipids and thyroid hormones. They reported that thyroid dysfunction is frequent in HIV infection and that with progression of disease there is a primary hypothyroid like stage that occurs in patients.

Desai Vidya Sripad et al (2015)¹⁰

study found that FT3 and FT4 as the most powerful and independent factor of ICU mortality among the complete thyroid panel of indicators. The cumulative death rate was significantly higher in patients with low T3 syndrome as compared to those without (18%). A significant association was found between patients death rate, Low T3 syndrome and APACHE II and other inflammation indices.

Though many similar kind of studies were done in different places, the findings of the present study are pertinent to the study area.

Conclusions

Present study has found that abnormalities in thyroid function were more common in critically ill non thyroidal illness patients. T3 level was low in 60% patients of critically ill non thyroidal ill patients with normal or low-normal T4 TSH levels.

References

- Adler SM, Wartofskv I. The non-thyroidal illness syndrome. *Endocrinol Metab Clin N Am* 2007; 36:657-72.
- De Groot LJ, Non-thyroidal illness syndrome is a manifestation of hypothalamic-pituitary dysfunction and in view of current evidence should be treated with appropriate replacement therapies. *Crit Care Clin* 2006; 22:57-86.
- Adler SM, Wartofsky L. The nonthyroidal illness syndrome. *Endocrinol Metab Clin North Am* 2007; 36:657-672.
- Foteini Economidou, Evangelia Douka, Marinella Tzanela, Serafeim Nanas, Anastasia Kotanidou. Thyroid function during critical illness. *Hormones* 2011; 10:117-124.
- Franklyn JA, Black EG, Betteridge J, Sheppard MC. Comparison of second and third generation methods for measurement of serum thyrotropin in patients with overt hyperthyroidism, patients receiving thyroxine therapy, and those with nonthyroidal illness. *J Clin Endocrinol Metab* 1994; 78: 1368-1371.
- Kumar KVSH, Kapoor U, Kalia R, Chandra NSA, Singh P, Nangia R. Low triiodothyronine predicts mortality in critically ill patients. *Indian Journal of Endocrinology and Metabolism* 2013; 17:285-288.
- Kiran Bhat, Sumita Sharma, Kapil Sharma, RK Singh. Assessment of thyroid function in critically ill patients. *Biomedical Research* 2016; 27:449-452.
- Joseph J, Saroha V, Payne H, Paul P, Didi M, Isherwood D, Blair J. Thyroid function at diagnosis of type I diabetes. *Arch Dis Child* (2010). doi:10.1136/adc.2009.168799.
- Palanisamy P, Perisamy M, Uma M, Deepa M. (3) did a study on 150 HIV positive subjects divided into groups based on CDC criteria to investigate level of serum lipids and thyroid hormones. *J Medicine* 2010; 11:131-136.
- Sripad DV, Chowdary NVS, Sivaprabodh V, Shekhar R. Relationship between Free T3 and ICU Mortality: A Prospective Observation. *International Journal of Scientific and Research Publications* 2015; 5:1-5.