Growth Assessment of Pre-School Children (1 to 4 Years of Age) Suffering from Congenital Hypothyroidism

Ashok Kumar[1], Shweta Joshi[2], Sushil Ojha[3]

[1]Associate Professor and HOD, Department of Paediatrics, GDMC, Dehradun. [2]Tutor, Department of Pathology, GDMC, Dehradun. [3]Assistant Professor, Department of Ophthalmology, GDMC, Dehradun.

ABSTRACT

BACKGROUND

Most common preventable reason for growth retardation and mental retardation is hormone deficiency of thyroid known as congenital hypothyroidism. In most of the cases of Congenital Hypothyroidism the cause is thyroid dysgenesis (abnormal development of thyroid) in around 80 to 85% of cases, and in 15 to 20% cases the cause is dyshormogenesis. As there is absence of signs and symptoms of Congenital Hypothyroidism in a newborn it may lead to delayed diagnosis in a newborn and leading to mental retardation and failure in normal growth attainment. So, neonatal screening is essential in every childbirth. We wanted to assess the growth of preschool child (1 to 4 years of age) suffering from congenital hypothyroidism.

METHODS

We have included children (age range from 1 to 4 years) on treatment with thyroxine hormone for the congenital hypothyroidism enrolled in Department of Pediatrics of Government Medical College (GMC), Haldwani, Nainital, Uttarakhand in December 2015 to November 2016. Exact age of the child was determined from the birth certificate. Each child was measured for growth. Patients were divided into 2 groups - Group 1 severe CH (pretreatment T4 level <4 microg/dL) (n = 9 total, 5 male and 4 female)-and group 2- Mild CH (pretreatment T4 level > or = 4 microg/dL) (n = 6 total, 4 male, 2 female).

RESULTS

All patients who received treatment at an early age showed normal measurable growth parameters; but girls were taller than boys in first year. Boys showed some comparative delay of measurable growth parameters compared to female children. In our study, the final growth attained at the age of 4 years did not show any statistically significant difference between mild and severe CH groups and had normal measurable growth parameters.

CONCLUSIONS

Early diagnosis and early treatment for CH can prevent the measurable growth parameter disorder in children. Normal measurable growth parameters in both mild and severe CH group are similar, if they are given thyroid hormone supplementation therapy. Age of normalisation of thyroid hormone after treatment is very important predictor of normal growth parameter attainment with growing age. Female children respond faster than male children.

KEYWORDS

Congenital Hypothyroidism, Growth Assessment, Preschool Children, Neonatal Screening

Corresponding Author:
Dr. Shweta Joshi,
Tutor,
Department of Pathology,
GDMC, Dehradun.
E-mail: ashoka.undefined@gmail.com

DOI: 10.18410/jebmh/2020/253

Financial or Other Competing Interests: None.

How to Cite This Article:
Kumar A, Joshi S, Ojha S. Growth assessment of pre-school children (1 to 4 years of age) suffering from congenital hypothyroidism. J. Evid. Based Med. Healthc. 2020; 7(25), 1183-1187. DOI: 10.18410/jebmh/2020/253

Submission 13-05-2020,
Peer Review 16-05-2020,
Acceptance 02-06-2020,
Published 17-06-2020.

BACKGROUND

Most common preventable reason for growth retardation and mental retardation is hormone deficiency of thyroid known as congenital Hypothyroidism. In most of the cases of Congenital Hypothyroidism the cause is thyroid dysgenesis (Abnormal development of thyroid) in around 80 to 85% of cases and in 15 to 20% cases cause is dyshormogenesis. As there is absence of signs and symptoms of Congenital Hypothyroidism in Newborn it may lead to delayed diagnosis in Newborn[1] and severe cases of Congenital Hypothyroidism in form of Mental retardation and failure in normal growth attainment. So, neonatal screening is essential in every child birth.

Thyroid hormones plays a vital role in physical and mental development starting from foetal life and neonatal life period.[2] Deficiency of thyroxine is known to affect children during growing years. Congenital Hypothyroidism (CH) is most common hormonal disorder of children and infant and is now growth retardation can be prevented with early diagnosis and treatment. Congenital Hypothyroidism (CH) normally seen in 1 in 3000-4000 newborn which varies with geographical area and Ethnicity[3-8] and method used for the screening.

Even after launching of screening programmes to ensure early diagnosis and early treatment, still we are seeing physical and mental developmental problems in children with thyroid hormone deficiency even developed countries.[9-11]

It has been established by different studies about the role of environment, genetic factors and Ethnicity in the final growth outcomes of children.[12-16] However measurable growth parameters in children of Congenital Hypothyroidism on treatment in a Hilly area Tertiary care Hospital of Uttarakhand not yet done.

Studies conducted by Awat Feizi et al[5] in Iranian population showed persistence of growth compromise compare to their normal population. On the contrary studies conducted by Siragusa et al,[17] Moschini et al,[18] Morin et al[19] and Cetinkaya et al[20] shown adequate growth and normal stature with adequate thyroxine therapy after birth. As per many observational studies it has been found that growth attainment in patients of Congenital hypothyroidism remains inconclusive even in developed countries, and similar data for Indian population in the Hilly area of Uttarakhand is also not yet available.

METHODS

We have included children (age range from 1 to 4 Year) on treatment with thyroxine hormone for the congenital hypothyroidism enrolled in Department of Pediatrics of Government Medical College (GMC) and Susheela Tiwari memorial Hospital, Haldwani, Nainital, Uttarakhand in December 2015 to November 2016. Exact age of the child determined by from known date of birth in the hospital records. Each child measured for Growth under following measurable body parameters.

Body Weight (in Kg)

Body weight was measured by on an electronic weighing scale (Avery Electronic Weighing Scale) (least count 50 gm). Height (in cm), Height was measured with a stadiometer (Holtain, Dyfed, UK; least count 1 mm).

Circumferences

Mid–upper-arm circumference (in cm), head circumference (in cm). Circumferences was measured with a discussion tape measure (least count 1 mm).

Skin Fold Thickness (SFT)

Triceps skinfold thickness (in mm), subscapular skin fold thickness (in mm).Harpenden Skinfold Caliper (Holtain; least count 0.2 mm) was used to measure skin fold thickness. All skin fold measurements was taken on the left side of the body. SFT was measured in triplicate and the mean values recorded.

All measurements was taken by standardised techniques described by Weinerand Lourie.[21] Body weight was measured by electronic weighing machine with accuracy up to 50 grams. Each enrolled Child was examined at 6 monthly interval. Follow up of these children was carried out on pre appointed date and time in growth clinic, GMC Haldwani. We employed whole day (24 Hour) recall method to monitor dietary intake. A record of dose and duration of thyroxine would be kept and also record of any other sickness and ailment would also be kept.

All body measurements was performed by the chief investigator himself. We have used already published data of developed country for comparison with our collected data from Indian children group.

RESULTS

With our study are trying to find out impact of early screening, early treatment on measurable growth parameters of children suffering from Congenital Hypothyroidism (CH).

In this study, we have included children (age range from 1 to 4 Year) on treatment with thyroxine hormone for the congenital hypothyroidism enrolled in Department of Paediatrics of Government Medical College (GMC), Haldwani, Nainital, Uttarakhand in December 2015 to November 2016. Total 15 children were enrolled in the present study. Out of which 9 were male and 6 were female. The follow up was done at 6-month interval with measurable growth parameter and complete thyroid profile test (T3, T4, TSH).

We ha**v**e noted significant impact thyroid hormone on growth, and its impact on growth depends on age of detection of congenital hypothyroidism, and age of normalisation of thyroid hormones with treatment. Out the thyroid hormones, TSH (Thyroid stimulating hormone) and Thyroxine normalisation found to be more important.

The mean age at the time of diagnosis of congenital hypothyroidism 20 ± 5 days as per records shown by the patients. (Thyroid function test was reconfirmed by doing repeat test after 1 week of getting the first report. so, mean age of diagnosis is around 20 ± 5 days)

	Group 1 Severe CH T4 <4 µg/dL	Group 2 Mild CH T4 >4 µg/dL
Male	5	4
female	4	2
Total	9	6

Table 1. Demonstrating the No. of Children in the Two Groups

Patients were divided into 2 groups - Group 1 severe CH (pretreatment T4 level <4 microg/dL) (n = 9 total, 5 male and 4 female)-and group 2- Mild CH (pretreatment T4 level > or = 4 microg/dL) (n = 6 total, 4 male, 2 female). (Table 1)

All patients who received treatment at early age showed normal measurable growth parameters, but girls noted be taller than boys in first year, but it was not statistically significant. (Table 2)

	Mean in Child of Congenital Hypothyroidism at 1 Year	Comparing Mean with WHO Normal Data for 1 Year Age	
Weight (in Kg)			P value
a. Boy	9.60	9.50	more than
b. Girl	8.90	9	0.05
Height (in CM)			P value
a. Boy	72	76	more than
b. Girl	73	74	0.05
Head Circumference (in CM)			P value
a. Boy	44.8	46	more than
b. Girl	44.9	45	0.05

Table 2. Growth Parameters in a Child with Congenital Hypothyroidism and Its Comparison with WHO Growth Chart at 1 Year of Age

	Mean in Child of Congenital Hypothyroidism at 4 Years	Comparing Mean with WHO Normal Data for 4 Years Age	
Weight (in Kg)			P value
a. Boy	15.5	16.34	more than
b. Girl	15.30	16	0.05
Height (in CM)			P value
a. Boy	102	104	more than
b. Girl	100	103	0.05
Head Circumference (in CM)			P value
a. Boy	50	50.2	more than
b. Girl	49	49.5	0.05

Table 3. Growth Parameters in a Child with Congenital Hypothyroidism and Its Comparison with WHO Growth Chart at 4 Years of Age

Boys showed some comparative delay of measurable growth parameters compared to female children at 1 Year of age (Table 2 and Table 3). In our study the final growth attained at age of 4 years was not having any statistically significant difference between mild and severe CH groups, boys Vs. Girls and also no significant difference when it was compared with normal measurable WHO growth chart database. (Table 2 and 3).

DISCUSSION

Our study showed that with recent early screening protocol and early thyroid hormone supplementation therapy can prevent the measurable growth parameter abnormality in children. Female children responded better to treatment compared to male children. Comparison with other studies to support our results.

Feizi Awat et al[5] weight in a prospective study by Feizi Et al of 760 CH neonate, found that proper treatment of neonates with congenital hypothyroidism would improve the growth delay of patients during follow up. V. Siragusa et al[17] have noted there is direct correlation between severity and duration of thyroid hormone deficiency and if they are provided with Thyroid hormone supplementation therapy they attained the normal growth parameters.

Author	Year	Type	Population or Target Patient Enrolled	Age Group	Result
Present Study	2016	Prospective Study	Hilly area of Uttarakhand, India	Up to 4year	Normal measurable growth parameter in both mild and severe CH group, if they are given thyroid hormones supplementation therapy achieved at age of 4 years
Awat Feizi et al[5]	2010	Prospective	Iran	Neonates	Growth remained less compared to control
Morin et al[19]	2010	Prospective	Argentina	Up to 3 Years	Normal growth achieved at age of 3 years
Siragusa et al[17]	1996	Retrospective	Italy	Up to 6 years	Growth retardation depends on age of starting Thyroxine therapy
Moschini et al[18]	1986	Prospective	Brazil	All children	Catch up growth achieved by 6 Years
Cetinkaya et al[20]	1997	Retrospective	Turkey	Pubertal and Pre pubertal	Growth velocity increases with Thyroxine Therapy
Ng, S. M., Wong et al[22]	2004	Prospective	Liverpool, UK	Up to 3 Years	No difference was found in gestation, birth weight, age of starting L-T4 and initial dose of L-T4 in mcg/Kg/day between groups

Table 4. Comparison of Our Study with Different Related Studies

In a longitudinal study of a cohort by Morin et al[19] of 74 children in Buenos Aires province in Argentina, the study found that patients with CH treated early showed sexually dimorphic pattern of growth, with girls tending to be longer than boys at all ages. No difference was found in the linear

growth between the groups having severe and less severe Congenital Hypothyroidism. Height was normal in both sexes at 3 years of age.

Cetinkayaet al[20] showed in a study involving 39 children with sub clinical hypothyroidism that their increased growth velocity and Growth Velocity standard deviation score (GVSDS) after L – Thyroxine treatment.

Study by Ng, S. M., Wong et al[22] suggest a direct relationship between severity and duration of hormone deficiency and growth retardation and confirm that replacement therapy started within the first year of live in CH patients clinically diagnosed allows a catch-up growth. There was no difference was found in gestation, birth weight, age of starting L-T4 and initial dose of L-T4 in mcg/Kg/day between groups.

Moschini et al.,[18] reported that Congenital Hypothyroidism patients reached normal height at 6 years of age if treatment initiation would be in 33 days after birth. Normal height at 6 years of age was also reported by Siragusa et al. [17] Heyerdahl and colleagues[23] in their study on linear growth of early treated CH patients reported that, in comparison with reference children, children with hypothyroidism had reduced growth from 6 to 12 months and increased growth after 12 months of age. They concluded that thyroid hormones during the first months of life are essential for normal growth of children. Their results indicated that both the infancy and the childhood components of growth are thyroid hormone dependent.

Sato et al.,[24] have reported normal weight for CH patients, but others have reported that CH patients were heavier than normal children even during childhood and adolescence period, in contrast with our findings.[25]

It is suggested that higher weight in CH patients is prominently related to inappropriate treatment such as under treatment condition as a result of parent-child or physician-child relationship and is not related to factors related to linear growth as mentioned by other studies.[22]

Our study concludes that early diagnosis and early treatment are very much essential to attain normal growth parameter in patients of Congenital Hypothyroidism. Also, we conclude that even with early treatment the independent predictor age of normalization of thyroid hormone after hormone supplement therapy.

CONCLUSIONS

The author recommends screening of all neonates for congenital hypothyroidism even if no signs or symptoms are present in the neonate after birth. If detected at an early age, we can prevent the mental and physical growth retardation in the children. Also, we recommend starting early treatment and early normalisation of thyroid hormone. Age at normalisation of thyroid hormone after hormone supplementation therapy is independent predictor for attainment of normal growth parameters. Although our sample size is less, we observed faster growth response in female children than male children at 1 year of age but at 4 years both sexes attained normal growth parameters.

REFERENCES

[1] LaFranchi SH. Hypothyroidism. Pediatr Clin North Am 1979;26(1):33-51.

[2] Bain P, Toublanc JE. Adult height in congenital hypothyroidism: prognostic factors and the importance of compliance with treatment. Horm Res 2002;58(3):136-142.

[3] Rastogi MV, LaFranchi SH. Congenital hypothyroidism. Orphaned J Rare Dis 2010;5:17.

[4] Rose SR, Brown RS, Foley T, et al. Update of newborn screening and therapy for congenital hypothyroidism. Pediatrics 2006;117(6):2290-2303.

[5] Rosenthal M, Addison GM, Price DA. Congenital hypothyroidism: increased incidence in Asian families. Arch Dis Child 1988;63(7):790-793.

[6] Hashemipour M, Hovsepian S, Kelishadi R, et al. Permanent and transient congenital hypothyroidism in Isfahan-Iran. J Med Screen 2009;16(1):11-16.

[7] Haghshenas M, Pasha YZ, Ahmadpour-Kacho M, et al. Prevalence of permanent and transient congenital hypothyroidism in Babol City-Iran. Med Glas 2012;9(2):341-344.

[8] Hashemipour M, Amini M, Iranpour R, et al. Prevalence of congenital hypothyroidism in Isfahan, Iran: results of a survey on 20,000 neonates. Horm Res 2004;62(2):79-83.

[9] Olney RS, Grosse SD, Vogt RF. Prevalence of congenital hypothyroidism-current trends and future directions: workshop summary. Pediatrics 2010;125 Suppl 2:S31-S36.

[10] Kempers MJE, van der Sluijs Veer L, Nijhuis-Van Der Sanden RWG, et al. Neonatal screening for congenital hypothyroidism in The Netherlands: cognitive and motor outcome at 10 years of age. J Clin Endocrinol Metab 2007;92(3):919-924.

[11] Leonardi D, Polizzotti N, Carta A, et al. Longitudinal study of thyroid function in children with mild hyperthyrotropinemia at neonatal screening for congenital hypothyroidism. J Clin Endocrinol Metab 2008;93(7):2679-2685.

[12] Hashemipour M, Hovsepian S, Kelishadi R, et al. Permanent and transient congenital hypothyroidism in Isfahan-Iran. J Med Screen 2009;16(1):11-16.

[13] Sabri MR, Hossein S, Mahin H. Congenital cardiac malformations in congenital hypothyroid patients in Isfahan. J Res Med Sci 2006;11(4):234-239.

[14] Hashemipour M, Nasri P, Hovsepian S, et al. Urine and milk iodine concentrations in healthy and congenitally hypothyroid neonates and their mothers. Endokrynol Pol 2010;61(4):371-376.

[15] Hashemipour M, Amini M, Talaie M, et al. Parental consanguinity among parents of neonates with

congenital hypothyroidism in Isfahan. East Mediterr Health J 2007;13(3):567-574.
[16] Adibi A, Haghighi M, Hosseini SR, et al. Thyroid abnormalities among first-degree relatives of children with congenital hypothyroidism: an ultrasound survey. Horm Res 2008;70(2):100-104.
[17] Siragusa V, Terenghi A, Rondanini GF, et al. Congenital hypothyroidism: auxological retrospective study during the first six years of age. J Endocrinol Invest 1996;19(4):224-229.
[18] Moschini L, Costa P, Marinelli E. Longitudinal assessment of children with congenital hypothyroidism detected by neonatal screening. Helv Paediatr Acta 1986;41(5):415-424.
[19] Morin A, Guimarey L, Apezteguía M, et al. Linear growth in children with congenital hypothyroidism detected by neonatal screening and treated early: a longitudinal study. J Pediatr Endocrinol Metab 2002;15(7):973-977.
[20] Cetinkaya E, Aslan AT, Vidinlisan S, et al. Height improvement by L-thyroxine treatment in subclinical hypothyroidism. Pediatr Int 2003;45(5):534-537.
[21] Weiner JS, Lourie JA. Human biology: a guide to field methods. Oxford UK Blackwell: International Biological Programme 1969.
[22] Ng SM, Wong SC, Didi M. Head circumference and linear growth during the first 3 years in treated congenital hypothyroidism in relation to aetiology and initial biochemical severity. Clin Endocrinol (Oxf) 2004;61(1):155-159.
[23] Heyerdahl S, Ilicki A, Karlberg J, et al. Linear growth in early treated children with congenital hypothyroidism. Acta Paediatr 1997;86(5):479-483.
[24] Sato H, Sasaki N, Aoki K, et al. Growth of patients with congenital hypothyroidism detected by neonatal screening in Japan. Pediatr Int 2007;49(4):443-446.
[25] Salerno M, Micillo M, Di Maio S, et al. Longitudinal growth, sexual maturation and final height in patients with congenital hypothyroidism detected by neonatal screening. Eur J Endocrinol 2001;145(4):377-383.