ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 17, Issue 11, 2024

Online - 2455-3891
Print - 0974-2441

Research Article

CONGENITAL HYPOTHYROIDISM IN NEWBORN AND ASSOCIATION WITH SOCIODEMOGRAPHIC PARAMETERS AMONG NEONATE DELIVERED AT MILITARY HOSPITAL IN A CITY OF CENTRAL INDIA

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Received: 22 July 2024, Revised and Accepted: 09 September 2024

ABSTRACT

Objectives: The present study aims to assess the incidence of congenital hypothyroidism (CH) among neonates in a tertiary care hospital in central India, examining its association with various sociodemographic parameters.

Methods: This cross-sectional study, conducted between January and December 2022, included all live births at a tertiary care center in Jabalpur, Madhya Pradesh. Cord blood thyroid-stimulating hormone (TSH) levels were measured for all newborns as part of routine screening. Sociodemographic data, including maternal age, gestational age, birth order, and newborn sex, were collected. Universal sampling was employed, encompassing all consenting parents and their neonates.

Results: Among 388 live births, TSH values ranged from 0.23 to 35.59 mIU/L, with a mean TSH of 8.76±5.92 mIU/L. Of the neonates, 95.9% had normal TSH levels, while 4.1% exhibited elevated levels. Subsequent follow-up identified CH in two neonates (5.2 per thousand live births). Analysis revealed no significant association between elevated TSH levels and maternal age or newborn sex. However, a significant association was observed with gestational age. Birth order also displayed significance, with the third birth order having a higher proportion of neonates with raised TSH levels.

Conclusion: This study highlights the importance of CH screening in preventing long-term complications and the various sociodemographic factors linked to CH, such as maternal age, gestational age, and birth order.

Keywords: Congenital hypothyroidism, Neonatal screening, Newborn, TSH levels, Sociodemographic parameters.

 DOI: http://dx.doi.org/10.22159/ajpcr.2024v17i11.52396. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Congenital hypothyroidism (CH) is an important medical condition that affects newborns, characterized by an underactive thyroid gland from birth, and can have a profound impact on a child's physical and cognitive development if left untreated [1]. Common symptoms of hypothyroidism in neonates being lethargy, reduced muscle tone, constipation, and poor feeding may be ignored or often go unnoticed [2]. Further, if left untreated can lead to growth delay, cognitive deficits, delayed puberty, cardiovascular complications, irreversible intellectual, and developmental disabilities [3]. It is crucial to emphasize that early detection and treatment of neonatal hypothyroidism are essential [4].

Newborn screening programs that identify infants with CH shortly after birth, allow for the initiation of thyroid hormone replacement therapy thereby preventing long-term complications [5,6]. With early and consistent treatment, many of the complications associated with CH can be prevented or minimized, enabling affected children to lead healthy and fulfilling lives [7,8]. Since India has a relatively higher occurrence of CH, it is quintessential to screen newborns [9,10].

CH can occur due to genetic mutation affecting various components of the thyroid hormone synthesis pathway, such as the thyroid peroxidase gene, the thyroglobulin gene, or the TSH receptor gene [11-13]. Genetic predisposition (family history), maternal hypothyroidism, gestational age, low birth weight, fetal macrosomia, and pre-term birth, also play an important role in CH [14-16].

Since there is limited information available from the central part of India, the present study was planned to determine the incidence of CH in neonates by measuring thyroid stimulating hormone (TSH) in cord blood of newborns and to find out the relation between demographic variable and TSH value of newborn.

METHODS

This is a cross-sectional study that was conducted in a tertiary care center in Jabalpur, Madhya Pradesh, India. The study was conducted between January and December 2022 wherein all newborn live births that were conducted in the institute were considered for the study. As a routine screening, all newborns are subjected to cord blood TSH level estimation. Consent was obtained from the parents in their vernacular language. Institutional ethical committee clearance was obtained before beginning the study. The current study employed a universal sampling approach, wherein all parents who provided consent for participation and their neonates, who underwent TSH level estimation, were included. Newborns delivered outside of the institute and admitted for other medical conditions were excluded from the study.

The data collected included sociodemographic parameters such as age, sex, birth weight, gestational age at delivery, family history of hypothyroidism, maternal education, and parity. In addition, TSH levels were measured in all neonates to identify CH. Universal sampling was followed in the present study wherein all neonates delivered in the institute during the study period (January 2022–December 2022) and the parents consenting for the study were included. Thyroid screening tests for newborns were conducted before hospital discharge, between 2 and 5 days after birth as collecting specimens before 48 h of age can result in inaccurate positive outcomes. In the case of a critically ill infant, a pre-term neonate, a blood sample was collected on the 7th day of age. Informed written consent was obtained for the parents of the neonates. Parents of the neonates found to have high TSH values

(20 mIU/L or more) were communicated regarding the findings of the screening test and the need for further investigations, follow-up, and management according to the confirmatory tests. All neonates with deranged TSH values on screening were further referred to a pediatrician/endocrinologist for further follow-up and management.

RESULTS

A total of 388 live births were recorded during the study period. All the parents consented for the study; hence, all were included. The age of the mothers ranged from 19 to 34 years with a mean age of 27.1±5.1 years (Interquartile range 23 years – 31 years). The mean age of gestation was 36.9±2.9 weeks (Interquartile range 35 weeks – 38 weeks) with minimum and maximum age of gestation at the time of delivery being 30 weeks and 41 weeks. The average birth weight of the newborns was noted to be 3100±445 g, minimum and maximum weights of the newborns were 1900 g and 4150 g, respectively (Table 1).

In terms of the newborns' gender distribution, 51.8% (201 infants) were female, while 48.2% (187 infants) were male. Most of the children were of the birth order one (174 newborns, 44.8%) and two (175 newborns, 45.1%). One-tenth (39 newborns, 10.1%) were of birth order three. Most of the deliveries were at term (325 births, 83.8%) and the remaining 63 births (16.3%) were pre-term births. The majority of the neonates (353 newborns, 91%) had birth weight within normal limits, 26 neonates (6.7%) were low birth weight and 09 (2.3%) were big babies.

TSH value varied from 0.23 to 35.59 mIU/L, with the mean TSH value being 8.76±5.92 mIU/L (median 6.39 mIU/L). Upon classifying TSH levels as normal and raised, it was observed that 372 neonates (95.9%) were within normal limits and 16 neonates (4.1%) had raised TSH levels.

Table 2 presents a comprehensive comparison of TSH levels with various study parameters. For mothers under 35, TSH levels were normal in 96.4% and raised in 3.6%, while for mothers aged 35 and above, 89.3% exhibited normal levels and 10.7% showed elevated levels, with a non-significant p=0.100. Both female and male infants exhibited similar patterns, with 96.0% and 95.7%, respectively, having normal TSH levels, and the p-value was found to be non-significant at 0.883. A higher percentage of pre-term infants, 11.1%, showed raised TSH levels compared to 2.8% in term deliveries, yielding a significant p=0.007. The birth order parameter demonstrated that TSH levels were predominantly normal across different birth orders, but a notable difference was observed in the third birth order, where 15.4% exhibited raised TSH levels, presenting a significant p=0.001.

Of the 16 neonates who had high TSH values were further followed up and two neonates (5.2 per thousand live births) were confirmed to have CH. Both cases were born to mothers of more than 35 years of age, with a birth order of three, delivered before term, one being a baby girl and the other a baby boy.

DISCUSSION

CH screening holds paramount significance in early infancy as it serves as a critical public health measure with profound implications for the lifelong well-being of newborns. This screening enables the early detection of thyroid hormone imbalances, which if left untreated, can lead to irreversible cognitive and developmental impairments. CH screening exemplifies the principles of preventive medicine, emphasizing the proactive identification and management of potential health risks before they manifest clinically.

In the present study, TSH value varied from 0.23 to 35.59 mIU/L, of which 95.9% of neonates' TSH was within normal limits and 4.1% had raised TSH levels. Later on further follow-up of these patients, two neonates (5.2 per thousand live births) were confirmed to have CH. The findings are similar to the study conducted by Banerjee *et al*. [17] in West Bengal, wherein the mean TSH levels were 9.99±0.65; however, the proportion of neonates with elevated TSH levels and confirmed CH were slightly higher (12.6% and 8 per thousand live births, respectively) compared to our study. In another study conducted by Patil *et al*. [18] in the Belgavi district of Karnataka, the authors observed a relatively higher proportion of neonates with elevated TSH levels (12%), the reason being the cut-off value being 10 mIU/L whereas the same for our study was 20 mIU/L. However, the prevalence of CH was comparable (4 per thousand newborns). Jacob *et al*. [19] in their study conducted in Kerala also observed the incidence of CH to be 6.2 per thousand live births. Though the prevalence of elevated TSH was relatively higher among male children in the above studies [18,19] but our study found similar distribution among male and female children.

Our study observed that among mothers aged 35 and above 10.7% of neonates had elevated TSH levels whereas only 3.6% of neonates born to mothers under 35 had elevated TSH levels; however, the difference was statistically not significant. Luo *et al*. [20] also noted an association between older maternal age at delivery and increased susceptibility of CH in neonates. Similarly, Fan *et al*. [21] also observed an association between advanced maternal age and low thyroid hormone levels among Chinese newborns. Vidhyadhara Naik *et al*. [22] in their study in a tertiary care hospital in Burla observed a positive correlation between maternal age and TSH levels among neonates.

The current study also observed a significant association between pre-term deliveries and higher levels of TSH when compared to term deliveries (11.1% versus 2.8%, respectively). Heather *et al*. [23] noted an association between younger gestational age and high-normal levels

Table 1: Baseline parameters of study subjects

Parameter	Values
Age of mother	
Mean±SD	27.1±5.1 years
Interquartile range	23.0–31.0 years
Minimum	19.0 years
Maximum	34.0 years
Period of gestation	
Mean±SD	36.9±2.9 weeks
Interquartile range	30.0–41.0 weeks
Minimum	30.0 weeks
Maximum	41.0 weeks
Birth weight	
Mean±SD	3100±455 g
Interquartile range	2700–3400 g
Minimum	1900 g
Maximum	4150 g

Table 2: Comparison of TSH levels with various study parameters

Parameters	TSH Levels		p-value
	Normal n (%)	Raised n (%)	
Age of the mother			0.100
<35 years	347 (96.4)	13 (3.6)	
35 years and more	25 (89.3)	3 (10.7)	
Sex of newborn			0.883
Female	193 (96.0)	8 (4)	
Male	179 (95.7)	8 (4.3)	
Gestation age			0.007
Pre-term delivery	56 (88.9)	7 (11.1)	
Term delivery	316 (97.2)	9 (2.8)	
Birth order			0.001
One	169 (97.1)	5 (2.9)	
Two	170 (97.1)	5 (2.9)	
Three	33 (84.6)	6 (15.4)	

TSH: Thyroid-stimulating hormone

of TSH whereas Tan *et al.* [24] found no significant difference in TSH concentration among term and preterm babies. Jo *et al.* [25] noted that the risk of CH was approximately 2.5 times, 6 times, and 7 times higher among moderate-to-late preterm (32–37 weeks), very preterm (28–31 weeks), and extremely pre-term (<28 weeks) infants, respectively, in comparison to term infants.

In the present study, the third birth order exhibited a relatively higher proportion of neonates with raised TSH levels whereas birth orders one and two had similar occurrences. Verma *et al.* [26] also observed a positive correlation between neonatal TSH levels and parity whereas Lakshminarayana *et al.* [27] observed TSH levels to be significantly higher in first-order neonates. Poyekar *et al.* also observed higher TSH levels among first-order babies but the difference was statistically not significant.

CONCLUSION

In the study sheds light on the incidence of CH among neonates in a military hospital in central India. Despite the majority of neonates having normal TSH levels, the identification of CH cases emphasizes the necessity for systematic screening. Various sociodemographic factors such as maternal age, gestational age, and birth order demonstrated associations with TSH levels. The findings emphasize the importance of neonatal screening programs to identify and manage CH early, preventing potential complications in affected infants.

To enhance the understanding of CH and its associations with sociodemographic parameters, future research should consider larger and more diverse cohorts. Longitudinal studies tracking TSH levels over time could provide insights into the natural course of CH. Furthermore, collaboration with geneticists could explore the role of genetic factors in the development of CH. The study highlights the importance of continuous awareness campaigns to educate healthcare providers and parents about the significance of CH screening, ensuring early detection and intervention. Limitations: The study being conducted in a single center of central India might be a constraint in drawing broader generalizations.

AUTHORS' CONTRIBUTIONS

Anisha Beegum and Sruti Kriti designed the entire work. Contribute in making necessary corrections and revisions of the manuscript. The final draft was checked by both the authors.

CONFLICTS OF INTEREST

Nil.

FUNDING

Nil.

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