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Thyroid Profile in Seriously ill Children and its Impact on the Clinical Outcome

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ABSTRACT

Background: Different endocrine axis react differently to stressful situations. The body maintains homeostasis with the help of the modifications brought on by those fluctuations. The endocrine changes could also go too far in a few people, having negative effects.
Aims and Objectives: to evaluate serum T3, T4, and TSH levels and their impact on hospital stay and recovery in ill children.
Methodology: Between October 2017 and May 2019, this study was carried out in a tertiary care hospital's department of pediatrics. An observational research was conducted. Analyses were done on samples of 170 patients who met the requirements for inclusion. Based on the results of the PRISM-II test, children were divided into two groups. The clinical outcome, length of stay in the PICU, and thyroid profile were correlated.
Results: All 170 of the kids had low T4 levels. Children with PRISM-II scores >5 showed a substantial correlation between T4 levels and death and length of hospital stay. Among children with higher PRISM-II scores, higher T4 and T3 levels at admission were linked to a higher risk of mortality.
Conclusion: This study demonstrates a substantial correlation between T4 levels and mortality and length of hospital stay in kids with PRISM-II scores greater than 5. T4 levels that were higher at the time of admission were linked to a higher mortality risk and a shorter hospital stay. Children with higher PRISM-II scores had higher mortality risks and higher T3 levels at admission.

Keywords: Thyroid profile, T4 levels, critically ill children

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INTRODUCTION

Different endocrine axis react differently to stressful situations. The complex reaction helps the body maintain homeostasis. The most common changes in critical illness are variations in corticosteroid, sex hormone, and thyroid hormone levels[1-3]. In certain people, the endocrine changes may exceed the safe limits and have negative effects. Through their modulation of the immune system and metabolism, thyroid hormones play a significant part in the preservation of body growth. In patients without a history of intrinsic thyroid disease, changes in thyroid hormone concentrations are frequently linked to critical illness. Either euthyroid sick syndrome (ESS) or non-thyroidal illness syndrome are names for the abnormal thyroid activity. The most frequent endocrine change observed in critically ill patients is the euthyroid sick syndrome (ESS) [4,5]. Low serum levels of free triiodothyronine (fT3) and thyroid-stimulating hormone (TSH), as well as low or normal amounts of free thyroxine, are present in patients (fT4). Additionally, due to the

decreased conversion of reverse T3 (rT3) to diiodothyronine (T2) as a result of the suppression of 5'-monodeiodinase activity, high levels of reverse T3 (rT3) are seen in nonthyroidal disease. The impairment of 5' deiodinase may result from decreased glutathione availability brought on by reduced carbohydrate intake. The body's increased steroid levels brought on by stress prevent T4 to T3 conversion. According to reports, serum T4 decreases in direct proportion to sickness severity. Numerous investigations have discovered a correlation between the patient's result and the degree of T4 level reduction[6]. The low thyroid hormone levels are independent predictors of death in patients admitted to critical care units, according to a small number of studies. We conducted this prospective observational study to evaluate the thyroid hormone profile in connection to survival in children referred to PICU because, surprisingly, very limited records available from India about the endocrinological parameters in critically sick children[7].

OBJECTIVES: 1. To evaluate the serum T3, T4, and TSH levels and their impact on hospital stay and recovery in ill children. 2. Examine the relationship between the baseline serum T3, T4, and TSH levels and mortality (if any) in these kids.

METHODOLOGY

Consecutive pediatric patients between the ages of 1 month and 18 years who were admitted to the PICU at Medical College Hospital and met the inclusion criteria were enrolled into the study after receiving approval from the ethics committee and the required parental agreement. In this study, research was done from October 2018 to May 2020. Any child with a PRISM-II score of less than five upon initial admission was considered critically sick. Children who had a history of thyroid disease in the past, were on iodine-containing medications, or had a family history of thyroid conditions were not included in the study. In plain vacutainer tubes, 3ml of blood was drawn shortly after admission while taking all necessary aseptic precautions.

Using the enzyme-linked immunosorbent assay (ELISA) technique and ELISA kits made by Calbiotech, serum TSH, serum T3, and serum T4 levels were determined. The maker of the ELISA Kit supplied the reference ranges that were used. In the clinical Biochemistry Section, additional tests such the CBC, SGOT, SGPT, serum albumin, serum electrolytes, and serum creatinine that were required as part of the management protocol for all critically sick individuals were carried out using automated analyzers like the Roche COBAS 6000 analyzer. All subjects had their serum T3, T4, and TSH levels evaluated. The study looked at the relationship between the patients' clinical diagnoses and their serum thyroid levels. We searched for any associations between the clinical outcome and the serum thyroid levels (T3, T4, and TSH).

Using descriptive statistics like mean and standard deviation, all the quantitative variables were summarized. Frequency and percentage were used to compile a list of all the qualitative variables. Use of the Fisher Exact test was made for statistical analysis. 0.05 was used as the threshold for statistical significance.

RESULTS

In the hospital, this study was carried out from October 2017 to May 2020. Out of the 1970 children admitted to the RMCH PICU who were critically sick and met the criteria, 200 were included in the study. Because of inadequate samples and sampling error, 30 samples were removed. The study's conclusion involved the analysis of 170 samples in total. Based on their PRISM-II scores, the patients were split into two groups. PRISM-II patients with scores of 5 and 6 were placed in groups 1 and 2, respectively.

The study covered children from 1 month to 18 years old. They were then separated into the following age groups.

Table 1: Showing distribution of cases according to the age interval

Age in Months	N	Group 1	Group 2	Percentage
1-12	44	26	18	26
13-60	56	20	36	33
61-120	34	28	6	20
121-216	36	12	24	21
Total	170	86	84	100

Out of 170 children between the ages of more than one month and fifteen years that were researched, 44 (26%) were between one month and a year, 56 (33%) between one and five, 34 (20%) between six and ten, and 36 (21%) between eleven and eighteen. In 170 children, the CNS was involved in 50 (29.4%), the respiratory system in 36 (21.2%), the gastrointestinal system in 18 (10.6%), and the cardiovascular and endocrine systems in 6 (3.5%) each. Out of the 170 individuals admitted, 122 were discharged, 22 disobeyed medical advice, and 26 died. 38 of the 170 patients had low T3 levels, whereas 124 had normal T3 levels, and 142 of the patients had low TSH levels and 26 had normal TSH levels. In group 1, TSH was low in 76 kids and normal in 10 kids.

T3 among children in group 1 was low in 6 of them, normal in 46, and high in 4. In group 2, TSH was low in 68 youngsters and normal in 16 of them. T3 was low in 22, normal in 58, and high in 4 children in group 2. T4 levels were low in all 170 of the kids. Between the two groups, there was no statistically significant difference in the T3, T4, or TSH levels.

Table 2: Thyroid Profile of patients

		Group 1 N=86	IQR	Group 2 N=84	IQR	P
T3	Low	16 (18.6%)	0.32 (0.19-0.55)	22 (26%)	0.32 (0.18-0.57)	0.989
	Normal	66 (76.7%)		58 (69%)		
	High	4 (4.7%)		4 (5%)		
T4	Low	86 (100%)	1.08 (0.88-1.4)	84 (100%)	1.09 (0.8-1.4)	0.916
	Normal	0		0		
	High	0		0		
TSH	Low	76 (88%)	1.08 (0.87-1.32)	68 (81%)	1.14 (0.9-1.25)	0.68
	Normal	10 (12%)		16 (19%)		
	High	0		0		

Table 2: Shows the T3, T4, TSH values among two groups, Inter quartile ranges of thyroid hormones and p values.

Co-relation of thyroid profile with patient profile

Table 3: Corelation of T3, T4 and TSH levels with clinical outcomes in Group 1

	TSH		T3		T4	
	Correlation co-efficient [r]	p	Correlation co-efficient [r]	p	Correlation co-effecient[r]	p
hospital stay	-0.057	0.714	0.254	0.101	-0.185	0.236
PICU stay	-0.111	0.049	0.336	0.027	-0.175	0.262
Mortality risk	-0.083	0.598	0.018	0.906	-0.001	0.997

Table 3: Shows Correlation co-efficient [r] and p values of TSH, T3, T4 levels compared to Hospital stay, PICU stay and Mortality risk among patients in group 1

For patients in group 1, there was a substantial correlation between T3 levels and length of hospital stay. Children in group 1 with greater T3 values at entry had longer hospital stays, as was seen. The amount of time spent in the hospital and T4 levels were significantly correlated. Longer hospital stays are associated with lower T4 levels at admission. The levels of T3 and T4 were significantly correlated with the risk of mortality. An increased risk of

mortality was linked to higher T3 and T4 levels at admission (from the baseline in our sample).

DISCUSSION

Patients with serious illnesses who have never had intrinsic thyroid disease before frequently exhibit changes in their thyroid hormone levels. The non-thyroidal illness syndrome, sometimes referred to as the low T3 syndrome or the euthyroid sick syndrome, is defined by aberrant thyroid function tests seen in patients with acute or long-term systemic illnesses[8,9]. The majority of critically ill patients with non-thyroidal illnesses have lower fT3 levels because 5'-monodeiodinase is inhibited, which results in a slower conversion of T4 to T3. The suppression of 5'-monodeiodinase is caused by cytokines, circulating deiodenase inhibitors (free fatty acids), and glucocorticoid therapy, among other things. Reduced TSH and fT4 levels are a prognostic indicator of a poor outcome and a symptom of severe chronic illness. 170 of the 200 samples that were gathered for our investigation were examined. Due to flawed and insufficient sample, the remaining individuals were excluded. Out of the 170 samples, 86 were assigned to group 1 and 84 to group 2, respectively. Children were divided into two groups based on their PRISM-II admission score. Children with scores of 5 or higher were categorized as cases, while those with scores of 5 or less were categorized as controls. In our study, the majority of patients admitted to PICU had low T4 (N-170, 100%) and low TSH (N-144, 84.7%). The risk of mortality and morbidity was higher in subjects with low T4 levels[10]. Higher the baseline T4 level at admission to PICU was associated with increased risk of mortality among critically ill children (r- 0.356, p- 0.023). (r- 0.356, p- 0.023). Low T4 levels co-related with PRISM-II score and mortality risk among critically ill children in PICU. Also noted was a significant positive correlation between serum T3 levels and risk of mortality among cases. Similar findings were reported by Suvarna JC et al. in their study, which found that serum T4 levels were significantly lower in children who died than in children who survived. A patient's risk of dying was 30 times higher when their T3 and T4 levels were low combined. T4 levels and the PRISM-II score at 24 hours can be used to predict survival[11]. Additionally, they mentioned that low T3 and T4 values might be used to predict death, which was in line with the results of our study. The results of our investigation were consistent with those of a study conducted by Kiran et al., which showed low T3 and T4 levels in seriously ill children. Our study, which defied the findings of earlier research, identified low T4 levels upon admission as the most potent predictor of mortality risk among thyroid profile factors. Meyer et al. reported that non-survivors' fT4 levels dropped considerably, which was extremely consistent with the results of our investigation. Similar to our study, Anna G et al. showed that T3 and T4 levels were noticeably low upon admission in sick children[12]. T3 levels in our patients, however, were merely borderline normal. According to Wang et al., T3 levels and the APACHE score in adults have a strong correlation. We discovered a similar substantial correlation between PRISM-II score and mortality risk to this study. The findings of Kumar et al studys which demonstrated noticeably low levels of T3, T4, and TSH in critically ill children, were similar to those of our own. According to Kothiwale VA et al., mean fT3 and TSH levels were lower in non-survivors than in survivors, whereas mean fT4 levels were higher in non-survivors. fT3 and fT4 levels were negatively linked with APACHE II score. However, in our study, we found that the majority of critically ill children had low mean T4 and TSH levels, and that T4 levels were closely related to PRISM-II scores in these patients. All children admitted to the PICU had low T4 levels at admission, according to our study. This might be because patients were admitted to our hospital, a tertiary care facility and referral facility, after a protracted initial illness, by which point the hypothalamo-pituitary axis has already been suppressed and the body is unable to meet the metabolic demands of the illness.

CONCLUSION

In our study, we found that the baseline T4 levels of all 85 study participants were below average. A total of 62 kids (73%) had normal T3 levels (0.82-1.85 ng/mL), 19 kids (22%) had low T3 levels (0.82 ng/mL), and 4 kids (5%) had high T3 levels (>1.85 ng/mL). At admission, 13 children (15%) and 72 kids (85%) had normal TSH (age specific) and low TSH, respectively. This study demonstrates a substantial correlation between T4 levels and mortality and length of hospital stay in kids with PRISM-II scores greater than 5. Higher levels of T4 at admission were linked to a higher mortality risk and a shorter hospital stay. Children with higher PRISM-II scores had higher mortality risks when their T3 levels were higher at the time of admission.

REFERENCES

1. Van den Berghe G. Endocrine evaluation of patients with critical illness. Endocrinol Metab Clin North Am 2003;32:385-410.

2. K. V. S. Hari Kumar, Umesh Kapoor, Richa Kalia, N. S. Ajai Chandra, Parikshit Singh, R. Nangia. Indian J Endocrinol Metab. 2013 Mar-Apr; 17(2): 285–288.
3. Kiran Bhat, Sumita Sharma, Kapil Sharma, RK Singh. Assessment of thyroid function in critically ill patients. Biomedical Research 2016; 27 (2): 449-452.
4. Sahana PK, Ghosh A, Mukhopadhyay P, Pandit K, Chowdhury BK, Chowdhury S. A study on endocrine changes in patients in intensive care unit. J Indian Med Assoc 2008; 106: 362-364.
5. VA Kothiwale, Pournima Patil, Saurabh Gaur. Correlation of Thyroid Hormone Profile with the Acute Physiology and Chronic Health Evaluation II Score as a Prognostic Marker in Patients with Sepsis in the Intensive Care Unit. (2018). Journal of The Association of Physicians of India, 66, pp.59-62.
6. Economidou F, Douka E, Tzanela M, et al. Thyroid function during critical illness. Hormones (Athens) 2011; 10:117-24.
7. Bermudez F, Surks MI, Oppenheimer JH. High incidence of decreased serum triiodothyronine concentration in patients with non-thyroidal disease. J Clin Endocrinol Metab 1975; 41: 27-40.
8. Jyoti Chandrashekar Suvarna and Chandrashekar N. Fande.Serum Thyroid Hormone Profile in Critically Ill Children. Indian J Pediatr. 2009 Dec;76(12):1217-21
9. Meyer S, Schuetz P, Wieland M, Nusbaumer C, Mueller B, Christ-Crain M. Low triiodothyronine syndrome: a prognostic marker for outcome in sepsis? Endocrine 2011;39:167–74.
10. Angelousi AG, Karageorgopoulos DE, Kapaskelis AM, Falagas ME. Association between thyroid function tests at baseline and the outcome of patients with sepsis or septic shock: a systematic review. Euro J Endocrinol. 2011 Feb;164(2):147-55.
11. Wang Feilong, Pan Wenzhi, Wang Hairong, Wang Shuyun, Pan Shuming, Ge Junbo. Relationship between thyroid function and ICU mortality: a prospective observation study. Crit Care 2012;16:11–2
12. Kumar KH, Kapoor U, Kalia R, et al. Low triiodothyronine predicts mortality in critically ill patients. Indian Journal of Endocrinology and Metabolism 2013; 17:285.