INTELLECTUAL AND ACADEMIC PERFORMANCE OF CHILDREN WITH CONGENITAL HYPOTHYROIDISM IN RELATION TO TIME OF DIAGNOSIS
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ABSTRACT

BACKGROUND
Context- Congenital hypothyroidism is an important cause of preventable mental retardation in children. Since, neonatal screening is not done routinely in India, many cases are diagnosed late. Earlier, the diagnosis and initiation of treatment, better will be the outcome.

The aim of the study is to assess the effect of time of onset of treatment in intellectual and scholastic performances in children with congenital hypothyroidism.

MATERIALS AND METHODS
Children were classified into 3 groups. Group 1 were diagnosed and treatment initiated within one month of birth. Group 2, between 1 and 6 months and group 3 after 6 months. General intelligence and IQ were assessed by Malin’s intelligence scale for Indian children. Scholastic performance were evaluated by academic evaluation scale for slow learners and ADHD were diagnosed by DSM-IV criteria.

Settings and Design- The study was done in the Paediatric Endocrinology Clinic of Institute of Maternal and Child Health, Department of Paediatrics, Government Medical College, Kozhikode. Study population included children of age group 6-9 years with congenital hypothyroidism.

Statistical Methods Used- Statistical analysis was done with SPSS software version 16. The statistical analysis was done by ANOVA test.

RESULTS
IQ and intellectual outcomes were better in group 1 where treatment was initiated within one month. Similarly, poor academic abilities and increased incidence of ADHD were noted in children in whom diagnosis was made late.

CONCLUSION
Later the diagnosis more will be the intellectual and scholastic backwardness in children underscoring the importance of universal newborn screening.

KEYWORDS
Congenital Hypothyroidism, Intelligence Quotient, Attention Deficit Hyperactive Disorder (ADHD), Thyroxine.


BACKGROUND
Congenital hypothyroidism is the commonest preventable cause of mental retardation in children. As per the data obtained from neonatal thyroid screening all over the world, the incidence of congenital hypothyroidism is 1:2000-1:2500. Undiagnosed congenital hypothyroidism results in permanent neurological and intellectual impairment. Thyroid hormone is essential for brain growth in foetuses and young children and also for growth and skeletal maturation.

Most neonates born with congenital hypothyroidism have normal physical appearance. This is due to effect of maternal thyroxin. Hence, this condition is often overlooked in them. This fact underscores the importance of neonatal screening, which is universal in all developed countries. Unfortunately, routine neonatal screening is done only in very few centres in India.

AIMS AND OBJECTIVES
To assess the effect of time of onset of treatment in intellectual and scholastic performances in children with congenital hypothyroidism-
1. To assess intellectual outcome by IQ assessment.
2. To assess scholastic performances by academic evaluation scale for slow learners.
3. To detect features of Attention Deficit Hyperactive Disorder (ADHD) by using DSM-IV criteria.

MATERIALS AND METHODS
This was a cross-sectional study conducted in children on regular treatment for congenital hypothyroidism from paediatric endocrinology clinic of Institute of Maternal and Child Health, Government Medical College, Kozhikode, and who have achieved good control. Age group selected was between six and nine years. Study period was from January 2012 to December 2013.

Exclusion Criteria
1. Hypothyroidism with syndromic association or with mental retardation due to some other causes, other than hypothyroidism.
2. Central hypothyroidism.
3. Acquired hypothyroidism.
4. Transient hypothyroidism.
5. Children not on regular treatment and whose thyroid functions were not titrated properly.

Tools Used in Assessment
1. Malin’s Intelligence Scale for Indian Children (MISIC) for IQ.
2. Academic evaluation scale for slow learners.
3. DSM-IV criteria for diagnosing ADHD.

Malin’s intelligence scale is based on David Wechsler’s Intelligence Scale for Children (WISC) modified by Arthur J Malin. This scale is useful for children from 6 years to 15 years. The scale comprises of twelve subsets divided into verbal and performance groups. Academic evaluation scale for slow learners is a simple method to assess the scholastic performances of children by assessing their abilities in 3 modalities, i.e. reading, writing and mathematical abilities. In each modality, children are given grades from 0 to 5.

Features of ADHD were assessed using DSM-IV criteria, which is divided into criteria A to E.

Methods
Children were categorised into 3 groups according to the age of onset of treatment.
Group 1- Those who were diagnosed and on treatment from <1 month of age.
Group 2- Those who were diagnosed and on treatment after 1 month of age, but before 6 months of age.
Group 3- Those who were diagnosed and on treatment after 6 months of age.

Children from these 3 groups were assessed using the above-mentioned tools for IQ, scholastic performances and for features of Attention Deficit Hyperactive Disorder (ADHD). The parameters assessed by the above tests were compared between 3 groups. Statistical analysis was done with SPSS software version 16. The statistical analysis was done by ANOVA test.

OBSERVATIONS
A total of 60 children satisfied the inclusion criteria. Mean age was 7.6 with a standard deviation of 1.157. Majority was girls (57%) and was from low socioeconomic class (grade IV as per modified Kuppuswamy criteria) (83.3%). Family history of thyroid disease was present in very few cases (6.7%).

Intellectual Assessment
There was a statistically significant difference in verbal and performance quotient as well as total intelligence quotient when the three groups are compared. Children who were put on thyroxine replacement at later ages were found to have low values.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Verbal Quotient (VQ)</th>
<th>Mean Performance Quotient (PQ)</th>
<th>Mean Intelligence Quotient (IQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>96.38</td>
<td>99.32</td>
<td>97.7</td>
</tr>
<tr>
<td>2.</td>
<td>91.21</td>
<td>93.5</td>
<td>92.3</td>
</tr>
<tr>
<td>3.</td>
<td>80.73</td>
<td>80.7</td>
<td>81.09</td>
</tr>
</tbody>
</table>

Table 1. Values of Intellectual Scores

The values of 3 groups were statistically compared using ANOVA. The results were plotted on a Bonferroni table. There is a statistically significant difference between each group in each domain with p values less than 0.05.
Academic evaluation scale for slow learners.

Using grading system, children were graded from 0-5 in 3 domains, i.e. reading, writing and mathematical ability. Lower values were seen in children who belonged to group 2 and 3 who were started treatment at a later age.

<table>
<thead>
<tr>
<th>Parameter Tested</th>
<th>Group</th>
<th>Grade</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>1</td>
<td>4.7</td>
<td>0.483</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.0</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.5</td>
<td>0.527</td>
</tr>
<tr>
<td>Writing</td>
<td>1</td>
<td>4.6</td>
<td>0.516</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.5</td>
<td>0.527</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.3</td>
<td>0.483</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1</td>
<td>4.1</td>
<td>0.738</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.2</td>
<td>0.422</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.6</td>
<td>0.699</td>
</tr>
</tbody>
</table>

**Table 3. Academic Evaluation Scale**

There was a statistically different difference between each group in each domain with p value less than 0.05.

Attention deficit hyperactive disorder.

There were 6 children with Attention Deficit Hyperactive Disorder (ADHD) in group 3 and 4 in group 2 and one in group 1.

**DISCUSSION**

The main factors affecting intellectual outcome in children with congenital hypothyroidism are time of initiation of treatment, T4 levels at birth, initial dose of thyroxine therapy and maintenance of euthyroid state. Various studies show a significantly lower level of intelligence in children with congenital hypothyroidism compared with normal children. In this study, analysis showed that there was a significant effect of time of onset of treatment on intellectual outcome. The 3 groups showed a statistically significant difference in mean IQ levels. Those children who were put on treatment before one month (group 1) showed a mean IQ of 97.7, while 2nd and 3rd group showed IQ of 92.3 and 81.09, respectively. The individual components, i.e. the verbal and performance IQ also showed similar differences. Statistical analysis showed a significant difference with p value less than 0.01. The results were comparable with other studies. Alan H Klien showed a similar difference in IQ values with mean IQ in children in whom treatment was initiated before one month and 71 in children with delayed initiation of treatment (more than one month). French national program reported the effect as follows. IQ of 119.2 if treatment was initiated before 15 days of birth compared to 107.7 in whom treatment was initiated after 15 days, but less than 30 days.

The present studies showed that learning scores in all 3 domains (reading, writing and mathematical abilities) were low in children of group 3 where treatment was delayed for more than one month. The difference was statistically significant study by Orbeck et al showed that children with congenital hypothyroidism had severe learning disability if treatment was delayed. The effect was more on verbal and arithmetic domains, which was consistent with present study. A study by Bargagna S showed that there was significant delay in language development and fine coordination in these children. All these studies underscore the importance of early detection by a neonatal thyroid screening program and regular follow up for a favourable outcome in children with congenital hypothyroidism.

In this study, we got few children having ADHD. Even though numbers are less, it shows that chance of getting ADHD was higher in children with congenital hypothyroidism. Various studies including a study by Nicoletta Bisacchi had shown that there is a definite risk of behavioural problems in children with congenital hypothyroidism again pointing for early diagnosis, prompt treatment and regular and systematic follow up for a better outcome in these children.

**CONCLUSION**

The following conclusions were drawn from this study-time of onset of treatment has a definite effect on intellectual outcomes in case of congenital hypothyroidism. Children who have received treatment in the first month of life showed higher IQ values. There was a statistically significant incidence of poor academic abilities in children with congenital hypothyroidism who were diagnosed late and received treatment after first month of life. Incidence of behavioural abnormalities like ADHD was observed to be higher in children with congenital hypothyroidism in whom treatment was delayed.

**Suggestions**

Neonatal thyroid screening program is a must in India for early detection of congenital hypothyroidism and for preventing the commonest cause of preventable mental retardation in children. All children should undergo regular follow up for early detection and effective management of intellectual and scholastic backwardness and also behavioural problems.
Limitations of This Study
This was a cross-sectional study, which assessed children at a single point of time. The study was not blinded and there was no control group of normal children.

REFERENCES