Study of thyroid hormone status in normal newborn and preterm, low birth weight baby

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Abstract

Background : Screening for thyroid hormones in the newborn baby is extremely important to detect the newborns who are born with hypofunctional state of thyroid gland. This screening program in first few weeks of life is essential to prevent serious complications of hypothyroidism in future such as mental retardation. **Objective :** To assess the thyroid hormone levels in normal newborn and preterm low birth weight (LBW) babies and comparison of thyroid dysfunction between these two groups. **Methods :** This cross-sectional analytical type of study was conducted in the department of physiology and paediatrics of Rajshahi Medical College & Hospital (RMCH) from July 2015 to June 2016. A total of 70 newborn baby were enrolled by systematic sampling of which 40 were normal healthy newborn and 30 were preterm, low birth weight babies. Data was collected from the parents and they were filled up standard questionnaire. Then venous blood was collected from each and every neonate and FT_4 and TSH values were estimated. **Results :** The mean (±SD) serum FT_4 level in term normal and preterm LBW neonates were 14.17±2.14 pg/ml and 12.25±3.16 pg/ml respectively. This FT_4 value is significantly higher in term neonates than preterm neonates ($P< 0.05$). The mean (±SD) serum TSH level in term and preterm neonates were 3.37±2.12 and 4.23±3.23 (μIU/ml) respectively. Statistically there was no significant difference in TSH values between these two groups ($P= 0.05$). **Conclusion :** Screening for serum TSH level among the newborns with low and very low birth-weight should be introduced in Bangladesh. **This can prevent serious complications of hypothyroidism in future.**

Key words : congenital hypothyroidism, **serum thyroid hormone levels, preterm low birth weight babies,**

Introduction

Newborn screening for congenital hypothyroidism is one of the major achievements in preventive medicine. Congenital hypothyroidism (CH) is one of the common causes of irreversible mental and physical disability if undetected in the neonatal period.[1] Congenital hypothyroidism (CH) is the most common congenital endocrine disorder seen in the newborns (1 in 4,000 births). It causes irreversible mental and physical disability if remains undetected or untreated. Diagnosis and treatment of CH before 3 months are mandatory to avoid cretinism.[2] Low birth weight (LBW) babies are those whose birth weight is less than 2.5 kg. It has two types : Preterm baby (Babies which are born before 37th weeks of gestation) and small for gestational age baby. Preterm newborn babies are more likely to develop hypofunctional state of thyroid gland due to immaturity of hypothalamo- pituitary-thyroid axis , immature thyroid hormone synthesis, immature thyroid hormone metabolism and systemic diseases.[3]

Iodine deficiency is the important and easily preventable cause of mental retardation. Globally about 10% population are suffering from iodine deficiency disorder and lack of iodine in mother leads to 30,000 still birth and 1,20,000 Congenital Hypothyroidism in infants.[4]

Bangladesh is known to be one hyperdermic zone for iodine deficiency. Goitre and other iodine deficiency disorder are very common in our country. The national survey for iodine deficiency

disease in 1993 showed that the incidence of congenital hypothyroidism is 0.5 % in our country.[5] But it was thought that the incidence would be much higher and one small study was done at institute of nuclear medicine, Dhaka. It showed the prevalence rate of CH in Bangladesh as 0.9% which is a cause of concern for physicians.[6,7] In Bangladesh, there are few institute based reports on thyroid disorder. In a recent community based study in southern part of Bangladesh revealed that 3.3 % of school going children are suffering from thyroid insufficiency including hypothyroidism and subclinical hypothyroidism.[8] Congenital hypothyroidism identified by newborn screening has favourable outcome but IQ reduction and persistent cognitive deficit are reported in many studies.[9]

In UK screening for congenital hypothyroidism was introduced in 1981 and the program has been successful in identifying infants before irreversible neurological damage has occurred.[10]

The central hypothyroidism may present for short term or long term. However TSH based neonatal screening cannot detect central hypothyroidism.[11]

The thyroxine level of premature babies are low and cause is multifactorial. These are loss of maternal T_4 contribution, immaturity of hypothalamic pituitary axis issue , unresponsiveness of thyroid gland to TSH and immaturity of peripheral tissue deiodination.[12]

A majority of European and Japanese program favors screening by means of primary TSH measurement supplemented by free T_4 determination for both normal newborns and preterm. Neonatal screening program for CH is highly cost effective for a nation because it prevents the mentally retardation of persons.[8] Therefore, screening program has become a routine practice in all developed countries and many developing countries in South East Asia have adopted neonatal screening for CH as an essential part of their health services.[9]

The aim of this study is to measure the thyroid hormone levels in normal newborns and preterm low birth weight babies and comparison of thyroid status between these two groups. It will facilitate the early detection of hypofunctional state of thyroid gland and thus treat accordingly. In this way, this study contributed in reducing infant and childhood morbidity.

Methods

This cross- sectional analytical type of study was carried out in the department of Physiology and department of Paediatrics of Rajshahi Medical College Hospital (RMCH) between the period of July 2015 to June 2016. Seventy (70) newborn babies were selected between the age group 5 to 28 days, among which 40 were normal healthy newborns and 30 were preterm low birth weight newborns. Study subjects were selected by systematic sampling in Rajshahi Medical College Hospital. All the subjects were free from birth asphyxia, meningitis, septicaemia and other serious neonatal diseases. The aim, benefit and procedure of the study were explained to the parents of the newborns and their informed written consents were taken. Data was collected from the parents by face to face interview with the help of a questionnaire. After completion of the interview of the parents, with all aseptic precaution, venous blood was collected from the newborn babies and sent to the laboratory for estimation of thyroid hormone levels. Serum FT_4 and TSH levels were measured by ELISA (Enzyme linked immuno sorbent assay) method. Student's t test was applied to observe the difference of the thyroid hormonal levels between normal and preterm LBW babies.

Results

A total of 40 normal healthy term newborns, 38(95%) has normal FT_4 and TSH level. Only 2(5%) newborns were found to be hypothyroid (low FT_4 and high TSH). On the other hand among 30 preterm low birth weight baby, 6(20%) babies were found to be hypothyroid. The mean (± SD) serum FT_4 level in term and preterm neonates were 14.17±2.14 pg/ml and 12.25±3.16 pg/ml respectively (Table 1). Serum FT_4 level was significantly higher ($P< 0.05$) in term neonates than preterm neonates (Table 2). Mean FT_4 level in <36 weeks, 36-40 weeks and > 40 weeks gestational age group newborn were 12.13, 13.9 and 15.21 pg/ml respectively. The mean(±SD) serum TSH level in term and preterm neonates were 3.37±2.12 µIU/ml and 4.23±3.23 µIU/ml respectively (Table 1). There was no statistically significant difference (P=0.05) of mean serum TSH level between these two groups (Table 2).

Table 1 Mean (±SD) serum FT_4 & TSH level in normal newborn and preterm low birth weight babies.

Group	Mean(±SD) serum FT_4 (pg/ml)	Mean(±SD) serum TSH (µIU/ml)
Term baby	14.17±2.14	3.37±2.12
Preterm low birth weight baby	12.25±3.16	4.23±3.23

Table 2 Comparison of mean serum FT_4 & TSH level between normal newborn and preterm low birth weight babies.

Parameters of thyroid function	Term baby mean(±SD) n= 40	Preterm low birth weight baby mean(±SD) n=30	P value
Serum FT_4 (pg/ml)	4.17±2.14	12.25±3.16	0.003
Serum TSH(µIU/ml)	3.37±2.12	4.23±3.23	0.183

Discussion

Thyroid hormones screening in the neonatal period is essential to detect the hypofunctional state of thyroid gland. Most neonates born with congenital hypothyroidism (CH) have normal appearance and no detectable physical signs. Hypothyroidism in the newborn period is almost always overlooked and delayed diagnosis leads to the most severe outcome of CH, mental retardation, emphasizing the importance of newborn screening. In developed countries, this screening program was initiated in the last century and now it is well established. But in developing country like Bangladesh, this screening program for thyroid status in newborn is a new concept.[9,10]

In this study, total 70 neonates were included out of which 40 were normal, term baby and 30 were preterm, low birth weight baby. In first 2 to 3 days of life, there occurs TSH surge in the newborn baby due to neonatal cooling. It causes raised thyroid hormone level (T_3 & T_4).[3] To exclude this phenomenon, blood was collected from 5th day onwards from the newborn baby.

In this study, the mean(±SD) serum FT_4 values in term and preterm babies were 14.17±2.14 and 12.25±3.16 (pg/ml) respectively. This FT_4 value is significantly higher in term babies than preterm babies ($P< 0.05$). This result is similar to the study performed by Carrascosa et al. in 2004.[15] They measured FT_4 level in 75

preterm, newborn baby and later compared this value with term baby. The FT_4 level was found higher in term babies than preterm counterpart.

In my study, mean FT_4 level in < 36 weeks, 36-40 weeks and > 40 weeks gestational age group newborn were 12.13, 13.9 and 15.21 pg/ml respectively. Literature suggests that FT_4 level declines in relation to prematurity.[16] The findings of this study agreed with this.

In this study, mean serum TSH values among newborns having birth weight 2-2.5 kg and > 2.5 kg were 3.12 and 3.69 (μIU/ml) respectively. So it suggested that TSH elevation was attenuated in low birth weight infants. This finding consistent with the study performed by Tylek- Lemanska D, Kopice M & Starzyk J in 2002.[17]

Screening for serum TSH level among the newborns with low and very low birth-weight should be introduced in Bangladesh. This can prevent serious complications of hypothyroidism in future.

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