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Original Research Article

Prevalence of thyroid dysfunction in neonatal population

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ABSTRACT

Background: The objectives of this study was to study the prevalence of thyroid disorders in high risk neonatal populations and to study association of maternal thyroid dysfunction with neonatal thyroid problems and outcome.
Methods: This was an observational study, conducted in NICU at Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. The study included neonates born to mothers with thyroid disorder or with clinical features suggestive of thyroid dysfunction. Neonates with history of maternal thyroid dysfunction were screened at 72 to 96 hrs of postnatal age. Those with TSH >10 mIU/L or free T4 <1.1 ng /ml were followed up after two weeks. The neonates with clinical features suggestive of thyroid dysfunction were screened at presentation and those with abnormal thyroid profile were followed up after two weeks. Results obtained were statistically analyzed using SPSS 17.0 software.
Results: Out of 260 neonates screened, 208 neonates were born to mothers with hypothyroidism, 6 neonates had increased levels of TSH during first week which normalised on follow up during third week. One neonate born to hyperthyroid mother, showed increased TSH levels during first week and 2nd week which declined to normal level on follow up at 3rd week. Out of 51 neonates with clinical features suggestive of thyroid dysfunction, born to euthyroid mothers, 3 neonates had increased levels of TSH on presentation which normalised on further follow up. Thus, majority of high risk neonates at birth show transient hypothyroidism.
Conclusions: None of the neonate was labelled as hypothyroid, all the 10 neonates showed transient hyperthyrotropinemia.

Keywords: IUGR, FT4, FT3, LBW, NICU, The serum thyrotropin

INTRODUCTION

The thyroid gland disorders are the commonest endocrine disorders in the world. Congenital hypothyroidism remains commonest preventable cause of mental retardation. It is estimated to occur in 1 in 3000-4000 children in the world.

In India, this ratio is 1 in 2500. In the absence of the national neonatal screening programme thyroid disorders remain unrecognized in Indian children. The prevalence of thyroid dysfunction depends on gender, age, ethnicity, geographical background and iodine intake.[1-3] Thyroid hormones are of significant importance for regular functioning of almost all body organs.

Thyroxine (T4) is the main hormone released from the thyroid gland and it is transformed into biologically active 3,5,3'- triiodothyronine (T3) via 5' - deiodinases of thyroid hormone target cells.

Approximately 20% of triiodothyronine (T3), the more active thyroid hormone, is synthesized by the thyroid gland, while 80% is formed in the peripheral tissues from the 5'- deiodination of T4. T3 has a lower affinity for binding to transport proteins and globulins than T4.[4] Most cases of congenital hypothyroidism are not hereditary and result from thyroid dysgenesis. Some cases may be familial, usually caused by one of inborn errors of thyroid hormone synthesis, and may be associated with goiter.[5]

The newborn screening test can be performed either on cord blood or postnatal blood sample with each having its own merits and demerits. The advantages of cord blood sample includes being painless, not affected by neonatal surge, ensures screening for early discharged cases, and report is ready before discharge of newborn and one can counsel parents if needed. Disadvantages include false results due to birth asphyxia and inability to test other metabolic disorders.

Postnatal sample offer advantage of screening of other treatable inborn error of metabolism like CAH, galactossemia, phenylketonuria etc. and can be done for babies delivered at home.[6,7] Since routine neonatal screening is not being done in this part of the country and hypothyroidism being an important cause of preventable mental retardation, the present study was planned to study the prevalence of thyroid disorders in high risk neonatal population i.e. neonates born to mothers with thyroid dysfunction or clinical features suggestive of thyroid dysfunction.

Aims and objectives was to study the prevalence of thyroid disorders in high risk neonatal populations and to study association of maternal thyroid dysfunction with neonatal thyroid problems and outcome.

METHODS

The study was hospital based, observational study conducted in the Department of Pediatrics at Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Sri Amritsar from 1st January 2018 to 30th June 2019. The study included neonates born to mothers with thyroid disorder or with clinical features suggestive of thyroid dysfunction.

The newborns having abnormal thyroid function test i.e. serum TSH >10 (mIU/L) or free T4<1.1ng/ml during first postnatal week/ first presentation were followed up after two weeks.

Inclusion criteria

- Newborn with maternal history of thyroid dysfunction.
- Neonates with prolonged jaundice, feeding problems, constipation, enlarged protruding tongue, hoarse cry, protruding abdomen, cold mottled skin, patent posterior fontanelle.

Exclusion criteria

- Neonates with genetic syndromes (Down syndrome, trisomy 18, neural tube defects, Pierre Robin syndrome) etc.
- Neonates in whom an informed consent could not be obtained.

Sample collection

Blood sample was taken at 72 to 96 hrs of age on all neonates born to mothers with thyroid dysfunction or neonates with clinical features suggestive of thyroid dysfunction at first presentation in a plain- tube (red top vacutainer) under sterile conditions.

The serum Thyrotropin (TSH) levels (3rd Generation assay), FT4, FT3 was estimated in these subjects using vitros ECi by ortho clinical diagnostics which is Non competitive sandwich immunoassay. Neonates with TSH >10 mIU/L or free T4 <1.1 ng /ml were followed up after two weeks. Results obtained were statistically analyzed using SPSS 17.0 software.

RESULTS

A total of 260 neonates were screened. Mean age of the neonates was 5.46±3.63 days, while mean birth weight was 2.54±0.47Kg. 158 neonates (60.77%) were males while 102 (39.23%) were females.

Total 210 neonates (80.76%) were term, while 50 neonates (19.24%) were preterm. Hypothyroidism was present in mothers of 208 (80%) neonates and hyperthyroidism was present in mother of 1 (0.38%) neonate while mothers of 51 neonates (19.62%) were euthyroid.

Mean maternal TSH values of the hypothyroid mothers was 5.68±1.42 mIU/L. Serum TSH of hyperthyroid mother was 0.015mIU/L. Mean FT4 of hypothyroid mothers was 1.21±0.28 ng/ml while FT4 of hyperthyroid mother was 1 ng/ml (Table 1).

Neonates of hypothyroid mothers (n=208) had mean FT4 2.36±1.29 ng/ml and mean TSH was 8.85±7.87mIU/L during first postnatal week. 6 neonates had TSH >10 mIU/L. On further follow up of these cases (n= 6) after two weeks, mean FT4 was 2±0.64 ng/ml and mean TSH was 3.74±2.22 mIU/L. All of them had TSH <10 mIU/L in 3rd postnatal week. TSH and FT4 of newborn of hyperthyroid mother (n =1) during first postnatal week was 126 mIU/L and 1.31 ng/ml which declined to 18.6 mIU/ L and 0.69 ng/ml during 2nd postnatal week, 6.81 mIU/L and 1.8 ng/ml during 3rd postnatal week (Table 2).

Table 1: Distribution of neonates according to maternal history of thyroid dysfunction.

Maternal h/o thyroid dysfunction	Number of neonates (n, %)	Maternal free T4 (Mean±SD, range)	Maternal TSH (Mean±SD, range)
Hyperthyroidism	1, 0.38%	1	0.015
Hypothyroidism	208, 80%	1.21±0.28, 0.6-2.1	5.68±1.42, 2.72±10.3
No history of maternal thyroid dysfunction	51, 19.62%	1.12±0.07, 1.05-1.19	2.01±0.59, 1.62-2.60
Total	260, 100%		

Table 2: Thyroid profile of neonates.

Maternal history of thyroid dysfunction	Ist Post-natal week			3rd Post-natal week (Follow up positive cases)		
	No. of cases	FT4 ng/ml	TSH mIU/L	No. of cases	FT4 ng/ml	TSH mIU/L
Hypothyroidism	208	2.36±1.29	8.85±7.87	6	2±0.64	3.74±2.22
Hyperthyroidism	1	1.31	126	1	1.8	6.81
Euthryrodism	51	1.87±0.27	9.4±6.04	3	2.25±1.09	4.23±2.41

In neonates of euthyroid mother (n=51) with suggestive clinical features of thyroid dysfunction, Feeding difficulty was present in 6 neonates (2.3%), prolonged jaundice in 57 neonates (21.9%), lethargy and constipation in 6 (2.3%) and 3 neonates (1.2%) respectively, poor weight gain and hypotonia in 5 (1.9%) and 4 neonates (1.5%) respectively. Macroglossia was present in 2 neonates (0.8%). Wide anterior fontanellae and patent posterior fontanellae were present in 3 (1.2%) and 1 neonate (0.4%) respectively. Mean neonatal free T4 was 1.87±0.27 ng/ml and mean TSH was 9.4±6.04 mIU/L at first presentation 3 neonates had serum TSH >10 mIU/L. On follow up after two weeks, mean free T4 was 2.25±1.09 ng/ml and mean TSH was 4.23±2.41 mIU/L (Table 2).

Out of 260 neonates screened for thyroid dysfunction, 10 neonates had deranged thyroid profile during first week/first presentation. 7 were females while 3 were males. History of maternal hypothyroidism was present in 6 neonates and maternal hyperthyroidism in one neonate only. 3 neonates presented with prolonged jaundice (Table 4).

All 10 neonates had transient hyperthyrotropinemia as the levels of TSH declined to normal after two weeks. The mothers with thyroid dysfunction had more previous abortion (17.7%), more preterm delivery (14.8%), high incidence of IUGR (11.4%) as compared to euthyroid mother (3.92%, 7.8%, 5.88%) respectively and the difference was statistically significant (Table 3).

Table 3: Maternal demographic characteristics and neonatal outcomes of mother with thyroid dysfunction.

Parameter	Mother's with thyroid dysfunction (n=209)	Euthyroid mothers (n=51)	p- value
Maternal age (years) (min-max)	23-38	21- 32	0.35
Parity Primipara/Multipara	78/131	16/35	0.23
Previous abortion history n (%)	37 (17.7%)	2 (3.92%)	0.002
Current preterm delivery n (%)	31 (14.8%)	4 (7.8%)	<0.001

Table 4: Prevalence of congenital hypothyroidism in neonates with maternal history of thyroid dysfunction (n=209).

Maternal history of thyroid dysfunction	Number of neonates screened	Neonates with increased levels of TSH at 1st week		Neonates with increased levels of TSH at 3rd week	
		n	Percentage	n	Percentage
Hypothyroidism (n=208)	208	6	2.88%	Nil	Nil
Hyperthyroidism (n=1)	1	1	100%	Nil	Nil

Table 5: Overview of neonates with increased levels of TSH at first postnatal week or first presentation.

Age (Days)	Sex	History of maternal thyroid dysfunction	Clinical features	Maternal TSH (mIU/L)	Maternal free T4 (ng/ml)	N Free T4	Neonatal TSH	Follow up after 2 weeks	
								N Free T4	N TSH
4	F	Yes	-------	6.37	1.22	2.94	15.4	2.65	3.91
4	M	Yes	-------	10.3	1.17	1.11	14.83	1.30	2.35
4	M	Yes	--------	6.93	2.1	3.57	10.2	2.16	4.09
3	F	Yes	---------	5.93	1.02	1.18	10.9	2.74	7.93
3	F	Yes	---------	8.66	0.88	1.07	11.5	1.15	1.62
3	F	Yes	--------	5.59	1.26	1.37	16.72	1.51	2.62
3	M	Yes (hyper)	---------	0.015	1	1.31	126	1.8	6.81
15	F	No	Prolonged jaundice	2.35	1.16	1.17	13.45	1.30	8.63
19	F	No	Prolonged jaundice	2.20	1.04	1.27	15.28	1.69	0.33
15	F	No	Prolonged jaundice	2.67	1.19	1.27	15.4	2.87	1.67

Out of 260 high risk neonates screened for thyroid dysfunction, 10 neonates had deranged thyroid profile at first week/presentation. Out of 10 neonates, 7 were females while 3 were males. History of maternal thyroid dysfunction was present in 7 neonates. Six neonates were born to hypothyroid mother and one neonate was born to hyperthyroid mother. 3 neonates presented with prolonged jaundice. On further screening of these neonates after two weeks, the thyroid profile was found to be normal. All 10 neonates had transient hyperthyrotropenemia (Table 5).

DISCUSSION

In the present study, out of 260 neonates screened for thyroid dysfunction, 10 neonates had serum TSH >10mIU/L in the first postnatal week /first presentation, out of which only one neonate had serum free T4 <1.1 ng/ml. On follow up of these neonates after two weeks, the serum TSH levels returned to normal (<10mIU/L). Hence these 10 neonates showed transient hyperthyrotropinemia. Out of these 10 neonates, maternal hypothyroidism was present in 6, maternal hyperthyroidism in one neonate and three neonates had suggestive clinical features of thyroid dysfunction. The neonates of mothers with thyroid dysfunction had higher recall rate compared to neonates of euthyroid mothers. Ozdemir et al also observed a higher recall rate in newborn TSH screening in association with maternal hypothyroidism. Although most of them returned to normal on follow up indicating transient thyroid dysfunction in the first 8 weeks of life.[8]

Dussault and Fisher documented that the prevalence of newborn transient hypothyroidism in a population of hypothyroid infants was 27% which is significantly higher than 15% observed in overall population of 523 congenitally hypothyroid infants.[9]

In our present study, the preterm delivery was more in mothers with thyroid dysfunction (14.8%) as compared to euthyroid mothers (7.8%). The median gestational age of mother with thyroid dysfunction was 36.5 weeks while median gestational age of euthyroid mother was 38 weeks and the difference was statistically significant (p <0.001). Results are in concordance with study conducted by Ozdemir H et al who reported increased rate of preterm (27.3%) delivery in hypothyroid mothers as compared to euthyroid mother (18.5%). The median gestational age reported by Ozdemir H et al was 36.5 weeks in hypothyroid mother and 38 weeks in euthyroid mother.[8]

In this present study, the neonate born to hyperthyroid mother had gestational age 36 weeks with low birth weight 1.8 kg. These results are in concordance with Medici et al who also reported that maternal high-normal FT4 levels in early pregnancy are associated with lower birth weight and an increased risk of small for gestational age (SGA) newborns.[10]

CONCLUSION

Maternal hypothyroidism is associated with increased risk of abortions, still birth, preterm delivery. Therefore; women with thyroid disorders should be closely monitored throughout the pregnancy for prevention of obstetric complications.

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

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