Int J Pharm Bio Sci 2012 Oct; 3(4): (B) 51 - 57

Research Article **Biochemistry**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

STATUS OF PITUITARY-THYROID AXIS OF NEWBORNS AND ITS RELATIONSHIP WITH ANTHROPOMETRY AND MATERNAL FACTORS AT BIRTH

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ABSTRACT

Thyroid hormone is crucial for growth and hence the current study is designed to correlate the cord blood thyroid stimulating hormone (TSH) levels with their anthropometry and maternal factors in 187 newborns. Statistical analysis was done by Mann Whitney-U test and Spearman correlation coefficient. TSH levels were significantly higher in males than in female newborns (P=0.018). Low birth weight newborns had significantly lower TSH than normal or high birth weight newborns (P=0.02). Ponderal Index exhibited a significant negative correlation (P=0.012) whereas head circumference did not correlate with TSH. Relationship between maternal factors like age, parity and MOD and newborns' TSH levels were statistically not significant. This study creates a hope for using TSH as a tool for screening various metabolic changes in newborns with different anthropometry.

KEY WORDS: Cord blood, thyroid stimulating hormone, anthropometry

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INTRODUCTION

Fetal growth retardation is the result of a complex pathology caused by multiple factors of fetal, placental and maternal origin. Hormones and growth factors released as a result of maternal-fetal physiological interactions play an important role in fetal well-being and outcome [1].Thyroid hormone is crucial for mental and physical growth in a newborn.Congenital hypothyroidism (CH) is a major preventable cause of mental retardation in children [2].CH can be caused by premature birth, maternal factors like thyroid disease, anti-thyroid medications, illness, iodine deficiency or excess.The relationship between decreasing birth weight percentiles and increasing fetal morbidity and mortality has been demonstrated by several investigators and epidemiological studies. Coronary heart diseases and adverse metabolic profiles in adulthood are associated with low birth weight, small head circumference and short body length at birth [3,4].Studies have revealed an association between low birth weight of babies with increase in total and LDL cholesterol levels [5].Influence of thyroid hormones on metabolism of lipids is well established.However, there exists a lacuna in the scientific literature to explain the relationship between anthropometric changes & thyroid hormone status of newborns.TSH (Thyroid stimulating hormone) levels are inversely related to the status of free Thyroxine (T_4) or triiodothyronine (T_3) levels in blood and are hence, commonly used to study the thyroid status. Screening of newborns for CH is not implemented to its best in India due to several factors like cost, lack of reliable laboratories on a large scale, and no availability of baseline data in our population [2].Earlier studies have shown that mixed cord blood is a good sampling technique for screening of CH [6]. Reports have also concluded that cord blood TSH have a better specificity and sensitivity as compared to cord or filter paper T_4 at 3-5 days of age [7].The Indian Academy of Pediatrics has recommended the use of cord blood at birth for screening of CH [8]. Hence, the current study was designed to correlate newborns' cord blood TSH levels with their anthropometric changes and maternal factors.

MATERIALS AND METHODS

(i) Subjects

The current prospective study was carried out at our hospital. A total of 187 newborns, 108 males and 79 females, were screened for their cord blood TSH levels at birth, with the informed consent of their parents and under the approval acquired from the Hospital and University Ethical committee. Allconsecutive deliveries during this period thatincluded normal vaginal delivery (NVD) and Lower segment caesarean section (LSCS) were part of the study. Neonates with normal fetal heart rate patterns during labour with a one minute APGAR score >7 were included into this study. Neonates born with perinatal asphyxia and congenital anamolies were excluded from the study. Age, parity, mode of delivery was noted as a part of maternal data recording.

(ii) Preparation of anthropometric data of neonates and maternal data

Anthropometric data included the neonates' birth weight (BW), head circumference (HC), length and abdominal circumference (AC). Weight was measured using electronic weighing scale with accuracy up to 5g. Length was recorded using an infantometer. Head circumference was measured using non-stretchable tape passing above supraorbital ridge and over occipital protuberance at the time of discharge. Abdominal circumference was measured with non-stretchable tape passing through the umbilicus soon after birth. Ponderal Index (PI) was calculated by the formula Weight (g)/Length (cm^3) X100. The maternal age, parity and mode of delivery (MOD) was noted down for this comparative study.

(iii) Biochemical estimations

Blood samples drawn from a 15-20 cm length of the umbilical cord, incised while severing it at the time of birth of the baby were collected in a plain vacutainer. This mixed cord blood sample was obtained post-delivery. Serum TSH levels were assayed by immunoturbidimetric methods using Roche, Hitachi autoanalyzer in our Biochemistry Stat Lab.

(iv) Statistical analysis

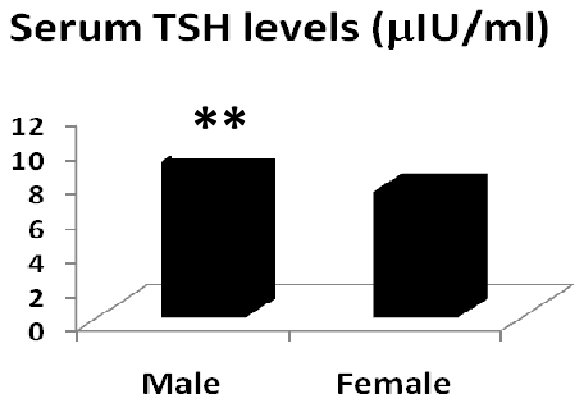
Data were analysed using SPSS 13.0, Apache software foundation 2000. The relationship between anthropometric data, maternal data and the neonates TSH levels at birth were statisticallyanalysed by using the Mann Whitney-U test and Spearman correlation coefficient.

RESULTS

The current study had no case of congenital hypothyroidism. The normal levels of cord blood TSH at birth were standardized in our lab to be 0.7-15 μIU/ml at birth. Graph 1 shows the comparison of cord blood TSH levels between male and female newborns at birth. TSH levels were normal in all the 187 newborns, but was significantly higher in males than in female newborns (P=0.018).

Graph 1

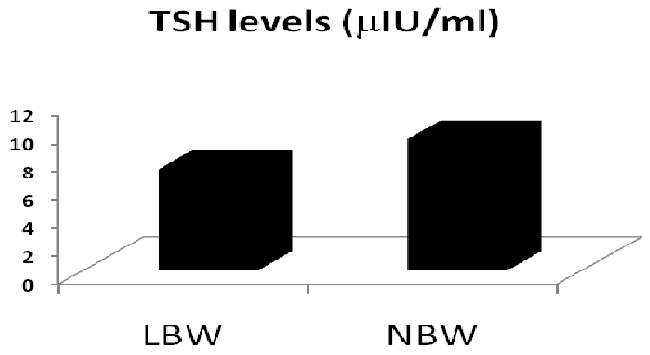
Comparison of cord blood TSH levels among genders of newborns. (N= 187 newborns, 108 males and 79 females, ** P=0.018: statistically very significant)



Newborns were divided into two groups based on their birth weight and compared i.e. LBW(Low birth weight <2500g) and Normal birth weight (NBW) ≥2500g. LBW newborns had normal but significantly higher TSH than NBW newborns (P=0.02) as shown in Graph 2.

Graph 2

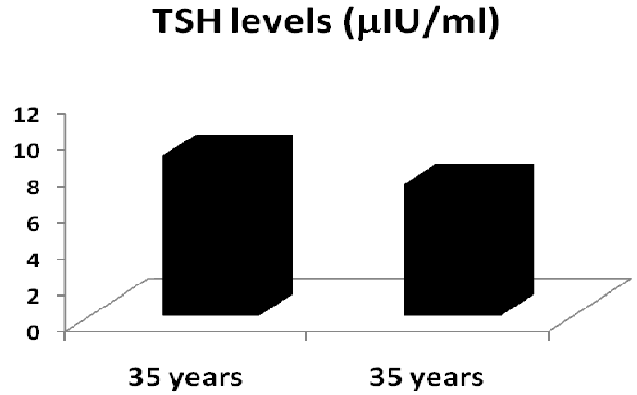
Comparison of cord blood TSH levels among newborns with different birth weight. (LBW= birth weight of newborn < 2500g and NBW= birth weight of newborn ≥ 2500g; **P=0.02: statistically very significant).



Head circumference was measured in centimeters and correlated with TSH levels of all 187newborns. There was no statistically significant correlation between these two parameters.Ponderal Index (PI) was calculated using the formula Ponderal index= Weight/Length * 100. It was correlated with the TSH levels of all 187 newborns.Ponderal Index exhibited a significant negative correlation (P=0.012) with cord blood TSH levels. The maternal factors chosen for the current study like parity, maternal age and mode of delivery did not show statistically significant changes as shown in Graphs 3-5. Babies of young mothers with age less than 35 were compared with babies of elderly mothers whose age were greater than or equal to 35. Based on parity, mothers were divided into two groups i.e. Primigravida and multiparous for comparative studies. Based on mode of delivery (MOD), newborns were grouped into 2 groups, which included those born to mothers with NVD (Normal vaginal delivery) and those to mothers with I/LSCS (instrumental/Lower segment caesarean section).

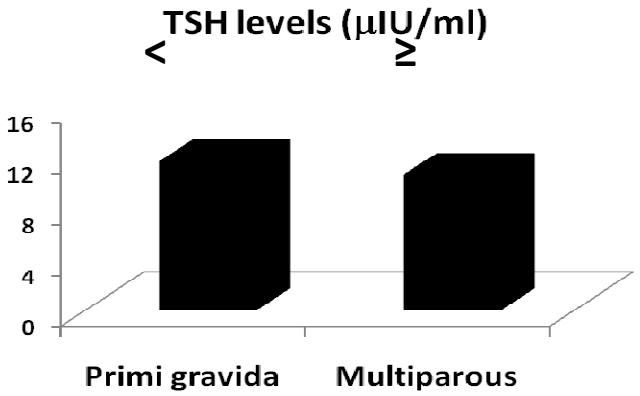
Graph 3

Relationship between cord blood TSH levels among newborns and their maternal age.



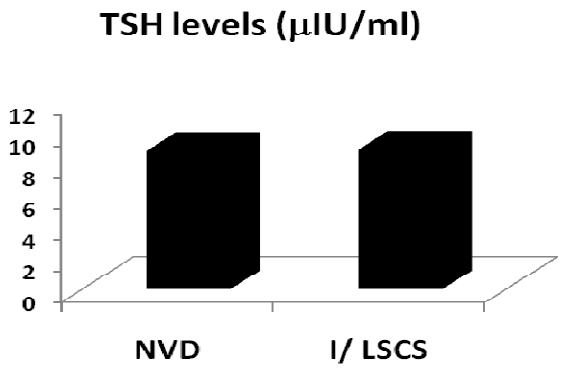
Graph 4

Relationship between cord blood TSH levels among newborns and parity of mother.



Graph 5

Relationship between cord blood TSH levels among newborns and mode of delivery. (NVD= normal vaginal delivery and I/LSCS= Instrumental or lower segment caesarean section)



DISCUSSION

Cord blood TSH levels were significantly higher in male neonates as compared to female neonates in the current study population. Our study is in agreement with an earlier study which also has revealed a significant increase in TSH levels in male neonates as compared to females when the newborns weighed <2500g and were all term neonates [9]. The present study revealed that the LBW newborns had significantly higher TSH levels at birth as compared to NBW group. We hypothesize that the intrauterine malnutrition or placental defects leading to fetal hypoxia and acidosis can trigger the HPT axis in the last 2 trimesters in LBW babies and hence contribute to the ↑TSH levels.The current study has identified its relationship of TSH with anthropometric data of newborns. The ponderal index (PI) is a widely accepted measure of disproportionate growth or asymmetrical growth retardation by pediatricians worldwide. Poor maternal nutritional status can result in fetal adaptation to a growth restricted environment via the modulation of the pituitary-thyroid (HPT) axis thereby altering the endocrine milieu, thus affecting fetal growth. Studies have shown correlation between poor nutritional statuses of mothers with changes in TSH levels of newborns at birth [10]. In the current study we also observed the similar tendency of negative

correlation between PI and cord blood TSH levels.In response to stress, the production of hormones including epinephrine, norepinephrine, and cortisol is increased. These increases alter the hypothalamic–pituitary–adrenal (HPA) axis, which is also involved in thyroid hormone production [11]. Thus we hypothesize that the significant negative correlation between PI and cord blood TSH levels further potentiates the theories put forth by earlier studies that prenatal stress has an impact on the anthropometry of newborns.Earlier studies have indicated that the mode of delivery should be taken into consideration in the interpretation of umbilical cord plasma TSH results [12]. Studiesindicate that babies born vaginally had statistically significantly higher umbilical cord plasma TSH than babies born by caesarean section [12,13]. They hypothesize that the changes in cord blood TSH levels are a reflection of the fetal changes inresponse to perinatal stress events. Scientific literature states that among twins born with more than 20% discordance in weight and in second born twins, the cord blood TSH levels at birth are significantly higher [14]. Our present study has no cases of twin pregnancy and our results vary from the above data revealing that mode of delivery had no statistically significant influence on the TSH levels of newborns. The present study gives a scope for the possibility of extending our study to compare the lipid profile changes of newborns with their TSH changes at birth as the scientific literature regarding the same is very scanty.

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