# A Detailed Analysis of the Various Perinatal Factors Influencing Neonatal TSH: Results from a 6 Months Congenital Hypothyroidism Screening Program.

**Dr Vijay Bhalodiya[1], Dr Bhavin B Padhariya[2], Dr Niyati Mehta[3], Dr Lalji Valiya[4*]**
[1,3] Assistant Professor, Department of Pediatrics, GMERS Medical College, Junagadh.
[2,4]Associate Professor, Department of Pathology, GMERS Medical College, Junagadh.

***Corresponding Author:** Dr Lalji Valiya
**E-mail**: drlgvmd700@yahoo.co.in
DOI:10.56018/2023069

**Abstract**
**Background**: The aims of this study are to analyse various perinatal factors influencing neonatal cord blood thyroid stimulating hormone (TSH) level and to find out incidence of congenital hypothyroidism in neonates. **Material and Methods:** A total of 800 newborns whose mother not having any thyroid medications during her pregnancy period were enrolled for the study. Cord blood samples of the neonates were collected for estimation of TSH level at the Laboratory Services of GMERS Medical College, Junagadh. TSH levels above 20mIU/L were considered as having congenital hypothyroidism. The data were compared with other similar international as well as national studies. **Result:** In present study, there was no significant difference in cord blood TSH level when compared for various mode of delivery of newborn, as well as according to birth weight and gender of newborn. There was a statistically significant higher mean cord blood TSH level in newborns whose mother had a history of pregnancy induced hypertension (PIH). One newborn was found to have congenital hypothyroidism. **Conclusions:** It was evident from the present study that newborns whose mother having history of PIH had significantly higher cord blood TSH level. Though incidence of congenital hypothyroidism was rare, routine congenital hypothyroidism screening program was advisable.
**Keywords:** Congenital hypothyroidism, TSH, PIH, Cord blood TSH.

## Inroduction

Congenital hypothyroidism is one of the most common preventable causes of mental retardation in the country. It has an incidence of 1 in 4000 births in various neonatal screening programs.[1] Screening for congenital hypothyroidism is cost-effective tool to prevent mental retardation in the neonates.[2] Thyroid-stimulating hormone (TSH) level estimation from umbilical cord blood is an attractive and a practical step for screening for congenital hypothyroidism. Such programmes for screening are available in developed countries, but are still not available in our country due to lack of available facilities, lack of awareness among treating physicians, cost, and early discharge of neonates due to overburden in the government setups.[3, 4] The use of cord blood TSH as a screening tool for congenital hypothyroidism remains a practical option due to its ease of availability, simplicity, and accessibility. Studies across the world have shown that cord blood remains a good sampling technique for screening of congenital hypothyroidism.[5]

## Material and Methods

The present study was carried out in maternal and neonatal care unit of Department of Paediatrics and Department of Pathology at GMERS Medical College and Hospital, Junagadh from January 2022 to June 2022. The study group comprised of a cohort of neonates born at the GMERS Medical College and Hospital during the study period. The sample size was not predetermined as it was based on cord blood samples obtained during the study period.
Ethical approval was obtained from the ethical committee of the institution.
Inclusion criteria: all live newborns delivered at the GMERS hospital during the study period.
Exclusion criteria: Newborns whose mother were on any thyroid medication.

Written consent for collection of cord blood was obtained from the parents before delivery of the newborns. A 2-3 ml of cord blood was collected in a sterile serum separator tubes (SST II advance, BD Vacutainer™) immediately after birth of the babies, drawn from a 15-20 cm length of umbilical cord incised while severing it at the time of birth of the baby. Thus a mixed umbilical cord blood sample containing blood both from umbilical arteries and veins was obtained.Serum analysis for TSH was carried out. The parameters was measured by Micro plate Enzyme Linked Immunosorbent Assay Kit, DiagnovaEliscan™ T4 manufactured by Ranbaxy Fine Chemicals Ltd. (RFCL). Descriptive statistical analysis, cross- tabulation were applied using the statistical software SPSS 16.0.A.

Records of mother's age, parity, thyroid status, residence, blood pressures, diabetes etc. were kept. The medication / anaesthesia details received by mother were also noted. At birth all the baby were resuscitated, examined and their weight, sex etc. were recorded.

Recall Process: The parents of newborn with cord blood TSH > 20 mIU/L was informed about the test results before discharge from the hospital. Retesting was scheduled on their first revisit to paediatrician that was usually at 1 week of age of the baby.

Statistical Analysis: The mean, median and standard deviation for TSH values of the cohort were calculated by using windows SPSS (15) software. T-test was applied to see the significance of difference in mean TSH value of different groups.

**Results**

A total of 800 newborns were enrolled in the study out of which 424 (53%) were male and 376 (47%) were female. Male to female ratio was 1.12.Table 1 depicts differences in mean cord blood level for TSH, T3 and T4 between male and female newborns which were statistically non-significant.

**Table 1**: **TSH, T3 and T4 levels according to gender**

| **Gender** | **Mean cord blood TSH mIU/L (SD)** | **Mean T3 mIU/L (SD)** | **Mean T4 mIU/L (SD)** |
|---|---|---|---|
| Male | 7.87 (5.14) | 0.89(0.85) | 12.1 (3.9) |
| Female | 7.53 (3.77) | 0.81(0.38) | 11.6 (3.8) |
| P-Value | t=0.368, p=0.71 | t=0.59, p=0.58 | t=0.916,p=0.36 |

Out of a total 800 newborns, 472 (59%) were delivered by normal vaginal delivery (NVD) and 328 (41%) were delivered by lower segment cesarean section (LSCS). NVD to LSCS ratio was 1.43.

**Table 2: TSH, T3, T4 levels according to Mode of Delivery (MOD)**

| **MOD** | **Mean cord blood TSH mIU/L (SD)** | **Mean T3 mIU/L (SD)** | **Mean T4 mIU/L (SD)** |
|---|---|---|---|
| NVD | 5.86(1.96) | 0.84(0.39) | 12.27(3.90) |
| LSCS | 10.38(5.73) | 0.88(0.94) | 11.34(3.77) |
| P-Value | t=5.61,p=0.00 | t=0.27,p=0.79 | t=0.77,p=0.44 |

Table 2 depicts differences in mean cord blood level for TSH, T3 and T4 between newborns delivered by normal vaginal delivery (NVD) and lower segment cesarean section (LSCS) which were statistically non-significant.

All the newborn whose birth weight less than 2.5 kg were categorized as low birth weight (LBW) and those whose birth weight more than 2.5 kg were categorized as normal birth weight. In the present study 624 (78%) newborn had normal birth weight and 176 (22%) newborn had LBW.

**Table 3: TSH, T3, T4 levels according to birth weight**

| **Birth weight** | **Mean cord blood TSH mIU/L (SD)** | **Mean T3 mIU/L (SD)** | **Mean T4 mIU/L (SD)** |
|---|---|---|---|
| >2.5 kg | 5.95(4.79) | 0.86(0.74) | 12.01(4.1) |
| <2.5 kg | 6.17(3.0) | 0.86(0.35) | 11.30(2.7) |
| P-Value | t=2.02 ,p=0.046 | t=0.03.,p=0.98 | t=1.26 ,p=0.21 |

Table 3 depicts differences in mean cord blood level for TSH, T3 and T4 between newborns with birth weight > 2.5 kg and birth weight < 2.5 kg (LBW) which were statistically non-significant. The present study had 56 (7%) newborns whose mother had positive history for pregnancy induced hypertension (PIH) and 744 (93%) newborns whose mother didn't had history of PIH.

**Table 4:TSH, T3, T4 levels according toPIH**

| **Mothers** | **Mean cord blood TSH mIU/L (SD)** | **Mean T3 mIU/L (SD)** | **Mean T4 mIU/L (SD)** |
|---|---|---|---|
| With PIH | 14.4 (6.63) | 0.54(0.21) | 8.86(2.01) |
| Without PIH | 7.21 (3.94) | 0.87(0.69) | 11.92(3.87) |
| P-Value | t=4.41 ,p=0.000 | t=1.25 ,p=0.22 | t=2.07 ,p=0.042 |

Table 4 depicts differences in mean cord blood level for TSH, T3 and T4 between newborns whose mother had history of PIH and without history of PIH. There was statistically significant higher mean cord blood TSH level in mother with PIH in comparison to mothers without PIH while the differences in mean cord blood T3 and T4 levels between the two groups were statistically non-significant.

**Table 5: Distribution of newborns according to cord blood TSH level range**

| **Cord blood TSH level range (mIU/L)** | **No. of newborns** | **Percentage (%)** |
|---|---|---|
| 0-10 | 592 | 74% |
| 11-20 | 184 | 23 % |
| > 20 | 24 | 3% |
| Total | 800 | 100 % |

Table 5 depicts that 592 (74%) newborns had cord blood TSH level between 0-10 mIU/L, 184 newborns had the level between 11-20 mIU/L and only 24 (3%) newborns had the level >20 mIU/L.

**Table – 6: Details of congenital hypothyroidism screening program**

| | |
|---|---|
| Total newborn screened | 800 |
| Mean cord blood TSH (mIU/L) | 7.7 |
| Standard deviation (SD) | 4.45 |
| Total newborns recalled | 24 |
| Recall rate (%) | 3 |
| Repeat thyroid function tests done | 24 |
| Recall response rate (%) | 100 |
| Congenital hypothyroidism confirmed on repeat test | 01 |

Table 6 depicts that out of a total 800 enrolled newborns, congenital hypothyroidism was detected only in 1 newborn even though there was a 100% recall response rate. In the present study incidence of congenital hypothyroidism was 1 in 800.

**Discussion**

Total 800 newborns delivered at our institute during the study period were included in our study. In our study male: female ratio was 1.12:1. We found statistically non-significant difference in mean cord blood TSH level between male and female newborns. In our study regarding the mode of delivery, normal delivery predominates the LSCS delivery. Mean cord blood TSH level was slightly higher in LSCS delivery in comparison to normal delivery but that was statistically non-significant.In our study176 newborns had low birth weight and 624 newborns had normal birth weight. The difference in cord blood TSH level between low birth weight and normal birth weight newborns was statistically non-significant. Our study result is comparable to the study done by Mekonnen et al.[6] which consists of 128 LBW and 790 normal birth weight babies. Study done by Rashmi et al.[7] also

shows similar findings without significant differences in cord blood TSH level according to weight of newborns. In present study 56 out of a total 800 newborns delivered from mothers having PIH. Their mean cord blood TSH level was 14.4 mIU/L which is below the cut off value 20 mIU/L. It suggests that there is no significant relationship between maternal history of PIH and occurrence of congenital hypothyroidism. This finding of our study is correlated with the findings of study done by ward et al.[8] In present study 74% newborns had cord blood TSH level < 10 mIU/L, 26 % newborns had cord blood TSH level >10.00 mIU/L and only 3% newborns had cord blood TSH level > 20 mIU/L. These findings are comparable to the study done at Ethiopia by Mekonnen et al.[6] and also with the study done by Klein et al.[9] In our study 24(3%) newborns were found to had cord blood TSH level more than the cut off value of 20 mIU/L. These 3% newborns were recalled for retesting thus in present study recall rate was 3%. Study done by Hardy JD et al.[10] also used cord blood TSH level and they had a recall rate of 4.5%. Incidence of congenital hypothyroidism in our study was 1 in 800. This finding of our study is much higher as compared to worldwide figure of 1 in 4000[11]. However, studies done at Indian subcontinent by Desai MP et al.[12]and by Manglik Arun Kumar et al.[13] also found higher incidence of congenital hypothyroidism than the worldwide figure which was 1 in 2481 and 1 in 600 respectively.

**Conclusion**

Worldwide incidence of congenital hypothyroidism is 1 in 4000 births. Our study as well as some other studies indicates its higher incidence in India. It is one of a major preventable cause of mental retardation that why its early detection and treatment is of paramount importance. Screening for congenital hypothyroidism can be performed by a simple test. For last many years congenital hypothyroidism screening program has been widely practiced in developed countries. Nowadays even in the developing world congenital hypothyroidism screening program gains considerable importance. There is no national screening program for congenital hypothyroidism in our country till today. The present study concludes that cord blood TSH level is a very effective and attainable method for Congenital Hypothyroidism screening in India. We conclude that cord blood TSH level is not affected by various perinatal factors except maternal PIH. We highly recommend that universal congenital hypothyroidism screening should be included in our national health program.

**References**


1. Desai MP, Colaco MP, Ajgaonkar AR, Mahadik CV, Vas FE, Rege C, et al. Neonatal screening for congenital hypothyroidism in a developing country: Problems and strategies. Indian J Pediatr 1987; 54:571-81.
2. Fagela-Domingo C, Padilla CD, Cutiongco EM. Screening for congenital hypothyroidism (CH) among Filipino newborn infants. Philippine newborn screening study group. Southeast Asian J Trop Med Public Health 1999; 30 Suppl. 2:20-2.
3. Fisher DA, Dussault JH, Foley TP Jr. et al. Screening for congenital hypothyroidism: results of screening one million North American infants. J Pediatr.1979 May; 94(5):700-5.
4. Newborn Committee of the European Thyroid Association. Neonatal screening for congenital hypothyroidism in Europe. Acta Endocrinol. Suppl (copenh). 1979; 223:3-29.
5. Gurge P. To study umbilical cord blood TSH values in newborn in BHMRC over a period of 1 year. International Journal of PediatricResearch.feb, 169(3), 105-112.
6. YalemtsehayMekonnen, Gizachew W Hawariat, Bekele Chamiso, FriedhelmRaue. Thyroid stimulating hormone values from cord blood in neonates. Ethiop. J. Health Dev. 2003; 17(2):125-130.
7. Rashmi, Seth A, Sekhri T, Agarwal A. Effect of perinatal factors on cord blood thyroid stimulating hormone levels. J Pediatr Endocrinol Metab. 2007 Jan; 20(1):59-64.
8. Ward LS, Kunni IS, DE Barros Maciel RM. Thyroid stimulating hormone levels in cord blood are not influenced by non thyroidal mother's diseases. Sao Paulo Med J. 2000 Sep 7; 118(5):114-7.
9. Klein AH, Agustin AV, Foley TP Jr. Successful laboratory screening for congenital hypothyroidism. Lancet 1974; 2:77-9.
10. Hardy JD, Azyed R, Doss I, Dhatt GS. Cord blood thyroxine and thyroid stimulating hormone screening for congenital hypothyroidism: how useful are they? J Pediatr Endocrinol Metab. 2008 Mar; 21(3):245-9.
11. Lafranchi S, Hypothyroidism IN: Behrman RE, Kleigman RM, Jenson HB, editors. Nelson Textbook of Paediatrics', 18th ed. Philadelphia: Saunders. 2008:2316- 2324.
12. Desai MP, Colaco MP, Ajgaokar AR, Mahadik CV, Rege C, Shiordkar VV et al. Neonatal screening for congenital hypothyroidism in a developing country: problems and strategies. Indian J Paediatric, 1987 jul-aug; 54(4):571-81.
13. Manglik Arun Kumar, Chatterjee Nandita and Ghosh Gautam. Umbilical Cord Blood TSH Levels in Term Neonates: A Screening Tool for Congenital Hypothyroidism Indian Paediatrics. 2005; 42:1029-1032.