International Journal of Medical and Health Research
ISSN: 2454-9142, Impact Factor: RJIF 5.54
www.medicalsciencejournal.com
Volume 3; Issue 2; February 2017; Page No. 163-165

Evaluation of thyroid hormone levels with fluid-resistant shock among preterm septicemic neonates

[1] Dr. Pankaj Kumar Kashyap, [2] Dr. Sushil Kumar Pathak, [3] Dr. Anil Kumar Jaiswal

[1, 2] Senior Resident, Upgraded Department of Paediatrics, Patna Medical College & Hospital, Patna, Bihar, India
[3] Professor & HOD, Upgraded Department of Paediatrics, Patna medical College & Hospital, Patna, Bihar, India

Abstract
Congenital hypothyroidism is the most common preventable cause of mental retardation. The premature inborn neonates admitted to NICU in North India were considered in the study. Due to the established relationship of lower levels of the thyroid hormones and septic shock; this study has planned to evaluate the imbalanced Thyroid function test associated with the hypotension
The inborn premature neonates having gestation age of 30-35 weeks diagnosed with sepsis are studied. Two study groups were enrolled into the study. Group A Neonates having with sepsis and fluid-resistant hypotensive shockand Group B: Neonates having those with sepsis but no shock.
Our study expressed that low levels of T3, T4 and TSH are linked with fluid-resistant hypotensive shock among septic preterm neonates, but, after adjusting for the level of sickness, TFTs are not independently associated with shock or mortality.
Hence from the above data it can be concluded that no factor is independently responsible for the septic shock among premature neonates. Also thyroid hormone levels do not individually envisage occurrence of shock amongst septic premature neonates.

Keywords: thyroid hormone levels, fluid-resistant shock, preterm neonates, septicaemia etc.

Introduction
Thyroid hormones are important for growth, metabolism and mental development in infants and children. Congenital hypothyroidism is the most common preventable cause of mental retardation with an incidence of 1:2500-2800 live births in India [1, 2]. Hypothyroidism, during later years, when brain development is completed, leads to slow growth and delayed skeletal maturation [3]. On the other hand, hyperthyroidism is rare in children [2]. It can induce rapid skeletal growth and maturation and other systemic effects due to increased metabolic activity.The measurement of thyroid-stimulating hormone (TSH) levels is often used by as a screening test. Elevated TSH levels can signify an inadequate thyroid hormone production, while suppressed levels can point at excessive unregulated production of hormone. If TSH is abnormal, decreased levels of thyroid hormones T4 and T3 may be present; T4 and T3 levels may be determined with blood tests to confirm that their levels are decreased. Auto antibodies may be detected in various disease states (anti-TG, anti-TPO, TSH receptor stimulating antibodies) [3].
Neonatal sepsis and the consequent septic shock have been causing increased early infantile morbidity and mortality for years. According to the World Health Organization (WHO), 130 million children are born yearly, and about 4 million die every year, while infection causes 36% of these deaths; this is even worse in countries where critical patient resources are limited [4].
A Critical Care Society paediatric intensive doctors' task force has recently coordinated an updating, leading to incorporation of some evidence-rated recommendations, being the septic shock definition based on clinical parameters and the shock graded according to the response to therapy (Table 1). Many these recommendations were not from good quality studies and consist on consensus statements; the literature shows a drop in mortality following these guidelines implementation, thus suggesting that the biggest impact comes from the approach to care rather than from the interventions themselves [5].

Table 1: Chart 1- Septic shock definitions (according to the Critical Care Society pediatric intensive doctors' task force)

Septic shock (cold)	Reduced perfusion, including altered mental status, longer than 2 seconds capillary filling, reduced peripheral pulse, cold spotted extremities, or reduced urinary output (less than 1 mL/kg/ hour).
Septic shock (warm)	Reduced perfusion, including altered mental status, shorter than 2 seconds capillary filling, wide peripheral pulse, and reduced urinary output (less than 1 mL/kg /hour).
Dopamine-resistant/fluid refractory shock	Shock persists independent of fluid resuscitation = 60 mL/kg in the first hour and dopamine infusion at 10 µg/kg/min.
Catecholamine-resistant shock	Shock persists independent of catecholamine's use as epinephrine or norepinephrine
Refractory shock	Shock persists independent of targeted use of inotropes, vasopressors, vasodilators and metabolic homeostatic (glucose and calcium) and hormonal (thyroid and hydrocortisone) agents.

The thyroid function test and the cardiac function have correlation. The Children who undergo cardiac bypass surgery have unbalanced thyroid function tests and management with T3 recovers myocardial function [6, 7]. The researcher have found that the children having septic shock have lower thyroid hormone levels [8, 9].

Due to the established relationship of lower levels of the thyroid hormones and septic shock; this study has planned to evaluate the imbalanced Thyroid function test associated with the hypotension.

Methodology

The premature inborn neonates admitted to NICU in North India were considered in the study. The approval of the Ethical Committee is taken from the Hospital. The written consent from the parents was taken.

The inborn premature neonates having gestation age of 30-35 weeks diagnosed with sepsis are studied.

Inclusion Criteria: The neonates are diagnosed with the clinical sepsis having:

- Positive body fluid culture or
- C-reactive protein level more than 10 mg/L or
- Chest X ray positive pneumonia.

Exclusion Criteria

- Subjects on drugs affecting thyroid function test
- Subject mothers having thyroid disorders

Study Groups

Group A: Neonates having with sepsis and fluid-resistant hypotensive shock

Group B: Neonates having those with sepsis but no shock

Shock was defined as systolic blood pressure (BP) less than the lower bound of the 95% CI by Zubrow's charts after receiving two normal saline boluses of 10 ml/kg each.

Results & Discussion

Out of the many births in the North Indian Hospital total 30 cases were included in the study. 15 cases were considered for the each study group A & B. All premature neonates' parents were informed consents.

Table 1: Comparison of Clinical Parameter

Parameter	Group A	Group B
Age Gestational	32 weeks	32 weeks
Neonate Weight	1.30-1.46 kg	1.40-1.55 kg
Male Gender	8	10
Female Gender	7	5
Blood Pressure	26-28 mm of Hg	32-36 mm of Hg
Blood Glucose	75-85 mg/dL	72-88 mg/dL
Blood pH	7.1-7.3	7.3-7.6
Serum Calcium Ionized	0.7-0.8 mEq/L	0.8-0.9 mEq/L
Blood Culture Positive	2 cases	3 cases
Pneumonia found in X Ray	7 cases	2 cases

The table 1 illustrates the comparison of the general parameters within the both study group. The age in both the group was observed is around 32 weeks. The neonatal weight is observed is 1.46 in group A and 1.40 in group B. Out of the 15 cases in each group mixed genders are observed in the study population. The Blood pressure in the group A is detected at 26-28 mm of Hg; where as in group B neonates blood pressure was found to be higher side 32-36 mm of Hg. The blood glucose levels were also monitored in both study groups. In group A neonates the blood glucose level is found 75-85 mg/dL and in group B 72-88 mg/dL.

The ionized calcium in the serum is also monitored. In group A Calcium is estimated as 0.8 mEq/L and in group B it is seen as 0.9 mEq/L. The blood culture of 2 cases was found in group A and in group B3 cases are found to be positive for septicaemia. In the X ray of chest 7 cases and in group B 2 cases were found positive.

Table 2: Comparison of Thyroid Function:

Parameter	Group A	Group B
T3	0.70- 0.98 mg/dL	1.10-1.60 mg/dL
T4	2.1 - 5.8 mg/dL	5.8 - 8.9 mg/dL
Thyroid stimulating hormone	0.89 – 4.10 µmol/dL	2.9 – 6.8 µmol/dL

Table 2 illustrates the comparison of the thyroid function in the both study group. The level of the T3 is detected as 0.70- 0.98 mg/dL in group A and 1.10-1.60 mg/dL in group B. The level of the T4 is also monitored in the both study groups. In group A T4 was observed as 2.1 - 5.8 mg/dL and in group B it is observed as 5.8 - 8.9 mg/dL. The Thyroid stimulating hormone level is seen as 0.89 – 4.10 µmol/dL in group A and 2.9 – 6.8 µmol/dL in group B.

Conclusion

In a similar study in older children, Lodha, *et al*. [9] found significantly lower thyroid hormone levels in those with septic shock. They also reported no deaths in the group without septic shock whereas 50% of the children with septic shock died [9]. Yildizdas, *et al*. [8] showed that mean (SD) total T3 levels among children with sepsis alone vs those with septic shock were 0.91 (0.22) nmol/L vs 0.64 (0.23) nmol/L and total T4 levels were 100.6 (1.93) vs 65.8 (19.35), respectively (P<0.05). Our study expressed that low levels of T3, T4 and TSH are linked with fluid-resistant hypotensive shock among septic preterm neonates, but, after adjusting for the levelof sickness, TFTs are not independently associated with shock or mortality. The cases of septic shock had a significantly higher proportion with probable sepsis (defined on chest X-ray) and disproportionately less definite sepsis (blood culture positive) compared to subjects with no shock. Subjects in Group A had significantly lower mean pH and were significantly more hypoxic.

Hence from the above data it can be concluded that no factor is independently responsible for the septic shock among premature neonates. Also thyroid hormone levels do not individually envisage occurrence of shock amongst septic premature neonates.

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