

Screening of New-Borns for Thyroid Status Admitted in Neonatal Ward of a Tertiary Care Hospital

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Abstract

Background: Neonatal screening program is very fruitful in saving our newborns from preventable neonatal diseases, thereby healthy grooming of future generations. Though newborn screening for a thyroid disorder is one of the greatest successes in preventive pediatrics but still has not practically worked out for all neonates in Bangladesh at the national level. The majority of newborns with a thyroid disorder have a normal appearance without detectable physical signs and are almost always missed. Screening at the proper time (Approximately 2-7 days after birth), rechecking of suspicious cases within a week, and initiation of treatment (Within 2 weeks of age) of thyroid disorders particularly Congenital Hypothyroidism (CH), can prevent the irreversible mental and physical impairments. Transient neonatal hyperthyroidism is the common form of neonatal hyperthyroidism. The purpose of the study was, Neonatal Screening (NS) to evaluate the rate of thyroid disorders among Preterm (Early preterm born before 34th week of gestation, late preterm born between 34th week and before 37th week of gestation), Term (Born within 37th to 42nd week of gestation) and Post-term (Born after 42nd week of gestation) newborns. Birth weight was also measured to categorize the newborns according to their weight.

Materials and methods: It was a cross-sectional, observational type of study. The place was the Neonatal Department of Chattogram Maa-O-Shishu Hospital Medical College, Chattogram. Blood samples were collected from eighty neonates aging 2 to 7 days and sent to the laboratory for estimation of TSH and FT₄.

Results: Total number of samples was 80. Out of them, preterm new-born were 19 and term new-born were 61, no post-term case was found. Both groups were again divided into normal birth weight (≥ 2.5 kg) and low birth weight (< 2.5 kg). Hyperthyroidism (High or normal FT₄ but low TSH) was observed in 23 term newborns (37.7%) and hypothyroidism (Low or normal FT₄ but high TSH) in 11 term newborns (18.03%) and the rest were Euthyroid (TSH normal, FT₄ normal/increased/decreased). In the case of preterm, there were more hypothyroid 03 (15.78%) than hyperthyroid 02 (10.52%).

Conclusion: Our study observed that, among the newborns, who were admitted to the hospital, around half of them (39 out of 80) had abnormal thyroid function. The newborns with abnormal thyroid status were informed to their parents for further evaluation by the Department of Endocrinology. It would be helpful to reach the final diagnosis and treat it accordingly.

Key words: Birthweight; FT₄; Hyperthyroidism; Hypothyroidism; Neonatal screening; Pre-term; Term; TSH.

INTRODUCTION

Congenital Hypothyroidism (CH) is responsible for permanent mental and physical disabilities if not treated in early life.¹ Neurodevelopmental damage caused by Congenital Hypothyroidism (CH) has been resolved by the introduction of Newborn Screening (NS) tests which is routinely implemented in developed countries since 1972, but developing countries have no such neonatal screening programs at the national level. So, delayed diagnosis leads to severe outcomes of CH.²

Thyroid hormones are important ingredients for energy metabolism, metabolism of minerals, thermogenesis, growth, and development of various tissues particularly the brain and skeletal structure of the body.³

Maternal thyroid function changes during pregnancy. There is increased thyroid Hormone-Binding Globulin (TBG) concentration and increased iodine clearance through kidneys, thyrotropic effects of high circulating human Chorionic Gonadotrophin hormone (hCG), and alterations in the expression of enzymes involved in thyroid metabolism.⁴

During fetal life after the development of the thyroid gland, thyroid hormones started to produce and secreted into serum at around 12 weeks of gestation and rise to the level till the term. T_4 (Thyroxine) is produced by the thyroid gland and T_3 (Triiodothyronine) is the product of T_4 conversion. T_3 is more potent than T_4 but T_4 has a longer duration of action. Both exert the physiologic effects. Normal thyroid function in the mother is important for the neurological development of the unborn child.³

Normally, in term delivery, with the reduction of surrounding temperature, there is a sudden rise of TSH within 30 minutes of birth. This stimulates the increased release of T_4 and T_3 , which needs to fall over the next four to six weeks for T_4 but the T_3 level falls between 2 and 12 weeks after birth.³

Hyperthyroidism is defined by a decreased serum TSH level and elevated or normal serum concentration of the FT_3 and FT_4 . Hypothyroidism is defined as the elevated TSH level with decreased or normal FT_3 and FT_4 .⁵

Incidence of congenital Hypothyroidism is about 0.15%, that is 1.5 in 1000 live birth in Bangladesh, which is notifiable higher in comparison to the global incidence of 1:3000- 1: 4000¹. On the contrary, neonatal thyrotoxicosis is rare. Transient neonatal hyperthyroidism is the common form of neonatal hyperthyroidism.⁶

Iodine is the important micromineral for the synthesis of thyroid hormones and some parts of Bangladesh are affected by iodine deficiency particularly places far away from the Bay of Bengal, where commercially available iodized salt is the alternative option of natural source of iodine such as 'sea fish'.

A national survey conducted in 1993, reported that the incidence of congenital hypothyroidism was 0.5%, but a small study conducted by the Institute of Nuclear Medicine, Dhaka found the prevalence rate 0.9%, which is a point of deep

concern.⁷ The newborn screening started in Bangladesh in 1999. The program started as part of a regional project of the International Atomic Agency (IAEA) to screen CH. Since then, 2 pilot projects were completed. The Bangladesh government approved a national project in 2006 to screen newborns in some selected areas for CH.⁸ Since Newborn Screening (NS) is a noble concept for Bangladesh, the program is gaining popularity. The pediatricians and obstetricians are also interested⁹.

The target of this study was to measure thyroid profiles (TSH, and FT_4) of preterm (Early preterm born before 34th week of gestation, late preterm born between 34th week and before 37th week of gestation), the term (Born within 37th to 42nd week of gestation) and post-term (Born after 42nd week of gestation) new-borns and compare the thyroid status among these groups. Birth weight was also measured to categorize the newborns according to their weight. It could be helpful for physicians in the early diagnosis of thyroid dysfunction and treatment accordingly. We hope this small study would act as a glimpse to taking the greater initiative to reduce infant and childhood morbidity and mortality due to thyroid disorder.

MATERIALS AND METHODS

This cross-sectional, observational type of study was carried out at the Neonatal Department of Chattogram Maa-O-Shishu Hospital Medical College, Chattogram from the period of October 2021 to March 2022. The protocol of this study was approved by the Institutional Review Board (IRB) of Chattogram Maa-O-Shishu Hospital Medical College, Chattogram. Eighty neonates who were admitted to the Neonatal Department aged between 2nd to 7th day were selected by purposive sampling technique.

Inclusion criteria: Newborns admitted to the Neonatal Department of Chattogram Maa-O-Shishu Hospital Medical College, Chattogram, age between 2nd to 7th day after birth.

Exclusion criteria: Newborns after the 7th day of birth, and parents of the neonates reluctant to give consent.

The purpose, process, and benefits of the study were explained to the parents and their informed written consent was taken. There were face-to-face interviews with the parents and they filled up a pretested mixed questionnaire. With all aseptic precautions, venous blood was collected from the newborns and sent to the laboratory of the same hospital for their TSH and FT_4 levels estimation. Laboratory investigation was carried out in Simens Dimension EXL version and Biomerieux Mini Vidas.

RESULTS

Our hospital-based study found that, almost half of admitted newborns were suffering from thyroid dysfunction in the form of hyperthyroidism or hypothyroidism. Our total sample size was eighty (80), of them, 39 (49%) had a thyroid disorder, 25 out of 80 (31%) were hyperthyroid, and 14 out of 80 (18%) were hypothyroid. The number of euthyroid was 41 (51%).

In our study, it was evident that among the hospital admitted term new-borns (61 out of 80) majority were diagnosed as euthyroid (27 out of 61) 44.27%, then hyperthyroid (23 out of 61) 37.7% and the rest were hypothyroid (11 out of 61) almost 18%. On the contrary, in the preterm group after euthyroid (14 out of 19) 73.68%, the majority were hypothyroid (03 out of 19) 15.78%. The number of hyperthyroid in the preterm group was only 02, 10.52%. We found a significant difference (p -value < 0.05) between term and preterm newborns in the euthyroid and hyperthyroid groups, but no significant difference between term and preterm newborns in the hypothyroid group.

When the newborns were categorized according to their birth weight, the ratio of thyroid disorders (Hyper or hypo) was the same in the low-birth-weight babies, (22.22%) whereas, hyperthyroid was seen more (35.84%) in the group of Standard birth weight (≥ 2.5 kg) than hypothyroid (15.09%). There was no significant difference (p -value > 0.05) between standard birth weight and low birth weight newborns regarding thyroid status.

Table I Thyroid status of hospitalized New-borns

Thyroid Status	No.of New-borns(%)
Euthyroid (Normal TSH, normal/increased/decreased FT ₄)	41 (51 %)
Hyperthyroid (DecreasedTSH, increased/normal FT ₄)	25 (31%)
Hypothyroid (IncreasedTSH, decreased/normal FT ₄)	14 (18%)
Total	80 (100%)

Source: Study report 2022.

Table II Thyroid status according to maturity of New-borns

Thyroid Status	Term new-borns	Pre-term new-borns	p-value*
Euthyroid	27 (44.27%)	14 (73.68%)	< 0.05
Hypothyroid	11 (18.03%)	03 (15.58%)	> 0.05
Hyperthyroid	23 (37.7%)	02 (10.52%)	< 0.05
Total	61	19	

Source: Study report 2022

*Actual difference compared with 2 SE (Standard Error).

Table III Thyroid status according to birth weight of New-Borns

Thyroid status	≥ 2.5 kg	< 2.5 kg	p-value*
Euthyroid	26 (49.05%)	15 (55.55%)	> 0.05
Hypothyroid	08 (15.09%)	06 (22.22)	> 0.05
Hyperthyroid	19 (35.84%)	06 (22.22)	> 0.05
Total	53	27	

Source: Study report 2022.

*Actual difference compared with 2SE (Standard Error).

DISCUSSION

Bangladesh is one of the most densely populated countries with a population of more than 160 million and more than two million infants born in each year.¹⁰ Bangladesh projected their data on neonatal screening in the 4th Asia -Pacific Regional

meeting for neonatal screening in 2001.⁸ The government of Bangladesh is very much keen on taking different initiatives to popularize this screening program. The government included the neonatal screening project in the Annual Developmental Program (ADP) in 2006, under which 200,000 newborns were screened for thyroid disorders.⁸

In our study, we included 80 neonates who were admitted to the Neonatal Department of Chattogram- Maa- O- Shishu Hospital Medical College, of them, 39 (49%) had a thyroid disorder, 25 (31%) were hyperthyroid and 14 (18%) were hypothyroid. The number of euthyroid was 41 (51%).

It was evident from this study that, among the hospital admitted term new-borns (61 out of 80) majority were diagnosed as euthyroid (27 out of 61) 44.27%, then hyperthyroid (23 out of 61) 37.7%, and the rest were hypothyroid (11 out of 61) almost 18%. It could be due to transient neonatal hyperthyroidism, which is the common form of neonatal hyperthyroidism. Further evaluation and follow-up of cases were needed in subsequent weeks to reach the final diagnosis and treat them accordingly.

On the contrary, in the preterm group after euthyroid (14 out of 19) 73.68%, most were hypothyroid (03 out of 19) 15.78%. The number of hyperthyroid in the preterm group was only 02, 10.52%. We found a significant difference (p -value < 0.05) between term and preterm newborns in the euthyroid and hyperthyroid groups, but no significant difference between term and preterm newborns in the hypothyroid group.

It is pointed out that preterm newborns were more susceptible to developing hypothyroid abnormalities than the term neonates. Our study results were similar to the results of the studies done by Iqbal T, Ali MOI, Atia NF, and Islam T.⁹ They did the study over 70 neonates, 40 of which were term and the rest 30 were preterm. They found more hyperthyroidism in term babies than the preterm ($p < 0.05$). Another study on neonatal screening for thyroid disorder was done by Hasan M, Nahar N, Moslem F, Begum NA on 31802 newborns, where they found only 16 cases of confirmed congenital hypothyroidism, which reflected the prevalence of congenital hypothyroidism only 1 in 2000 newborns.⁷

Neonatal hyperthyroidism is transient in the majority of cases and results from the transplacental passage of maternal stimulating TSH Receptor Antibodies (TRAb). Topical iodine exposure has also been reported as a less common cause of hyperthyroidism in newborns. Sometimes, neonatal hyperthyroidism may occur in neonates born to hypothyroid mothers. A study showed that patients treated for Graves' disease with radioactive iodine had TRAb detectable after 5 years. In these cases, the maternal thyroid has been damaged either by prior radioablation, surgery, or autoimmune processes, as a result, TRAb present in the maternal circulation, is silent in contrast to the newborn whose thyroid gland is normal.^{10,11}

The hospital-based study could differ from a community study, because sick newborns are usually admitted to the hospital and could have abnormal thyroid status.

From our study, it was focused that, among the hospital admitted neonates almost half of the total sample had hidden or undiagnosed thyroid disorders in the form of hyper or hypo functional state. So, it is a very urgent need to include a neonatal thyroid screening program at least at the hospital level to screen hospital-admitted newborns and thereby prevent serious complications of thyroid disorders.

LIMITATIONS

Due to resource constraints, we could not take a large sample size and were not able to follow up and further evaluation to reach a confirmed thyroid status.

CONCLUSION

Neonates who were found to have abnormal thyroid function, their parents were informed and advised for further evaluation with the department of endocrinology and get proper treatment and thereby prevent permanent serious complications of thyroid dysfunction in the future. Bangladesh has a successful immunization program with a more than 90% coverage rate. We hope neonatal screening would be the next one. It is an urgent plea from our small study to include a neonatal thyroid screening program at least for the hospital-admitted neonates.

RECOMMENDATIONS

- Large sample size, Community based study.
- Follow-up of abnormal thyroid cases.

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DISCLOSURE

All the authors declared no competing interest.

REFERENCES

1. Buyukgebiz A. Newborn screening for congenital hypothyroidism. *J Clin Res Pediatr Endocrinol.* 2013;5:8-12.
2. Ogilvy-Stuart AL. Neonatal thyroid disorders. *Arch Dis Child Fetal Neonatal Ed.* 2002;87:165-171.
3. Cooper DS and Laurberg P. Hyperthyroidism in Pregnancy. *The Lancet Diabetes & Endocrinology.* 2013;1:238-249.
4. Sundararaman PG. Neonatal Thyroid dysfunction-lessons from Indian experience. *Thyroid research and practice.* 2013;10:S7-S8.
5. Yousuf HKM, Salamatullah Q, Islam MN, Hoque T, Baguer M, Pandav CS. Report of iodine deficiency disorder survey in Bangladesh. Dhaka, UNICEF. 2003.
6. Hasan M, Nahar N, Moslem F, Begum NA. Newborn screening in Bangladesh. *Ann Acad Med Singap.* 2008;37:111-113.
7. Hasan M, Nahar N, Ahmed A, Moslem F. Screening for congenital hypothyroidism—a new era in Bangladesh. *Southeast Asian J Trop Med Public Health.* 2003;34:162-164.
8. WHO Bangladesh [internet]. World Heal.Organ. World Health Organisation. 2018 [Cited2019 Jan 31]. Available from.<https://www.who.int/countries/bgd/en/>.
9. Iqbal T, Ali MOI, Atia NE, Islam T. Study of thyroid hormone status in normal newborn and preterm, low birth weight baby. *KYAMC Journal.* 2017;7:787-790.
10. Samuels SL, Namoc SM, Bauer AJ. Neonatal thyrotoxicosis. *Clin Perinatol.* 2018;45:31–40.
11. Van Dijk MM, Smits IH, Fliers E, Bisschop PH. Maternal thyrotropin receptor antibody concentration and the risk of fetal and neonatal thyrotoxicosis: A systematic review. *Thyroid.* 2018;28:257.