

Original Research Article

A study to estimate similarities or dissimilarities of thyroid parameters of cord blood and new-born venous blood amongst new-borns

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ABSTRACT

Background: Hypothyroidism may be congenital or may be acquired which might or may not have a delayed onset. Incomplete thyroid development and decreased thyroid hormone biosynthesis is a result of congenital hypothyroidism. Screening is usually missed in areas where testing is not done and being the reason for new cases of hypothyroid cases. The aim was to assess/evaluate whether cord blood can be used as a primary screening method for congenital hypothyroidism.

Methods: The study was taken up in the department of pediatrics of a tertiary teaching hospital. A total of 200 babies were taken for the study during the whole study period. The cord blood at the time of delivery and 48 hour serum blood was collected and sent to the lab for thyroid profile estimation.

Results: The study consisted of 109 males and 91 female infants. Among the 200 subjects, 156 were term babies and 44 preterm. The mean birth weight was 2.44 kgs. The mean cord TSH was 6.89 ± 4.56 , the mean T3 level was 81.03 ± 38.84 and mean T4 level among the subjects was 11.17 ± 3.33 . The capillary venous blood was collected after 48 hours for thyroid profiling. The mean TSH was 5.15 ± 3.13 , mean T3 level was 111.53 ± 36.49 and mean T4 level was 14.65 ± 6.07 . On comparison of cord blood and venous blood association was noted between them.

Conclusions: From the present study findings it can be suggested cord blood can be used as a marker for early detection of congenital hypothyroidism.

Keywords: Cord and capillary blood, TSH, T3 and T4

INTRODUCTION

Hypothyroidism can be present from birth (congenital/neonatal) or may be acquired. Neonatal hypothyroidism a thyroid hormone deficiency syndrome in newborns resulting from incomplete thyroid development and decreased thyroid hormone biosynthesis or TSH secretion.^{1,2} Most infants with neonatal hypothyroidism are diagnosed by screening of newborn in the 1st few weeks after birth before any obvious clinical signs or symptoms develop. In areas with no screening program, severely affected infants usually

manifest features within the 1st week of life, but in infants with milder hypothyroidism, clinical manifestations may be masked for months.¹ The incidence of neonatal hypothyroidism in different parts of world ranges from 1 in 4000 to 1 in 1000 in 3 developing countries like India have a higher incidence of neonatal hypothyroidism.⁴ There were two major studies done in India so far, one on incidence of congenital hypothyroidism in study reported 1:2640 (1998) and second study (ICMR) showed 1:1130 newborns (2007-2012) which is almost double the incidence when compared with the previous study.^{5,6} The reliable and

feasible way to detect infants with neonatal hypothyroidism is cord blood thyroid hormone estimation which can be applied prevent neurodevelopmental abnormalities by giving early and prompt treatment.

Aim

The aim was to assess/evaluate whether cord blood can be used as a primary screening of congenital hypothyroidism.

Objectives

The objectives were to evaluate cord and venous blood thyroid parameters and to compare association between cord blood thyroid parameters with venous blood thyroid parameters.

METHODS

The study design was a prospective observational study. The study was conducted from August 2018 to December 2019. Newborn babies born to mothers delivered in Vishnu hospital (maternity and child health) were the study population.

Ethical approval

Institutional ethical committee approval was obtained prior to the initiation of the study.

Inclusion criteria

All newborns were included in the study.

Exclusion criteria

Patients at risk of sepsis, patients with instrumental delivery (vacuum and forceps) and birth asphyxia were excluded from the study.

Sample size

Considering the prevalence congenital hypothyroidism as 15.15% in a study by Rathna et al the sample size was calculated for our study using the formula,⁷

$$N = \frac{4pq}{L^2}, \square$$

where, p=15.15%, q=84.85 (100-p), L=30%.

Sample size works out to 249 subjects with the above formula and considering the dropout rate between 10% to 20% the total number of subjects worked out to 200.

Sampling technique

The sampling technique used was simple stratified sampling method.

Study variables

The study variables were cord blood and venous blood at 48 hours for TSH, T3 and T4.

Study tools

The study tools used were pre-designed, pre-tested questionnaire.

Criteria used for diagnosis

Cord blood and venous sample blood was sent for TSH, T3 and T4 at, that is, during birth and 48 hours.

Cord blood cut off at TSH: <2.43mIU/l; T3: >19.53ng/dl; T4: <5.85mcg/dl.

Venous blood cut off at TSH: <0.58mIU/l; T3: <20.83ng/dl; T4: <5.90mcg/dl.

Data collection methodology

The approval from the ethics committee was obtained for this study.

Informed consent regarding participation in the study was obtained in the regional language.

The pre-designed pre-tested questionnaire was explained to the mother or caregiver. Babies were clinically assessed for age, sex, gestational age, birth weight, previous history of jaundice in the family, day of onset of jaundice, pattern of feeding, fever and other neurological symptoms. A complete clinical examination of the baby was also carried out. 2 ml of blood was drawn in a sterile manner from the umbilical cord and veni-puncture on subsequent analysis at 48 hours of life from neonates.

All these samples were sent with sterile disposable syringes and needle.

The test tubes contained ethylene diamine tetra acetic acid (EDTA) and they were taken to the lab immediately.

Statistical analysis

The collected data was coded, entered Microsoft excel work sheet and exported to SPSS. Data was analyzed using SPSS version 21. Data is presented as percentage in categories and then presented as tables. The test used for test of significance was t test.

RESULTS

In the present study a total of 200 subjects were considered which had 109 male babies and 91 were females. The gestational age among the subjects were 78% babies were term (38-41 weeks) and 22% were preterm (<37 weeks). The infant's mother's thyroid status

was noted were 78.5% of the mothers did not have hypothyroidism and 21.5% of them had hypothyroidism. Birth weight of all the subjects were 71% had normal birth weight, 23.5% were low birth weight babies and 5.5% were very low birth weight. The mean weight among the subjects was 2.810 ± 0.587 (Table 1).

The means of cord blood thyroid profile were the mean TSH was 6.89 ± 4.56 mIU/l, mean T3 was 81.03 ± 38.84 ng/dl and 11.17 ± 3.33 mcg/dl was the T4 mean. Capillary venous blood thyroid profile, the mean TSH was 5.15 ± 3.13 mIU/l, mean T3 was 111.53 ± 36.49 ng/dl and 14.65 ± 6.07 mcg/dl were the T4 mean (Table 2).

The findings of this study suggested a statistical significance ($p < 0.001$) were TSH screening at birth was useful and the 48-hour report strengthening the suggestion for screening and diagnosing hypothyroidism. A high significance ($p < 0.001$) was noted between the former two. From the present study cord T3 and T4 for screening was needed followed by 48 hours testing to ascertain congenital hypothyroidism (Table 3).

Table 1: Distribution of subjects.

Distribution	Frequency	Percent
Sex		
Male	109	54.5
Female	91	45.5
Gestational age (in weeks)		
<37	44	22
38-41	156	78
Maternal hyperthyroidism		
Yes	43	21.5
No	157	78.5
Birth weight		
2.5-4.2 kgs	142	71
<2.5 kgs	47	23.5
<1500 grams	11	5.5
Mean birth weight (in kgs): 2.44 ± 0.92		

Table 2: Distribution of subjects according to cord and venous blood thyroid profile levels.

Distribution	Mean
Cord blood thyroid profile	
TSH	6.89 ± 4.56 mIU/l
T3	81.03 ± 38.84 ng/dl
T4	11.17 ± 3.33 mcg/dl
Capillary venous blood	
TSH	5.15 ± 3.13 mIU/l
T3	111.53 ± 36.49 ng/dl
T4	14.65 ± 6.07 mcg/dl

Table 3: Association between cord and capillary venous thyroid parameters.

Thyroid profile	Mean	SD	95% CI		P value
			Lower	Upper	
Cord TSH	6.89	5.12	1.613	3.394	<0.001*
48 hour TSH	5.15	4.25			
Cord T3	81.03	40.82	41.539	26.517	<0.001*
48 hour T3	111.53	38.64			
Cord T4	11.17	5.45	4.195	2.907	<0.001*
48 hour T4	14.65	5.93			

*Level of significance: <0.05.

DISCUSSION

In the present study a total of 200 subjects were considered 54.5% were male babies and 45.5% were females. Around 78% babies were term and 22% were preterm. The present study findings were different as compared to a study conducted by Sunil et al in which females were higher as compared to males. The male to female ratio was found to be 1:1.07 and all the babies had a gestational age of ≥ 37 weeks.⁸ The present study findings were almost similar to a study conducted by

Armanian et al in which 50.2% were males and 49.8% were females. The mean gestational age of babies in this study was found to be 37.75 ± 2.28 weeks.⁹ In the present study 71% of babies had normal birth weight, 23.5% were low birth weight babies and 5.5% was very low birth weight. The mean weight among the subjects was 2.44 ± 0.92 kgs. The present study findings were almost comparable to a study by Poyekar et al in which 23.1% were low birth weight and 76.9% were normal birth weight.¹⁰ The present study findings were almost similar to a study by Sheetal et al in which 68.84% had normal

birth weight and 27.27% were low birth weight and 3.57% had very low birth weight.¹¹ In this study mean cord blood TSH level was 6.89 ± 4.56 mIU/l. Findings were close enough to a study conducted by Armanian et al in which the mean TSH level of neonates was 7.6 ± 6.2 mIU/dl.⁹ Study by Poyekar et al in which the mean CB-TSH was 8.9 μ IU/ml and 7.5% newborns had elevated levels of TSH.¹⁰ In this study, the cord T3 levels mean among the subjects was 81.03 ± 38.84 ng/dl and the mean cord T4 level was 11.17 ± 3.33 mcg/dl. The present study findings were different to a study conducted by Kayode et al in which the mean serum T3 and T4 cord values at birth were 0.89 and 75.48 nmol.¹² It was observed that the mean TSH level at 48 hours was 5.15 ± 3.13 mIU/l. Repeat T3 levels mean at 48 hours was 111.53 ± 36.49 ng/dl and T4 mean was 14.65 ± 6.07 mcg/dl. The present study findings were consistent with a study conducted by Suresh et al in which repeat TSH and T4 levels in neonates with CB-TSH level of >20 mIU/l at birth was found to decline on 7th and 21st day of illness.¹³ In this study the association between cord blood TSH and 48 hours TSH was done and it was found that there is a statistically high significance ($p < 0.001$) of screening for TSH levels at birth and at 48 hour for diagnosing hypothyroidism. In the present study the association between cord blood T3 and 48 hours T3 was done and it was found that there is a statistically high significance ($p < 0.001$) of screening for T3 levels at birth and at 48 hour for diagnosing congenital hypothyroidism. In this study the association between cord blood T4 and 48 hours T4 was done and it was found that there is a statistically high significance ($p < 0.001$) of screening for T4 levels at birth and at 48 hour for diagnosing congenital hypothyroidism. The present study findings were similar to a study by Sunil et al in which TSH levels were assessed at birth and at 72 hours and it helped in diagnosing congenital hypothyroidism at an early stage and also further helped in initiation of treatment.⁸ The present study findings were similar to a study conducted by Sheetal et al in which follow up of TSH, T3 and T4 levels proved to be an important tool in identifying congenital hypothyroidism.¹¹ The present study findings were similar to a study conducted by Gupta et al in which changes in TSH levels in response to T3 and T4 blood levels at birth and 48 hours formed the basis of screening for congenital hypothyroidism.¹⁴ The present study findings were consistent with a study conducted by Bhatia et al in which estimating repeat TSH levels in neonates who had higher levels of TSH at birth helped in early diagnosis of congenital hypothyroidism.¹⁵

CONCLUSION

Cord blood can be used as a marker for detecting congenital hypothyroidism.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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