Original Article

Effect of Various Perinatal Factors on Cord Blood TSH Levels: A Cross-Sectional Study

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ABSTRACT

Background: Congenital hypothyroidism (CH) is one of the most common preventable causes of mental retardation (MR). Due to the typically asymptomatic nature of congenital hypothyroidism (CH) in newborns, universal screening is necessary. Cord blood TSH (CB-TSH) levels have good sensitivity. However, many maternal and perinatal factors cause variations in Cord blood TSH levels, which can interfere with interpreting its levels and diagnosis. **Aim:** This study was done to determine various maternal and perinatal factors affecting CB-TSH levels. **Materials and Methods:** A cross-sectional study was conducted in the Department of Paediatrics and Neonatology in a Tertiary care centre. Cord blood TSH level was estimated, and the results were statistically analysed concerning various maternal and perinatal factors. A TSH cut-off of >20microIU/ml was considered as high. **Results:** The median Cord blood-TSH was 7.945microIU/L (Interquartile range = 6.475 – 12.82) with 10% (n=13) of newborns had elevated cord blood TSH levels (>20 microIU/ml). Among them, 2.3%(n=3) of newborns had subclinical hypothyroidism (serum TSH 10-20 microIU/ml, normal FT4). No babies were found to have overt hypothyroidism—requirement of resuscitation, low birth weight, birth asphyxia, and low Appearance, Pulse rate, Grimace, Activity, and Respiratory effort (APGAR) score, maternal (add a comma after APGAR score) diabetes and antenatal complications (other than hypertension/Diabetes (DM)/ hypothyroidism) showed a significant association even on multivariate analysis. Preterm gestation, male gender, and maternal hypothyroidism were significant in univariate analysis. The mean TSH levels found in our study were 11.96 ± 15.01. The correlation between cord blood TSH and 72-hour thyroid profile was found insignificant because of a low number of babies with high cord TSH. **Conclusions:** Since various maternal and perinatal factors affect the levels of TSH in cord blood, any increase in cord TSH should be interpreted in the context of these circumstances.

Key words: Cord blood TSH, Congenital hypothyroidism, maternal factors, perinatal factors

The thyroid gland is one of the endocrine glands responsible for secreting thyroid hormones and maintaining the body's physiology. These hormones are crucial for the body's developmental, growth, and metabolic functions. Thus, a thyroid hormone shortage causes cretinism, intellectual impairment, small stature, and other conditions [1]. Pregnant women have more dietary iodine needs than nonpregnant, due to increased thyroid hormone secretion, high kidney iodine elimination, and increased foetal iodine needs. In areas of minimal to moderate iodine deficiency whole-body iodine stores (not iron) decline gradually from 1st to third trimester of pregnancy [2]. CH is due to inadequacy of T3 and/or T4 in newborn infants and is one of the most common causes of MR which can be preventable.

Early diagnosis and treatment are of utmost importance in CH because the majority of newborns are before asymptomatic and may develop permanent features of cretinism if not detected, hence screening is of utmost importance [3]. The results of CH have improved since the implementation of newborn screening (NBS) due to early diagnosis and prompt thyroxine replacement is possible. Like many other developing nations, India lacks a national NBS program for the early detection of CH [4]. Three screening strategies are employed for congenital hypothyroidism (CH): initial thyroid-stimulating hormone (TSH) measurement followed by thyroxine (T4) testing in newborns with elevated TSH levels; initial T4 measurement with subsequent TSH assessment in infants with low T4 levels; and simultaneous measurement of both T4 and TSH levels. Although the simultaneous measurement approach is considered ideal, it is not yet routinely implemented due to practical limitations [5].

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Both heel-stick and cord blood tests are quite sensitive; cord TSH had a lower recall rate than capillary dried blood from a heel stick, which was caused by early sampling at least where early discharge is the norm or recall is difficult [6]. Indian Academy of Paediatrics recommends the use of cord blood samples for screening for CH. Very few reports of cord blood values of TSH or T4 exist in Indian literature [7]. Even when the results of the NBS thyroid test are normal, we still need to rule out hypothyroidism when a patient presents with clinical symptoms and regardless of NBS results, measurement of TSH and FT4 should be done [8].

Clinical manifestations of congenital hypothyroidism may not appear until a few weeks after birth, even in athyreotic newborns, due to the passage of maternal thyroid hormones through the placenta, thus it is not possible to predict newborn affection, hence screening for CH is necessary in all newborns [9]. While there is consensus on raised cord blood (CB), and TSH levels in infants born at low gestational ages (preterm), there is conflicting data regarding the effects of other perinatal variables on cord blood TSH levels. This study focused on examining the impact of maternal and perinatal factors on cord blood thyroid-stimulating hormone (TSH) levels in neonates born at a tertiary care medical college centre in Nagpur, India.

MATERIAL AND METHOD

The present descriptive cross-sectional study was conducted at the Department of Paediatrics and Neonatology, AIIMS Nagpur, from July 2023 to July 2024, after obtaining approval from the Institutional Ethics Committee. 130 newborns were included, with non-probability consecutive sampling used for case selection according to the inclusion criteria. The inclusion criteria comprised all eligible newborns delivered at AIIMS Nagpur, while exclusions included while newborns whose parents refused consent, those with major congenital malformations and stillbirths are excluded. Informed consent was obtained from the parents of all enrolled newborns.

Around 3ml of blood was collected in a sterile container drawn from the umbilical vein by a 5cc syringe immediately after birth. The sample was analyzed by using the CLIA method [Chemiluminescence Immunoassay]. The normal value by this method is 0.87 to 6.15microIU/L. Values more than 20microIU/ml were considered abnormal. On the third postnatal day, demographic details and other relevant information about the mother and newborn were recorded on a case record proforma. Newborns with elevated cord-blood TSH (CBTSH) levels (>20microIU/ml) were further evaluated with T3, T4, and TSH values from the baby's venous sample at 72 hours of life.

Sample size

Based on a prior study, and assuming a proportion of males with normal cord thyroid-stimulating hormone (TSH) levels of 57.1% and a proportion with elevated cord TSH levels of 31.5%, a sample size calculation was performed. Utilizing an alpha level of 5%, a power of 80%, and employing a chi-square test, the minimum required sample size per group was determined to be 58, resulting in a total sample size of 116. Furthermore, considering the proportion of newborns experiencing fetal distress with normal cord thyroid-stimulating hormone (TSH) levels at 9.4% and elevated cord TSH levels at 40.7%, and utilizing an alpha level of 5% and a power of 80%, the minimum required sample size was calculated to be 29 per group, totalling 58 samples. Consequently, the larger sample size of 116 was selected as the minimum required sample size for this study and is rounded off to 130. The final sample size was decided to be 130 based on the secondary objective of the present study compared to previous studies.

Statistical analysis

Statistical Analysis was performed with the help of Epi Info (TM) 7.2.2.2. EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC). Descriptive statistical analysis was performed to calculate the means with corresponding standard deviations (SD). A test of proportion was used to find the Standard Normal deviation (Z) to compare the difference proportions. The odds ratio (OR) with a 95% confidence interval (CI) was calculated to find the risk factors. $P < 0.05$ was taken as statistically significant. Maternal and Perinatal factors were evaluated as categorical variables for analysis of their association with Cord TSH, which was done using the chi-squared test. All the variables were normally distributed.

RESULT

The demographic details of the children who participated in the study are described in Table 1

Table 1. Demographic data of newborns with high and normal TSH

Variables	Newborns with TSH >20µIU/mL (%)	Newborns with normal TSH (%)
Maternal age (years)		
<30	8 (9.5%)	**76** (90.5%)
≥30	5 (10.9%)	41 (89.1%)
Gravida		
Primipara	6 (10.7%)	50 (89.3%)

Multipara	7 (9.5%)	67 (90.5%)
Maternal Diabetes		
Yes	3 (42.9%)	4 (57.1%)
No	10 (8.1%)	113 (91.9%)
Maternal Hypothyroidism		
Yes	5 (33.3%)	10 (66.7%)
No	8 (7%)	107 (88.5%)
Other antenatal complications		
Yes	10 (18.2%)	45 (81.8%)
No	3 (4%)	72 (96%)
Gender		
Male	10 (15.2%)	56 (84.8%)
Female	3 (4.7%)	61 (95.3%)
Period of gestation (weeks)		
Pre-term	8 (27.6%)	21 (72.4%)
Full term	5 (5%)	96 (95%)
Birth weight (kg)		
Low	9 (19.1%)	38 (80.9%)
Normal	4 (4.8%)	79 (95.2%)
Mode of delivery		
LSCS and Assisted	9 (13.2%)	59 (86.8%)
NVD	4 (6.5%)	58 (93.5%)
APGAR 1min		
<7 (birth asphyxia)	11 (20%)	44 (80%)
≥7 (normal)	2 (2.7%)	73 (97.3%)
APGAR 5min		
<7	9 (37.5%)	15 (62.5%)
≥7	4 (3.8%)	102 (96.2%)
APGAR 10min		
<7	6 (60%)	4 (40%)
≥7	7 (5.8%)	113 (94.2%)
Appropriate for gestation age		
SGA	3 (7.8%)	35 (92.1%)
AGA	10 (10.8%)	82 (89.1%)
Maternal Hypertension		
Yes	5 (17.2%)	24 (82.8%)
No	8 (7.9%)	93 (92.1%)
Maternal TSH		
High	2 (14.3%)	12 (85.7%)
Normal	7 (9.6%)	66 (90.4%)
Maternal thyroid drug intake		
Yes	2 (14.2%)	12 (85.7%)
No	11 (9.4%)	105 (90.5%)
Resuscitation required		
Yes	7 (22.6%)	24 (77.4%)
No	6 (6.1%)	93 (93.9%)

Note: **TSH** – Thyroid stimulating hormone; **LSCS** - Lower Segment Cesarean Section; **NVD** - Normal vaginal delivery; **ASA** - Appropriate for gestational age; **SGA** - Small for gestational age; **APGAR** - Appearance, Pulse rate, Grimace, Activity, and Respiratory effort

A total number of 130 newborns were enrolled in the study. The median Cord blood-TSH was 7.945microIU/L (IQR = 6.475 – 12.82) with 10% (n = 13) of newborns had elevated cord blood TSH levels(>20microIU/ml). Among them 2.3% (n = 3) newborns had subclinical hypothyroidism (serum TSH 10-20 micro IU/ml), normal FT4). They were advised to follow up with repeat TSH and FT4. No babies were found to have overt hypothyroidism.

Table 2: Comparison of means of different parameters

Parameters	Cord TSH	Mean	SD	t-value	p-value
Maternal age (year)	High	27.23	4.42	0.82	0.425 NS
	Normal	28.29	4.45		
Parity	High	1.69	0.85	0.93	0.367 NS
	Normal	1.93	1.10		
Maternal TSH (mIU/L)	High	3.67	2.73	1.06	0.310 NS
	Normal	2.71	2.37		
Gestational age (weeks)	High	33.85	3.86	3.85	0.002 S
	Normal	38.05	2.14		
Birth weight(kg)	High	2.09	0.82	2.16	0.049 S
	Normal	2.59	0.62		
APGAR at 1 minute	High	5.31	2.32	3.25	0.007 S
	Normal	7.43	1.12		
APGAR at 5minute	High	6.23	1.74	4.73	<0.0001 S
	Normal	8.55	0.90		
APGAR at 1 minute	High	7.15	1.57	4.24	0.001 S
	Normal	9.03	0.71		
Cord TSH value(mIU/L)	High	46.85	28.43	4.91	<0.0001 S
	Normal	8.08	3.93		
FT3 at 72hour	High	4.36	3.57	NA	NA
	Normal	NA	NA		
FT4 at 72hour	High	5.26	3.51	NA	NA
	Normal	NA	NA		
TSH at 72hour (mIU/L)	High	6.19	3.82	NA	NA
	Normal	NA	NA		

Note: **TSH** – Thyroid stimulating hormone; **APGAR** - Appearance, Pulse rate, Grimace, Activity, and Respiratory effort; **FT3** - free triiodothyronine; **FT4** - free thyroxine; NS – Not significant; NA – Not applicable; S – Significant

Maternal hypothyroidism and gestational age were significant in univariate analysis as shown in Table 3. Maternal age, maternal TSH levels, mode of delivery (vaginal, assisted delivery, lower segment caesarean section), gestational age, and maternal thyroid drug intake did not show any significant effect.

Table 3: Comparison of cord blood TSH for different parameters

Parameters	Mean Cord TSH	SD	t-value	p-value
Cord TSH				
High	46.85	28.43	4.91	<0.0001 S
Normal	8.08	3.93		
Maternal age (years)				
<30	11.96	14.35	0.01	0.999 NS
≥30	11.96	16.32		
Gravida				
Primipara	12.26	15.19	0.20	0.843 NS
Multipara	11.73	14.98		
Antenatal complications				
Yes	12.71	14.24	0.66	0.511 NS
No	10.91	16.11		
Diabetes				
Yes	34.62	37.96	4.39	<0.0001 S

No	10.67	11.68		
Maternal Hypothyroidism				
Yes	27.43	35.02	4.56	<0.0001 S
No	9.94	8.30		
Other complications				
Yes	16.02	21.30	2.38	0.021 S
No	8.98	6.37		
Gender				
Male	13.97	19.74	1.58	0.118 NS
Female	9.88	7.14		
Period of gestation (weeks)				
Pre-term	20.81	27.68	2.20	0.036 S
Full term	9.42	6.85		
Birth weight (kg)				
Low	16.91	22.21	2.32	0.024 S
Normal	9.16	7.47		

Table 3(continued): Comparison of cord blood TSH for different parameters

Parameters	Mean	SD	t-value	p-value
Mode of delivery				
LSCS	14.12	19.72	1.80	0.076 NS
NVD	9.59	6.20		
APGAR 1				
<7	15.77	19.74	2.53	0.013 S
≥7	9.17	9.48		
APGAR 5				
<7	21.07	24.28	2.20	0.037 S
≥7	9.90	11.16		
APGAR 10				
<7	37.25	38.33	6.33	<0.0001 S
≥7	9.85	8.66		
Appropriate for gestation age				
SGA	11.33	10.79	0.36	0.719 NS
AGA	12.22	16.49		
Hypertension				
Yes	15.22	14.29	1.38	0.176 NS
No	11.02	15.15		
Maternal TSH				
High	12.84	11.98	0.41	0.685 NS
Normal	11.35	14.13		
Maternal thyroid drug intake				
Yes	11.50	11.65	0.15	0.883 NS
No	12.01	15.41		
Resuscitation required				
Yes	18.08	20.34	2.66	0.009 S
No	10.04	12.43		

Note: **TSH** – Thyroid stimulating hormone; **LSCS** - Lower Segment Cesarean Section; **NVD** - Normal vaginal delivery; **ASA** - Appropriate for gestational age; **SGA** - Small for gestational age; **APGAR** - Appearance, Pulse rate, Grimace, Activity, and Respiratory effort; NS – Not significant; S – Significant

Maternal diabetes mellitus, Antenatal maternal complications (other than hypertension, diabetes, hypothyroidism), low birth weight, low APGAR score at 5 minutes (birth asphyxia), and newborns requiring resuscitation were found to be significantly associated with falsely elevated cord blood TSH levels. (P <0.01) as per Table 4.

Table 4: Logistic Regression after adjusting confounding factors

Variables	Odds Ratio (OR)	95% CI of OR		p-value
		Lower	Upper	
Significant risk factors				
Diabetes	8.72	1.76	37.91	0.018 S
Low birth weight	6.59	1.73	25.32	0.024 S
Appropriate for gestation age	3.03	1.01	4.68	0.028 S
Low APGAR Score at 5minute	9.00	1.09	14.08	0.041 S
Other complications	4.26	1.06	17.17	0.042 S
Resuscitation required	3.53	1.01	12.34	0.044 S
Risk factors but not significant				
Maternal Hypothyroidism	7.78	0.83	16.82	0.061 NS
Low APGAR Score at 10 minute	6.71	0.88	15.87	0.066 NS
Antenatal complications	3.14	0.50	9.83	0.224 NS
Maternal Hypertension	3.69	0.40	11.01	0.249 NS
Low APGAR Score at 1 minute	3.36	0.27	42.53	0.349 NS
Primiparity	1.11	0.30	4.07	0.877 NS
Male	1.12	0.16	7.71	0.911 NS
Not a risk factor				
Maternal high level of TSH	0.04	0.01	2.75	0.139 NS
LSCS	0.17	0.01	3.86	0.268 NS
Maternal age<30 years	0.71	0.19	2.75	0.624 NS
Maternal thyroid drug intake	0.91	0.09	9.07	0.933 NS
Pre-term	0.96	0.11	8.35	0.972 NS

Note: TSH – Thyroid stimulating hormone; **LSCS** - Lower Segment Cesarean Section; **APGAR** - Appearance, Pulse rate, Grimace, Activity, and Respiratory effort; NS – Not significant; S – Significant

The mean TSH levels found in our study were 11.96 ± 15.01 as shown in Table 5. The correlation between cord blood TSH and 72-hour thyroid profile was found insignificant because of a low number of babies with high cord TSH. The mean level of Cord TSH was higher among mothers with primigravida, antenatal complications, diabetes, hypothyroidism, and other complications, pre-term and low birth ($p<0.05$). The mean levels of cord TSH were higher among mothers with LSCS, hypertension, and high maternal TSH, and low APGAR scores. After adjusting the confound factors, maternal diabetes, low birth weight, low APGAR score at 5minute, other complications, and resuscitation required were found to be significant risk factors of high cord TSH.

Table 5: Mean cord TSH estimation

Variable	Observed no.	Mean ± SD
Cord TSH	130	11.9 ± 15
72-hour serum TSH	13	6.19 ± 3.8
fT4	12	3.78 ± 3.4
fT3	10	3.73 ± 2.2

Note: TSH – Thyroid stimulating hormone; **FT3** - free triiodothyronine; **FT4** - free thyroxine; SD – Standard deviation

Correlation between cord TSH and T3, T4, and TSH revealed a negative correlation between cord blood TSH levels and a 72-hour fT3 as shown in Table 6. (Considered insignificant, since insufficient sample.)

Table 6: Correlation between cord TSH and 72 hours serum TSH

Variable	Cord TSH	
	Spearman rho	P-value
72-hour serum TSH	-0.0055	0.98
fT4	-0.0629	0.84
fT3	-0.30	0.38

Note: TSH – Thyroid stimulating hormone; **fT3** - free triiodothyronine; **fT4** - free thyroxine; SD – Standard deviation

DISCUSSION

Congenital hypothyroidism (CH) is due to absent or inadequate thyroid hormone production at birth or, less commonly, due to transient thyroid dysfunction attributable to transplacental passage of maternal drugs or blocking antibodies or iodine deficiency or excess. There are very few studies in India on screening for Congenital hypothyroidism and the effects of various factors on Cord blood TSH levels [10]. While there is consensus on raised CBTSH levels in infants born at low gestational ages (preterm), there is conflicting data regarding the effects of other perinatal variables on cord blood TSH levels [11]. Hence this study was done to analyse the influence of

various maternal and perinatal factors on Cord blood TSH levels in newborns born at a tertiary-level teaching hospital in central India. This hospital-based, cross-sectional study was conducted over 13 months following approval from the Institutional Ethics Committee. Consecutive sampling was employed for case selection.

A previous study conducted in Hyderabad, southern India, comparing thyroid parameters in cord blood and postnatal venous samples from 200 neonates, reported a mean thyroid-stimulating hormone (TSH) level of 6.89 ± 4.56 mIU/L [12]. Similarly, other studies have shown lower mean TSH levels: 8.86 mIU/L [13] and 6.16 ± 0.15 mIU/L [14], compared to our study, which found a mean TSH level of 11.96 ± 15.01 mIU/L. This relatively higher mean TSH level in our study may be attributed to the inclusion of a greater number of high-risk mothers and those with antenatal complications, given that the present study was conducted in a tertiary care centre.

In our study, 11.5% of mothers had hypothyroidism, which is significantly higher than the 5% and 7.4% found in other studies [15, 16]. A similar study reported that 7.4% of the mothers in their study had diabetes mellitus, a figure quite close to the 5.4% observed in our study [15]. This contrasts with the findings of another study which noted a higher prevalence of diabetes among mothers at 12% [14]. To the best of our knowledge, no other studies have considered antenatal complications beyond hypertension, maternal hypothyroidism, and diabetes. Our study found that 42.3% of mothers had other complications, such as oligohydramnios, Rh-negative pregnancy, HELLP syndrome, and abruptio placenta. These factors may act like perinatal stressors, which, in turn, lead to catecholamine secretion and can affect cord TSH levels.

The rate of cesarean section (LSCS) in our study was 50.8%, which exceeded the rates reported in other studies (38% and 31%). This suggests a higher prevalence of high-risk pregnancies in our hospital population, potentially contributing to the elevated mean cord thyroid-stimulating hormone (TSH) levels observed in our study compared to those of others [17, 18]. However, a separate study reported an even higher LSCS rate of 75.5% [14]. This study had a significantly higher incidence of birth asphyxia and requirement of resuscitation compared to other studies 3.88% and 15% of babies requiring resuscitation [10, 16]. This discrepancy too, could be attributed to a higher prevalence of maternal antenatal complications and a greater number of high-risk deliveries in your hospital setting. Other parameters like gestational age, birth weight, and gender were similar to a previous study [16]. Similar distributions of these parameters in both studies indicate comparable baseline characteristics of the newborn populations, including gestational age, birth weight, and gender distribution

A novel finding of our study was that maternal diabetes was associated with higher cord blood TSH levels in univariate and multivariate (after adjusting for confounders) analysis. Limited studies have evaluated the association between maternal diabetes and cord thyroid-stimulating hormone (TSH) levels [14, 15, 19]. In contrast to our findings, these studies reported no significant association between maternal diabetes and cord TSH levels. Prior research suggests that maternal hyperglycaemia may induce fetal thyroid dysfunction by altering the expression of thyroid hormone (TH)-regulating genes and affecting T3 and T4 conversion. Additionally, maternal hyperglycaemia may generate oxidative stress and inflammatory response, impacting both maternal and fetal thyroid hormone (TH) utilization and cytokine production, thereby impairing hormone synthesis and metabolism [20].

In the present study, maternal hypothyroidism demonstrated a significant association with cord thyroid-stimulating hormone (TSH) levels in univariate analysis, but not in multivariate analysis. Several other studies have reported similar findings [13, 15, 16]. The underlying mechanism could be an insufficient transfer of maternal thyroid hormones, which in turn elevates fetal TSH levels as a negative feedback mechanism. Similarly, the present study had a significant proportion of mothers with various antenatal complications like abruptio placenta, Acute Kidney Injury (AKI) with Hemolysis, elevated liver enzymes, low platelets (HELLP) syndrome, acute pancreatitis, conceived after ovulation induction, hypokalaemia, oligohydramnios, Premature rupture of membranes (PROM), Rh negative, nephrotic syndrome, severe anaemia, which was found to have significant association after adjusting with confounding.

A study from Maharashtra, India, showed that low birth weight (LBW) was significantly associated with elevated CB-TSH [17]. These results are similar to those observed in our study and another [11]. The increase in abnormally elevated TSH levels in low-birth-weight (LBW) infants could be due to an immature hypothalamic–pituitary–thyroid axis (HPT axis) or nutritional insufficiency- low iodine reserve leading to decreased thyroid gland function), or it may be physiological. LBW may be caused by chronic placental insufficiency seen in gestational diabetes mellitus (GDM)/ Pregnancy-induced hypertension (PIH), etc., but it was found to be a statistically significant risk factor after adjusting for all these confounders.

Our study showed a statistically significant association between preterm gestation and elevated cord blood TSH levels only on univariate analysis (but not after adjusting to confounders), which is inconsistent with other cord blood TSH studies [11, 17]. Also, the immaturity of the HPT axis in preterm infants leads to a TSH surge after birth [21]. Few studies observed no significance of gender on cord blood TSH levels. Our study revealed a significant association between male gender and cord blood thyroid-stimulating hormone (TSH) levels. A separate study investigating cord blood TSH variations in newborns also reported a similar finding [22]. The mechanism of higher levels of thyroid-stimulating hormone (TSH) in cord blood for male infants compared to female infants is not completely understood. Still, it could be due to

inherent differences in hormone regulation even in utero, and male infants might respond differently to the stress of birth compared to female infants, which could influence TSH levels.

Various authors have correlated an increase in TSH values with low APGAR, birth asphyxia, and newborns requiring resuscitation, similar to our study where low APGAR at 5 minutes of life showed significant association even after adjusting for confounding by multivariate analysis [11, 13, 23, 24]. A probable explanation could be that the above factors lead to hypoxia, which causes alpha-adrenergic stimulation, which in turn might be responsible for the observed increase in CBTSH in the subjects who had low APGAR scores and required active resuscitation after birth. A study on neonatal rats demonstrated that perinatal hypoxia increases the secretion of catecholamines, as per a study on cord blood TSH [16]. A similar study on cord TSH levels did not find any difference in the cord TSH concentrations in newborns with low Apgar scores at 1 minute, which might be because of small numbers and low statistical power [19].

The majority of the studies have shown that babies delivered through vaginal mode tend to have significantly higher cord blood TSH levels compared to those delivered via cesarean section [10, 25]. Other authors showed newborns born by assisted delivery had significantly higher levels of cord blood TSH levels than newborns delivered vaginally [16, 25]. However, our study found no significant difference or association between the mode of delivery and cord blood TSH levels in newborns. A surge of catecholamine production occurs in human newborns during parturition, hence explaining the transient elevation of cord TSH in babies born through vaginal delivery or non-elective LSCS [16].

Unlike few authors who had excluded mothers with maternal thyroid drug intake to adjust for confounding factors, we evaluated its association with cord blood TSH levels [19]. It showed no significant association with cord blood TSH levels, a similar observation found by another study on- ‘‘Perinatal factors associated with neonatal thyroid stimulating hormone (TSH) in normal newborns” [15].

Many authors did not find any significant association between maternal age and cord blood TSH level, as seen in our study [15, 18, 25]. We couldn’t find any study with a significant association between maternal age and cord blood TSH levels. In our study, other maternal and perinatal factors, such as maternal parity, small or large for gestation, showed no association with cord blood TSH levels. In contrast, a previous study observed that primiparity had a significant association with elevated cord blood TSH levels, and SGA, and LGA had no association [16]. A moderate negative correlation was found between cord blood TSH levels and a 72-hour fT3. The rest of the parameters did not correlate with cord TSH as seen in Table 6. However, it was considered insignificant because of the low number of newborns with high cord TSH levels.

CONCLUSIONS

The findings from the present study conclude that cord blood TSH levels get falsely elevated due to various maternal and perinatal factors. Maternal diabetes mellitus, other antenatal maternal complications, low birth weight, low APGAR score at 5 minutes (birth asphyxia), and newborns requiring resuscitation were significantly associated with high cord blood TSH levels after adjusting for confounders. Since various maternal and perinatal factors affect the levels of TSH in cord blood, any increase in TSH should be interpreted in the context of these circumstances. This reduces the need for invasive tests and helps to prevent needless re-evaluation, which may be both time-saving and cost-effective.

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