

Original Article

Screening for Congenital Hypothyroidism — Umbilical Cord Blood TSH a Useful Tool : A Single Centre Eight Year Experience

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Background : Congenital hypothyroidism remains the most common preventable cause of mental retardation in pediatric age group. Screening for Congenital Hypothyroidism remains an effective tool to prevent mental retardation among the general population. Umbilical Cord blood TSH is an easily available reliable tool for screening for Congenital Hypothyroidism.

Aims and Objectives : The aim of the study was to find the normative Cord Blood TSH value for the study group and to assess the utility of Cord Blood TSH as a screening tool for Congenital Hypothyroidism.

Design : Cross Sectional study.

Material and Methods : CB TSH levels were measured in 8720 neonates over a study period of eight years. All neonates who had a cord blood TSH level greater than 20 mIU/L were called back on day 7 of life for a repeat thyroid profile.

Results : Cord blood samples of 8848 neonates were sent for analysis, 128 samples were hemolysed hence only 8720 were analysed. A total of 8720 neonates formed the study group. Male to Female ratio was 4720:4000 ie, 1.18:1. The birth weight of the study group ranged between 0.9 kg to 4.2 kg. The average birth weight was 2.92 kg. The study group was divided into two cohorts, cohort 1 comprised of babies who were term gestation (6366 babies, 73%), cohort 2 comprised of babies who were born between after 28 weeks of gestation but before 37 weeks of gestation (2354 babies, 27%). The mean TSH value of the entire study group was 7.34 mIU/ml. majority of neonates (93%) had a cord blood TSH level less than 10 mIU/L. In 130 neonates had a cord blood TSH value greater than 20 and were recalled for a repeat testing on day 7 of life. Out of the 130 neonates recalled for repeat testing (recall rate 1.48%), only 104 neonates turned up, 26 were lost to follow-up. Out of the 104 neonates which turned up for repeat testing, 4 eventually turned to be hypothyroid on repeat testing giving us an incidence of 1 in 2180. TSH values corresponding to the 3rd, 10th, 25th, 50th, 75th, 90th, 95th and 97th percentile were 2.2, 3.1, 3.9, 6.1, 7.1, 10.67, 13.8, 23 respectively. 98% of our study group had a cord blood TSH value less than 20, so a cord blood TSH of greater than 20 mIU/ml can safely be used for screening for congenital hypothyroidism.

Conclusion : A cut off of Cord Blood TSH value >20 mIU/ml can be used as a screening tool for Congenital Hypothyroidism.

[J Indian Med Assoc 2024; 122(7): 28-31]

Key words : Congenital Hypothyroidism, Cord Blood TSH.

Congenital Hypothyroidism remains the commonest cause of preventable mental retardation in the country. In the absence of a nationwide screening program for Congenital Hypothyroidism various studies across pan India have reported the incidence of Congenital Hypothyroidism to range from as low as 1: 3400 to as high as 1: 500¹⁻³. Since clinical features of Congenital Hypothyroidism are quite non specific a high index of suspicion is required for making a diagnosis of Congenital Hypothyroidism. Amongst the

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Received on : 24/10/2022

Accepted on : 08/12/2023

Editor's Comment :

- Congenital Hypothyroidism remains one of the most common preventable causes of mental retardation among children.
- Umbilical cord blood TSH level offers an easily available alternative for screening for Congenital Hypothyroidism.

various clinical features prolongation of neonatal jaundice is a key feature amongst patients who have been diagnosed with Congenital Hypothyroidism. Since the clinical features are quite non specific screening for Congenital Hypothyroidism remains imperative and is of paramount importance. Screening for Congenital Hypothyroidism remains the most cost effective method to prevent mental retardation amongst children.

Ideally screening for Congenital Hypothyroidism should be done after 72 hours of life since by then the TSH surge is over but in developing countries wherein the health resources are limited many babies get discharged early and are deprived of screening for

Congenital Hypothyroidism. In such scenarios Umbilical Cord Blood comes as an easily available alternative for screening for Congenital Hypothyroidism. Various Asian nations have used Umbilical Cord Blood TSH levels as a screening tool for Congenital Hypothyroidism⁴⁻⁶. There are a few studies from across India where researchers have studied Cord Blood TSH levels as a screening tool for Congenital Hypothyroidism⁷⁻¹⁴. We started this research project way back in 2014 and are using Cord Blood TSH levels as a screening tool for Congenital Hypothyroidism.

AIMS AND OBJECTIVES

(1) To find the normative values of Cord blood TSH of the study group.

(2) To use Cord Blood TSH level as a screening tool for Congenital Hypothyroidism

MATERIAL AND METHODS

This cross sectional study was carried from January, 2014 to January, 2022 in a private medical college in Rajasthan. Prior approval from the Institutional Ethics Committee was sought before starting the study.

Inclusion Criterion :

All neonates whose gestational age was greater than 28 weeks who were born during the study period formed the study group.

Exclusion Criteria :

(a) All neonates whose gestational age was less than 28 weeks.

(b) All neonates who required resuscitation at birth.

(c) Neonates who were admitted to NICU immediately after birth.

(d) Neonates with major congenital malformations.

(e) Neonates whose mothers were on medications for thyroid disorders

Detailed antenatal history, parity, medical history of mother, birth weight of baby, sex etc were recorded on a pre designed Performa. The umbilical cord was clamped using three clamp technique, one close to the baby and two near the placental end after cessations of pulsations. 5 ml of blood was collected at the time of delivery and was subjected to TSH estimation by chemiluminescence immunoassay method(kit supplied by Roche E411). Cord Blood TSH samples of 8848 neonates were sent for estimation, 128 samples were found hemolysed hence 8720 samples were analysed.

All those neonates whose Cord Blood TSH value was greater than 20 mIU/ml were called back on day 7 of life for a full thyroid profile which meant TSH, T3, T4, fT3 and fT4. If the venous TSH sample value was

greater than 20 mIU/ml it was considered confirmatory for Congenital Hypothyroidism. All the data collected was entered on an excel worksheet and analyzed using SSPS software for windows version (IBM, India).

RESULTS

A total of 8720 neonates formed the study group. Male to Female ratio was 4720:4000 ie, 1.18:1 (Table 1).

Gender	n (8720)
Male	4720 (54.12%)
Female	4000 (45.88%)

The birth weight of the study group ranged between 0.9 kg to 4.2 kg. The average birth weight was 2.92 kg. Table 2 depicts the weight wise distribution of the study cohort.

Birth Weight in Kg	Number of Neonates
< 1	118(1.3%)
1.0-1.499	228(2.69%)
1.5-1.99	668(7.66%)
2.0-2.49	906(10.38%)
2.5-2.99	4820(55.27%)
3	1980(22.70%)

The study group was divided into two cohorts, cohort 1 comprised of babies who were term gestation (6366 babies, 73%), cohort 2 comprised of babies who were born between after 28 weeks of gestation but before 37 weeks of gestation(2354 babies, 27%). The mean TSH value of the entire study group was 7.34 mIU/ml. majority of neonates (93%) had a cord blood TSH level less than 10 mIU/L. The Distribution of study group according to Cord Blood TSH values is given in Table 3.

TSH value(mIU/ml)	n= 8720(%)
Below 10	8110(93%)
11-20	480(5.51%)
21-50	124(1.42%)
>50	06(0.07%)

In 130 neonates had a cord blood TSH value greater than 20 and were recalled for a repeat testing on day 7 of life. Out of the 130 neonates recalled for repeat testing (recall rate 1.48%), only 104 neonates turned up, 26 were lost to follow up. Out of the 104 neonates which turned up for repeat testing, 4 eventually turned to be hypothyroid on repeat testing giving us an incidence of 1 in 2180. TSH values corresponding to

the 3rd, 10th, 25th, 50th, 75th, 90th, 95th and 97th percentile were 2.2, 3.1, 3.9, 6.1, 7.1, 10.67, 13.8, 23 respectively. 98% of our study group had a cord blood TSH value less than 20, so a cord blood TSH of greater than 20 mIU/ml can safely be used for screening for congenital hypothyroidism.

DISCUSSION

Since Congenital Hypothyroidism is the most common preventable cause of mental retardation among children screening for Congenital Hypothyroidism remains of paramount importance. Furthermore, since the symptoms of Congenital Hypothyroidism are quite non specific in nature the only way to pick up cases early is by screening neonates for Congenital Hypothyroidism. Unfortunately in the absence of a nationwide screening program for Congenital Hypothyroidism studies from across the country are few. Lack of awareness, over reliance on a venous sample, cost issue have all lead to screening for Congenital Hypothyroidism not being implemented on a nationwide basis. Many neonatologists are skeptical of using cord blood TSH as a screening tool for Congenital Hypothyroidism since Cord Blood TSH values are influenced by various maternal and perinatal factors but researchers across the World especially from South East Asia have demonstrated that Cord Blood TSH estimation is more practical and cost effective screening tool. In our study only 7% of the study group had a Cord Blood TSH value greater than 10 mIU/ml which is quite similar to that reported by other authors. The mean Cord blood TSH value of our study group was 7.34 mIU/ml which is quite similar to what reported by Manglik, *et al*; Bhatia, *et al*. Our recall rate in the study was 1.48% which is lower to what reported by Wu, *et al* which had a larger cohort of 11000 neonates. Manglik *et al* reported a recall rate of 1.833% but their cohort included only term neonates. Zion, *et al* in their study had a recall rate as high as 10% but their sample size was quite small only 73 neonates. Another study from our state had a high recall rate of 5.57% which is quite high as compared to other studies from across the country.

There is no universally accepted cut off for TSH levels as far as screening is concerned. Majority of researchers who have studied Cord Blood TSH as a screening tool have used the cut off level of 20. Had we used a cut off of 30, our recall rate would have fallen to 1.2% and a higher cut off of 40 would have seen a recall rate fall to 0.8%. Annually 20 million babies are born in our country every year, a recall rate of 1.48% would mean 2.96 lacs babies being called

back for repeat testing. It would put a huge burden on our health care systems. The best option would be to have large scale nationwide studies so that a consensus on a cord blood TSH cut off value be derived for uniform testing.

Four babies in our cohort of 8720 neonates turned out to hypothyroid giving us an incidence of 1 in 2180. From our own centre we had earlier reported an incidence of 1 in 1824 but that study included only term neonates. Another study from our state has reported an incidence of 1 in 1370. The incidence of Congenital hypothyroidism from across India from various studies is as varied as 1 in 248 to 1 in 1700¹⁵⁻¹⁶. Geographic factors, sample size and cut off used for screening are known to influence the incidence of the disease.

Our figures have shown a comparable trend with the normative values for Cord Blood TSH as reported by other researchers across the World.

One big drawback of our study in spite of it being a eight year long research project is the relatively small sample size as it being a private medical college the number of deliveries are less.

We require large population based multi centric studies to gauge and calculate the incidence of Congenital Hypothyroidism in the country.

CONCLUSION

When compared to data from Western World the incidence of Congenital Hypothyroidism seems to be high probably due to the methodology used. Delay in diagnosis can lead to permanent intellectual impairment. With babies being discharged early venous sample or a heel prick testing doesn't seem to be a practical option in our country, hence the use of Umbilical Cord Blood TSH is practical and easily available option for screening for Congenital Hypothyroidism in our country. Various studies including ours have reiterated the fact that a cut off of Cord Blood TSH value >20 mIU/ml can be used safely for screening of Congenital Hypothyroidism. Still we need large scale multi centric population based studies to further establish normative values for Cord blood TSH values.

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Journal of the Indian Medical Association (JIMA)



The Journal of the Indian Medical Association (JIMA) (ISSN 0019-5847) is published monthly in English language from Editorial Offices at Sir Nil Ratan Sircar IMA House, 53, Sir Nilratan Sarkar Sarani, Kolkata-700014. Telephone No.: +91-33-22378092, (+919477493027); websites: <https://onlinejima.com> & www.ejima.in; Emails: jima1930@rediffmail.com; jimaeditorial@gmail.com.

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