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Thyroid Screening in Neonates in a Tertiary Care Center

Dr. Anmol Khajuria[1], Dr. Harsh Vardhan Sharma[1], Dr. Akhilpreet Kaur[1], Dr. Anuj Gupta[1], Dr. Ravinder K. Gupta[1]*

[1]Department of Pediatrics, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu, Jammu and Kashmir, India

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***Corresponding Author**
Dr. Ravinder K Gupta

Department of Pediatrics, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu, Jammu and Kashmir, India

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A B S T R A C T

***Background*:** Maternal thyroid disorders during pregnancy can significantly impact fetal development and increase the risk of adverse pregnancy outcomes, including miscarriage, preterm birth, low birth weight, and neonatal morbidity and mortality. This study aims to evaluate the prevalence of thyroid dysfunction in a cohort of 300 neonates (aged 1-28 days) at a tertiary care centre, with a focus on comparing the thyroid hormone levels between neonates born to mothers with and without thyroid disorders. ***Methods*:** This was a prospective, observational study conducted over a 12-month period. The neonates were further divided into two groups based on maternal thyroid status: (i) cases (N=150) and (ii) controls (n=150). In the first and third postnatal weeks, the study group's infants' thyroid tests were measured. ***Results*:** The mean TSH levels were significantly higher in neonates of mothers with thyroid disorders, while the mean free T4 level was significantly lower in this group. The prevalence of subclinical hypothyroidism (elevated TSH with normal free T4) was significantly higher. ***Conclusions*:** Early identification and management of thyroid disorders in newborns can help prevent the adverse effects on growth and neurodevelopment.

Keywords: Thyroid dysfunction, prevalence, miscarriage.

INTRODUCTION

Thyroid disorders are a significant concern in the neonatal population, as they can have profound effects on a child's growth and development if not detected and treated early [1]. Congenital hypothyroidism, the most common congenital endocrine disorder, can lead to permanent intellectual disability if not addressed in a timely manner [2]. Screening for thyroid dysfunction in neonates is crucial to ensure that affected infants receive the appropriate treatment and interventions to minimize the risk of adverse outcomes.

The incidence of thyroid dysfunction is higher in the offspring of mothers with thyroid disorders compared to those born to healthy mothers [3]. Maternal thyroid disorders during pregnancy can significantly impact fetal development and increase the risk of adverse pregnancy outcomes, including miscarriage, preterm birth, low birth weight, and neonatal morbidity and mortality.

In neonates, if T4 hormone levels are low the condition is called congenital hypothyroidism and if the TSH levels are high it is called subclinical hypothyroidism. The prevalence of thyroid dysfunction in newborns is variable across studies and populations, underscoring the need for further research in this area. Factors that affect neonatal TSH concentration are mode of delivery, pregnancy duration, and maternal thyroid status [4, 5].

Neonatal hypothyroidism causes a wide range of clinical manifestations, including poor feeding, lethargy, constipation, and delayed neurodevelopment. Prompt diagnosis and treatment are essential to ensure optimal growth and development [6, 7].

The American Academy of Pediatrics recommends thyroid screening in neonates [8]. There are three types of screening method; primary TSH with backup T4 measurements, primary T4 with backup TSH measurements, and combined primary TSH and T4 measurements. Primary TSH approach mostly followed. It is usually performed within 2–4 days of life to avoid false positive tests resulting from initial TSH surge [9, 10].

Thyroid screening in neonates is, therefore, a critical public health measure to identify and manage thyroid dysfunction early in life [1, 11, 3]. In neonates, thyroid screening is especially important, as they are more susceptible to the deleterious effects of thyroid hormone deficiency on brain development.

Therefore, it is essential to identify these high-risk neonates and closely monitor their thyroid function to provide early and appropriate management.

This study aims to evaluate the prevalence of thyroid dysfunction in a cohort of 300 neonates (aged 1-28 days) in a tertiary care center, with a focus on comparing the thyroid hormone levels between neonates born to mothers with and without thyroid disorders.

Material and Methods

This was a prospective, observational study conducted in a tertiary care centre over a 12-month period. The study population included 300 neonates (1-28 days of age) born in the hospital as per the following inclusion and exclusion criteria:

Inclusion Criteria:

1. All neonates aged 1 to 28 days, regardless of gestational age or birth weight.

Exclusion Criteria:

1. Neonates with known genetic or chromosomal disorders
2. Congenital malformations or other severe medical conditions were excluded from the study.

Blood samples were collected from all enrolled neonates within the first week of life. From newborn blood is taken by prick method for screening. Estimation is done by the ELISA method. Newborns with abnormal results are reviewed and venepuncture blood samples are drawn for confirmation. The samples were analyzed for thyroid-stimulating hormone, free thyroxine, and free triiodothyronine levels using a chemiluminescent immunoassay. Proforma was used to record information on age, sex, birth weight, mode of delivery, and antenatal mother on thyroxine (regular/irregular) treatment.

The neonates were further divided into two groups based on maternal thyroid status: 1) neonates born to mothers with thyroid disorders (cases) and 2) neonates born to mothers without thyroid disorders (control group).

The Demographic characteristics of the infants were recorded on a pre-defined proforma. In the first and third postnatal weeks, the study group's infants' thyroid tests were measured. Before being released from the hospital, the control group infants' thyroid function tests were examined. The chemiluminescence assay was used to quantify serum TSH, FT4, anti-TPO, and ATG. During the first postnatal week, newborns with serum TSH levels ≥20 mIU/L were deemed abnormal and sent for additional testing. TSH >7 mIU/L, FT4 100 IU/mL, and anti-TPO >30 IU/mL were deemed abnormal during the third week. Informed consent was obtained from all patients, and the study was approved by the Institutional Ethics Committee of the Institute.

Statistical Analysis

Descriptive statistics were used to summarize the data. Continuous variables were presented as mean ± standard deviation, and categorical variables were presented as frequencies and percentages.

Comparisons between the two groups (neonates of mothers with and without thyroid disorders) were made using the student's t-test for continuous variables and Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

In the study, 300 neonates were included, who were born and admitted in the Acharya Shri Chander College of Medical Sciences and Hospital, Jammu.

In the study, neonates were divided into two groups: Group 1 (N=150) Neonates born to mothers with thyroid disorders (Cases), and Group 2 (N=150) Neonates born to mothers without any thyroid disorders (controls).

Table 1: Maternal Demographic and Laboratory Characteristics

Variables	Group-I (N=150)	Group-II (N=150)
Maternal age	31±4.9	29.5±5.1
Previous abortion history	42 (28.0%)	8 (5.33%)
Previous pre-term birth	30 (20.0%)	2 (1.33%)
Current preterm delivery	60 (40.0%)	36 (24.0%)
Maternal TSH	7.1±5.8	1.8±0.9
Maternal FT4	1.1±0.6	0.9±0.1

Table-1 depicted maternal demographic and laboratory characteristics. Maternal age between the two groups was not statistically different. Further, previous abortus history and more preterm deliveries were observed among the women having hypothyroidism (group I).

It was also observed in our study that Treatment for infertility was required in 35.0% (*n* = 53) of mothers in group I, 9.3% (*n* = 14) in group II.

Table 2: Prevalence of hypothyroidism in neonates

Total number of Neonates	Number with Hypothyroidism	Percentage
Group-1 (N=150)	9	6.0%
Group-II (N=150)	2	1.3%

Table 2 depicts the prevalence of hypothyroidism among the neonates. After screening of neonates, 6% (n=9) neonates were diagnosed with hypothyroidism born to hypothyroidism mothers whereas in the control group only 1.3% neonates diagnosed with hypothyroidism.

Table 3: Neonatal demographic and laboratory characteristics

Variables	Group-I (N=150)	Group-II (N=150)	P value
Gestational Age	37.6 ± 1.5	38.2 ± 1. 2	0.13
Birth weight	3.04 ± 0.4	3.26 ± 0.5	0.002
Neonatal TSH	5.1 ± 2.3	3.2 ± 1.8	0.001
Neonatal FT4	1.1 ± 0.3	1.4 ± 0.4	0.01
Intrauterine growth retardation	18	3	
NICU Admission	70	45	<0.001

Table 3 depicts the neonatal demographic and laboratory characteristics. There was no significant difference in gestational age among two groups (37.6 ± 1.5 vs 38.2 ± 1. 2, p=0.13).

Further, Neonates born to mothers with thyroid disorders had a significantly lower mean birth weight compared to neonates born to mothers without thyroid disorders (3.04 ± 0.4 kg vs. 3.26 ± 0.5 kg, p=0.002).

The mean TSH levels were significantly higher in neonates born to mothers with thyroid disorders, while the mean free T4 levels were significantly lower in this group.

In our study, the prevalence of subclinical hypothyroidism (elevated TSH with normal free T4) was significantly higher in neonates born to mothers with thyroid disorders.

In our study it was observed that neonates born to mothers having hypothyroidism needed more frequent NICU admission. NICU admission diagnoses were mainly respiratory distress or suspected sepsis.

DISCUSSION

This study demonstrates the importance of thyroid screening in neonates, particularly in those born to mothers with thyroid disorders.

Maternal thyroid disorders, both overt and subclinical, are associated with adverse pregnancy outcomes, including an increased risk of miscarriage, gestational hypertension, preeclampsia, placental abruption, preterm birth, and low birth weight [3, 12, 13].

In our study the Maternal age between the two groups was not statistically different. Further, previous abortus history and more preterm deliveries were observed among the women having hypothyroidism (group I). The higher incidence of maternal hypothyroidism and thyroid autoimmunity contributing to preterm delivery, and increased rates of neonatal intensive care admissions are consistent with previous studies by Groot *et al*., 2012 [12], Thangaratinam *et al*., 2011 [13], Sreelatha *et al*., 2018 [3] and Abalovich *et al*., 2002 [14].

It was also observed in our study that Treatment for infertility was required in 35.0% (n = 53) of mothers in group I, 9.3% (n = 14) in group II. In the previous studies, thyroid autoimmunity has been associated with higher rates of infertility and increased need for assisted reproductive techniques.

In our study, 6% (n=9) neonates were diagnosed with hypothyroidism born to hypothyroidism mothers whereas in the control group only 1.3% neonates diagnosed with hypothyroidism. In a previous similar studies by Abalovich *et al*., 2002 [14] and Lenz & Root, 2008 [15], the incidence of neonatal hypothyroidism was 5% in the group of mothers with hypothyroidism compared to 1.3% in the control group. The higher rates of neonatal thyroid dysfunction in infants of hypothyroid mothers emphasizes the need for close monitoring and early intervention to prevent adverse neurodevelopmental consequences.

In our study there was no significant difference in gestational age among two groups (37.6 ± 1.5 vs 38.2 ± 1. 2, p=0.13). Further, Neonates born to mothers with thyroid disorders had a significantly lower mean birth weight compared to neonates born to mothers without thyroid disorders (3.04 ± 0.4 kg vs. 3.26 ± 0.5 kg, p=0.002). The findings of our study are consistent with previous research by Eshkoli *et al*., 2018 [16] and Sreelatha *et al*., 2018 [3] which has shown that maternal hypothyroidism is associated with an increased risk of low birth weight.

In our study, the mean TSH levels were significantly higher in neonates born to mothers with thyroid disorders, while the mean free T4 levels were significantly lower in this group. The prevalence of subclinical hypothyroidism (elevated TSH with normal free T4) was significantly higher in neonates born to mothers with thyroid disorders. These findings are consistent with previous study by Abalovich *et al*., 2002 [14] demonstrating that infants of mothers with thyroid disorders are more likely to have elevated TSH and lower free T4 levels.

It was observed that neonates born to mothers having hypothyroidism needed more frequent NICU admission. NICU admission diagnoses were mainly respiratory distress or suspected sepsis. It is known that infants of hypothyroid mothers are more likely to require NICU admission due to the increased risk of preterm birth, low birth weight, and other neonatal complications.

In our study, pregnant women with autoimmune hypothyroidism had a higher rate of preterm delivery and their infants required more NICU admissions compared to the other groups. The findings of this study are consistent with existing literature, which suggests that neonates born to mothers with thyroid disorders are more likely to have thyroid dysfunction, including subclinical hypothyroidism.

Early identification and management of thyroid disorders in neonates are crucial to prevent the adverse effects on growth and neurodevelopment.

The study has several strengths, including a relatively large sample size and a clear comparison of thyroid parameters between neonates born to mothers with and without thyroid disorders. However, the study is limited by the single-center nature of the data, which may limit the generalizability of the findings.

CONCLUSION

In conclusion, this study highlights the importance of routine thyroid screening in neonates, particularly those born to mothers with thyroid disorders. Early identification and management of thyroid dysfunction in neonates can help prevent the adverse effects on growth and neurodevelopment.

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