DOES CORD BLOOD OF THYROID STIMULATING HORMONE, T3 AND T4 LEVELS IN INFANTS DIFFER IN DIFFERENT MODES OF DELIVERIES? A COMPARATIVE STUDY

Naser Malas JBOG[*], *Ibraheem Ayad JBOG*[*]

ABSTRACT

Objective: To determine whether the levels of cord blood TSH, T3 and T4 are affected by different modes of delivery.

Methods: This study was conducted out at Princess Haya Hospital over five months period (November 2004-March 2005). Cord blood samples for TSH, T3 and T4 were taken immediately from neonates delivered by normal vaginal delivery and Caesarean Sections either as emergency or elective. One hundred and fifty cord blood samples were obtained from three groups (group I- 50 neonates delivered by normal vaginal delivery, group II- 50 neonates delivered by emergency Caesarean Section and group III- 50 neonates delivered by elective Caesarean Section). All mothers of these neonates had no medical problems. Measurements of TSH, T3 and T4 levels were performed using IMX assay, which is a Micro particle Enzyme Immunoassay (MEIA) for TSH, T4 and T3. Simple descriptive statistics was used T-test was used to determine statistically difference between the study groups.

Results: The mean level of TSH in the cord blood samples taken from neonates delivered by normal vaginal delivery and emergency Caesarean Section was significantly lower than in elective Caesarean Section ($p<0.005$; 5.9±1.0 m I/ml, 5.8.±1.3 m I/ml and 7.4 ± 1.4m I/ml respectively). Regarding T3 and T4, they were significantly higher in elective Caesarean Section than in normal vaginal delivery and in emergency Caesarean Section ($p<0.05$; T4 and T3 were 4.1±1.1 n g/dl, 6.9+1.5 pg/d L 2.1±1.3 n g/dl 5.5±15 pg/dl and 5.8±1.3 n g/dl and 5.9±2.5 pg/dl, respectively).

Conclusion: Our results showed that TSH, T3 and T4 are lower in normal vaginal delivery and emergency Caesarean Section than in elective Caesarean Section.

Key words: Fetus, Mode of delivery, TSH, T3 and T4

JRMS August 2008; 15(2): 34-37

Introduction

Thyroid stimulating hormone (TSH), or thyrotropin, is a glycoprotein synthesized and secreted by the thyrotropes of the anterior pituitary gland. It has a molecular weight of about 28,000. TSH stimulates synthesis and secretion of the triiodothyronine (T3) and thyroid hormones, thyroxin (T4).[1]

*From the Department of Obstetrics and Gynecology, Princess Haya Hospital, (PHH), Aqaba-Jordan
Correspondence should be addressed to Dr. N. Malas, P. O. Box: 849 Aqaba 77110.
Manuscript received July 3, 2005. Accepted December 15, 2005

Cord blood is a source for the determination of thyroid related hormones in neonates.[2] The exposure of the neonate to the surrounding atmosphere after delivery may evoke the anterior pituitary gland to secrete extra hormones of TSH peaking at 30 minutes after birth resulting in an augmentation of conversion of T3-to-T4 in the liver.[3]

Thyroid hormones play an important role in the fetus, since they are essential for the maturation, differentiation and development of many organs, in particular the brain.[4] The various steps of the hormone action on the fetal brain are not well known.[5]

Although the relationship between cord blood TSH level and intra partum stress is well reported, data regarding the relationship between ante partum conditions and cord TSH level is sparse.[6] Variable studies showed that thyroid hormones were influenced by instrumental deliveries, fetal distress, and failure to progress, and TSH may reach up to or more than 15 mlU/L, while others found that both elective and emergency Cesarean section (C/S) were not associated with elevated cord TSH[7]. Our study was carried to assess the influence of mode of delivery on fetal TSH, T3 and T4.

Methods

This was a prospective study carried at Princess Haya Hospital over five months period (November 2004-March 2005). From the 882 term deliveries in our department during the period of study, cord blood samples were taken from 150 selected primi and multi-parous term pregnancies and these were enrolled as: (group I) 50 neonates delivered as normal vaginal delivery (35 primi and 15 multi), (group II) 50 neonates as elective C/S at completed 37 weeks (17 primi and 33 multi) and (group III) 50 as emergency C/S (7 primi and 43 multi). We selected mothers for the three groups to be singleton, within the near age group and gestational age. Exclusion criteria included mothers with thyroid disease or any medical disorder, neonates with confirmed congenital hypothyroidism proved later on by investigations and clinical features. Cord blood samples were taken immediately for neonates delivered by normal vaginal delivery and C/S either as elective or emergency C/S.

Methods of measurements of TSH, T3 and T4 levels were performed using the IMX assay which is a Micro particle Enzyme Immunoassay (MEIA) for the quantitative determination of thyroid stimulating hormone (TSH) in human serum and plasma, the same methods were used for T4 and T3.

Cord blood of five ml was taken immediately after delivery from the cord, which is toward the placenta after clamping it close to the neonatal umbilicus, and sent to the laboratory for processing the results of TSH, T4 and T3. The blood samples were allowed to separate for at least 15 min then centrifuged at 4000 rpm for five minutes. If collected out- with normal laboratory hours the blood was stored at $4C^{o}$ (maximum 15 hours) before processing the next day. Coefficients of variation were calculated within the assay of hormones. Simple descriptive statistics was used T-test was used to determine statistically difference between the study groups.

Results

Data were collected from 150 infants prospectively and immediately after delivery. The mean birth weight in normal vaginal delivery, emergency C/S and elective C/S was within average weight, the gestational age and the duration of first stage of labor for ND and emergency C/S were within normal range also (Table I). The neonatal weights were very near and the P value was < 0.05 which was not statistically significant (Table I).

The mean level of TSH in the cord blood samples taken from neonates delivered by normal vaginal delivery and emergency C/S was significantly lower than in elective C/S ($p<0.005$; 5.9±1.0 m I/ml, 5.8.±1.3 m I/ml and 7.4 ± 1.4m I/ml respectively) (Table II).

T3 and T4 were significantly higher in elective C/S than in normal vaginal delivery and in emergency C/S ($p<0.05$). T4 and T3 were 4.1±1.1 ng/dl, 6.9+1.5 pg/d L 2.1±1.3 ng/dl 5.5±15 pg/dl and 5.8±1.3 ng/dl and 5.9±2.5 pg/dl, respectively. Mean umbilical plasma concentrations of TSH and thyroid hormones were significantly higher in the elective cesarean than into other two labor groups ($p<0.005$ for TSH and $p<0.05$ for T4 and T3).

Within assay of hormones the coefficients of variation of TSH, T3 and T4 were calculated as 2-5%, 2-7% and 2-6% respectively.

Normal vaginal delivery and emergency C/S compared to elective C/S have shown impact on TSH, T3 and T4.

Table I. Parity, birth weight, gestational age and duration of labor in different modes of delivery

Mode of delivery	Parity		Birth Weight (g)		GA (weeks)		Duration of labor	
	Primi No	Multi No	Primi No	Multi No	Primi No	Multi No	Primi No	Multi No
ND*	35	15	3.150±250†	3.300±350†	40±0.2	39±0.6	10±1.5	4. ±1
Emergency C/S	17	33	3.190± 240†	3.270± 200†	39±0.4	39±0.2	5±0.5	4±2.1
Elective C/S	7	43	3.300± 150†	3.330±60†	38±0.2	38±0.1	_____	_____

*ND= Normal Delivery † P value < 0.05 (not significant)

Table II. Cord blood levels of TSH, T4 and T3 in different modes of deliveries

Hormone levels with modes of deliveries	TSH	T4	T3
ND^	5.9±1.0 m I/ml *	2.1±1.3 ng/ d l **	5.5±1.5 pg /ml **
Emergency C/S	5.8±1.3 m I /ml *	2.1±1.9 ng / dl **	5.9±2.5 pg /ml **
Elective C/S	7.4 ±1.4 m I /ml *	4.1±1.1 ng / dl **	6.9±1.5 pg /ml **

^ND= Normal Delivery

Normal ranges of TSH, T4 and T3 in our laboratory are (0.40- 4.00 m I/ml, 0.80 -1.90 ng/dl and 1.5 -4.10 pg/ml respectively)

* P <0.005, ** P< 0.05.

Discussion

The fetal thyroid and pituitary thyroid axis start to function late in the first trimester of pregnancy. The secretory activity of fetal thyroid gland begins to increase by mid-gestation and total T4 levels rise progressively in the fetal blood until term.[8] The threshold for negative feed back from thyroid hormones to the pituitary in the fetus is higher as compared to adult. Serum T4 and TSH levels showed a wide scatter or variability. Fetal serum T4 concentration rise from approximately 25 nmol/L at 12 weeks to 128 nmol/L near term, similarly serum TSH gradually rises from 4-8 m IU/L between 12 weeks and term.

The World Health Organization (WHO) has included neonatal TSH as one of the indicators for assessing iodine deficiency of neonates.[9] So it is vital to determine whether the level of TSH is affected by some perinatal factors, like mode of delivery in order to determine exactly the neonatal thyroid status.

Although the relationship between cord blood TSH level and intrapartum stress is well reported, data regarding the relationship between antepartum conditions and cord TSH level is sparse.[6] Cord blood thyroid-stimulating hormone level is elevated among neonates who undergo more perinatal stress, like progressive normal vaginal delivery and instrumental delivery, others found that both elective and emergency Cesarean section were not associated with elevated cord TSH.[7]

In our study, we obtained the same results as in international studies, where we found that the mean umbilical plasma TSH, T3 and T4 concentrations in the labor group including emergency C/S were lower than the elective cesarean section group. Bird obtained similar results that support our findings. These results suggest that labor reduces plasma thyroid hormone concentrations at birth in association with a rise in cortisol.[10]

Tahirovic explained that cord blood thyroxin level is reduced in emergency caesarean section, by the induced transient hypothyroxinemia in neonates with birth asphyxia that lead to emergency cesarean section.[11] However, Lao demonstrated that babies born vaginally had statistically significantly higher umbilical cord plasma TSH but similar T4 concentrations than babies born by caesarean section.[6] Also, in neonates delivered by vacuum extraction TSH level was significantly higher than that following normal vaginal delivery, according to Miyamoto.[12]

Conclusion

Our results showed that TSH, T3 and T4 are lower in normal vaginal delivery and emergency Caesarean Section than in elective Caesarean Section.

References

1. **Mariotti S.** Normal physiology of the hypothalamic-pituitary-thyroid system and relation to the neural system and other endocrine glands. *TSH* 2002; 4: 1-9.
2. **Abbas HG, Elhai S, Khan MS, Naeem M.** Serum thyroxine (T4) and thyroid stimulating hormone (TSH) levels in cord blood of newborns in Lahore. *Pak J Med Sci* 2003; 19(3):211-216.

3. **Ramezani TF, Aghaee M, Asefzadeh S.** The Comparision of Thyroid Tests in Cord Blood Following Cesaerean Section or Vaginal Delivery. *International Journal of Endocrinology and Metabolism* 2003; 1: 22-26.
4. **Williams FLR, Mires GJ, Barnett C, *et al.*** Transient hypothyroxinaemia in preterm infants; the role of cord sera thyroid hormone levels adjusted for prenatal and intrapartum factors. *Journal of Clinical Endocrinology & Metabolism* 2005; 10: 210-1214.
5. **Bellabarba D.** Effect of thyroid hormones on brain development. Thyroid Research in Canada - Parts 1 and 2, 2005; 13(2): 1-9.
6. **Chan LYS, Chiu PY, Lau TK.** Cord blood thyroid-stimulating hormone level in high-risk pregnancy. *Acta Obstetrician et Gynecologica Scandinavica* 2003; 82(1): 28-31.
7. **Chan LYS, Leung TN, Lau TK.** Influences of perinatal factors on cord blood thyroid-stimulating hormone level. *Acta Obstetricia et Gynecologica Scandinavica* 2001; 80(11): 1014 -1018.
8. **Burrow GN, Golden LH.** Fetal thyroid function. Endotext 2002; Chapter 1 (Section 2): 1-7.
9. **Delange F.** Screening for congenital hypothyroidism used as an indicator of the degree of iodine deficiency and of its control. *Thyroid* 1998; 8(12): 1185-1192.
10. **Bird JA, Spencer JA, Mould T, Symonds ME.** Endocrine and metabolic adaptation following caesarean section or vaginal delivery. *Arch Dis Child Fetal Neonatal Ed* 1996; 74(2): 132-134.
11. **Tahirovic HF.** Transient hypothyroxinemia in neonates with birth asphyxia delivered by emergency cesarean section. *J Pediatr Endocrinol* 1994; 7(1):39-41.
12. **Miyamoto N, Tsuji M, Imataki T, *et al.*** Influence of mode of delivery on fetal pituitary-thyroid axis. *Acta Paediatr Jpn* 1991; 33(3): 363-368.