Ophthalmic Manifestations in Children with Delayed Milestones- A Clinical Study

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ABSTRACT

A cross-sectional study of 150 children aged between 6 months and 3 years with delayed developmental milestones was conducted at Child Development Centre, Sri Avittam Thirunal Hospital and Regional Institute of Ophthalmology, Trivandrum over a period of 18 months. The study aimed at identifying the various ocular manifestations in children with developmental delay, the treatable causes of visual handicap among them and the associated antenatal and perinatal factors. A complete systemic examination in consultation with a paediatrician and a detailed ophthalmic evaluation including assessment of refraction was performed. The collected data was analysed by statistical methods. CONCLUSIONS: Ocular manifestations were present in 64% of selected children. Refractive errors (41.3%), Stabismus (40%) & Optic Atrophy (9.3%) were identified as the major causes of visual impairment. The chief treatable causes were Refractive errors (41.3%), Squint (40%), Cataract (2.6%) and Retinopathy of Prematurity (4%). Visual impairment and ocular manifestations like squint and optic atrophy were more in children with global developmental delay. The importance of ophthalmological examination in children with developmental delay was highlighted in the study.

Introduction

Development delay is estimated to be present in about 10% of pediatric population. Development may be impaired due to a variety of factors like maternal, genetic, perinatal, post-natal and social factors. Visual development is a highly complex maturation process involving structural and functional changes in both the eye and the CNS. The burden of visual handicap in childhood especially in a child with developmental delay is of enormous importance because of the life long impact of the handicap on other areas of development. Early recognition of the problem may expedite treatment or other forms of management where the condition is not treatable. Developmental delay may be associated with delayed visual maturation where infants fail to develop fixation for up to 6-12 months but may later develop normal visual behaviour. These children may have a totally normal eye but have poor fixation due to the delay in maturation of the visual system. In these cases, supportive treatment and reassurance is required until the visual attention becomes as expected.

Aim of the Study

- To study the various ocular manifestations in children with delayed milestones.
- To find out the treatable causes of visual handicap in these children.
To study antenatal and postnatal factors in these children.

To study type of developmental delay whether isolated or global delay.

To highlight the importance of detailed ophthalmic examination in children with developmental delay.

Materials and Methods

Study Design: Cross Sectional Study

Study Setting: Child Development Centre, SAT Hospital, Medical College, Trivandrum, and Regional Institute of Ophthalmology, Trivandrum

Sample size: 150 (calculated based on prevalence of Developmental Delay in South Kerala)

Study period: 18 months

Study Population: Children between 6 months and 3 years with delayed developmental milestones

Methodology

A cross-sectional study of 150 children between 6 months and 3 years of age with delayed developmental milestones attending Child Development Centre, SAT Hospital, Trivandrum and RIO, Trivandrum was conducted. Proforma was prepared for recording data of each patient separately. General examination including systemic examination in consultation with a pediatrician & ophthalmic examination consisting of visual acuity assessment, anterior segment examination, dilated fundus examination & retinoscopy were done.

Developmental delay was assessed by Denver Development Screening Test. The milestones were assessed in terms of ‘Personal Social’, ‘Gross Motor’, ‘Fine Motor’ and ‘Language’. Children who did not achieve milestones by the indicated ages were considered to have developmental delay. Delay may be present in either social, gross motor, fine motor or language milestones or in all the four areas, ie, global developmental delay.

In children <1 year, visual acuity was assessed by CSM method of fixation pattern and by indirect methods like assessing the red reflex and resistance to occlusion. Candy Bead test was used to assess visual acuity in 1-2 year age group or alternatively by CSM method if needed. Sheridan Letter test was used in 2-3 year age group. Additional investigations including baseline blood investigations were done if indicated. Children detected to have ocular features were managed accordingly. Children who were found to have visual acuity inappropriate for age or who were not fixing and following despite normal ocular examination were followed up after 6 months to see if there was any improvement in visual acuity. Data collected was then subjected to thorough descriptive statistical analysis. Proportions of all relevant study variables were calculated; such as demographic variables, clinical variables such as antenatal illnesses in others, mode of delivery of the babies, neonatal illnesses, neonatal oxygen administration, types of developmental delay, refractive errors, squint, nystagmus, optic atrophy, delayed visual maturation, cortical visual impairment, Retinopathy of Prematurity, papilloedema

Results

Sex Distribution

Of the 150 children with developmental delay included in study, 83 were males and 67 females.

Age Distribution

Children < 3 years were included in study. Among them 65 were between 6 months-1 year, 45 were between 1-2 years and 40 in 2-3 year age group.

Consanguinity

History of consanguinity was present only in 4 cases while the remaining 146 were nonconsanguinous.

Antenatal Period

Antenatal period was uneventful in 133 mothers, Pregnancy Induced Hypertension (PIH) was present in 5, fever with rashes in 5, 3 had history of trauma, 2 had Gestational Diabetes Mellitus and 2 had history of threatened abortion.
Delivery

125 were full term and 25 were preterm. Caesarian section was mode of delivery in 23, vacuum assisted in 2 while 125 had normal vaginal delivery.

Table 1 Postnatal Period

<table>
<thead>
<tr>
<th>Post Natal Period</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal Jaundice</td>
<td>7</td>
<td>143</td>
</tr>
<tr>
<td>Birth Asphyxia</td>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td>Oxygen administration</td>
<td>12</td>
<td>138</td>
</tr>
<tr>
<td>Seizures</td>
<td>19</td>
<td>131</td>
</tr>
</tbody>
</table>

Type of Developmental Delay

Out of the 150 children, 53(36 %) showed global delay, 45(30 %) had only motor delay, 33(22 %) had delay in motor as well as language milestones, 14(9 %) had isolated language delay and 5 children (3 %) showed delay in motor & personal social milestones.

Ocular Manifestations

Table 2. Ocular Manifestations

<table>
<thead>
<tr>
<th></th>
<th>Number of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocular manifestations</td>
<td>97</td>
<td>64.6</td>
</tr>
<tr>
<td>Normal but poor VA</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>Normal with good VA</td>
<td>29</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Of the total 150 children with developmental delay, 97 (64.6 %) had ocular manifestation, whereas 29 (19.4 %) had normal ocular examination and good visual acuity, whereas 24 (16 %) had normal ocular examination but were not fixing and following light or had poor visual acuity [Table 2].

Distribution of Ocular Manifestations

The various ocular manifestations seen in children with developmental delay are refractive errors, squint, optic atrophy, delayed visual maturation, cortical visual impairment, retinopathy of prematurity, papilloedema, nystagmus, and cataract. (Fig. 1)

Visual Acuity Assessment [Table 3]

Table 3 Visual Acuity Assessment

<table>
<thead>
<tr>
<th>Visual Acuity</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>By CSM method</td>
<td></td>
</tr>
<tr>
<td>NFNF</td>
<td>25</td>
</tr>
<tr>
<td>GEF</td>
<td>1</td>
</tr>
<tr>
<td>UCF</td>
<td>24</td>
</tr>
<tr>
<td>CSF</td>
<td>16</td>
</tr>
<tr>
<td>CSF-MP</td>
<td>16</td>
</tr>
<tr>
<td>CSM</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>By Sheridan Letter Test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6/60 -6/36</td>
<td>3</td>
</tr>
<tr>
<td>6/24 -6/18</td>
<td>2</td>
</tr>
<tr>
<td>6/12 -6/6</td>
<td>30</td>
</tr>
</tbody>
</table>

Refractive Errors

Refractive Errors (seen in 41.3 %) were the most common manifestation in these children on retinoscopy. 27 children had significant hypermetropia (> +3D) 18 had myopia and 17 showed astigmatism.

Squint [Table 4]

Table 4. Stabimus

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Exotropia</td>
<td>90(60 %)</td>
</tr>
<tr>
<td>Esotropia</td>
<td>19(13 %)</td>
</tr>
<tr>
<td>Latent</td>
<td>39(26 %)</td>
</tr>
<tr>
<td>Hypertropia</td>
<td>2(1 %)</td>
</tr>
</tbody>
</table>
Delayed Visual Maturation

24 children who had visual acuity inappropriate for age or were not fixing or following light despite normal ocular examination were followed up after 6 months to look for any improvement. It was seen that 15 of them showed some improvement in visual acuity while it remained status quo or worsened in 9 cases.

Vison and Delayed Milestones

Severe visual impairment (< 6/60) and majority of ocular manifestations like squint and optic atrophy were seen more in children with global developmental delay. Consanguinity was seen in only 2.7%. Antenatal history was uneventful in 133 cases whereas 17 cases had either history of pregnancy induced hypertension, gestational diabetes, trauma, threatened abortion or maternal infections. History of pre-term delivery was present in only 25 cases. In a study by Chen et al 13.95% had pre-term delivery and 13.45% had neonatal insults. In the post natal period, history of neonatal jaundice was present in 7 cases (4.7%), birth asphyxia in 25 cases (16%), oxygen delivery in 12 cases (8%) and seizures in 19 cases (12.6%). In a study by Nielson et al, it was found that visual impairment was due to prenatal factors in 11%, perinatal factors in 6% and postnatal factors in 1.4%.

On assessing developmental delay, 36% of cases showed global delay, 30% only motor delay, 22% both motor and language delay, 9% isolated language delay and 3% showed delay in both motor and social milestones. In the study by Chen et al, 51.2% had global delay, 21.9% had speech delay and 13.9% had motor delay.

In this study ocular manifestations were seen in 64.6% cases. On examining 150 children, refractive errors were seen in 62 cases (41.3%), squint in 55 cases (37%), ROP in 4 cases (2.6%), and cataract in 4 cases (2.6%).

Treatable Causes of Visual Disability

Among the various ocular manifestations, the various treatable causes identified were refractive errors (41.3%), squint (40%), ROP (4%) and cataract (2.6%) (Fig 2).

Discussion

Of the total 150 children with developmental delay examined at CDC and RIO Trivandrum, 97 (64.6%) had ocular manifestations. A study by Wu H J et al on 41 children with developmental delay showed ocular manifestations in 56.1%. Lagunju et al studied 149 cases of cerebral palsy alone and found ocular abnormalities in 28%. Regarding the sex distribution, 55% in this study were males and rest 45% were females. In study by Wu H J et al 68% were males and rest females. Mean age range 1.58 +/- 0.9 years. In Wu H J et al study mean age range was 3.53 +/- 2.25 years.

Consanguinity was seen in only 2.7%. Antenatal history was uneventful in 133 cases whereas 17 cases had either history of pregnancy induced hypertension, gestational diabetes, trauma, threatened abortion or maternal infections. History of pre-term delivery was present in only 25 cases. In a study by Chen et al 13.95% had pre-term delivery and 13.45% had neonatal insults. In the post natal period, history of neonatal jaundice was present in 7 cases (4.7%), birth asphyxia in 25 cases (16%), oxygen delivery in 12 cases (8%) and seizures in 19 cases (12.6%). In a study by Nielson et al, it was found that visual impairment was due to prenatal factors in 11%, perinatal factors in 6% and postnatal factors in 1.4%.

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- In this study ocular manifestations were seen in 64.6% cases. On examining 150 children, refractive errors were seen in 62 cases (41.3%), strabismus in 55 cases (37%), ROP in 4 cases (2.6%), and cataract in 4 cases (2.6%).

Refactive Errors (41.3%) were the most common manifestation in this study of which 18% had significant hypermetropia (> +3D) 12% had myopia.
and 11 \% astigmatism. In a similar study by Nielson et al, 15.3 \% had hyperopia > +3D, 10.8 \% were myopic and 20.6 \% had astigmatism.  

On assessing Visual Acuity severe visual impairment (<6/60) was seen in 51 cases(34.6 \%) Lagunju et al studied 149 Cerebral palsy cases and found that 61.9 \% were completely blind. Fazzi et al found that prevalence of reduced vision in children with CNS damage was about 86.7\%.  

29 children (19.4 \%) had normal ocular examination and good visual acuity while 24(16 \%) had normal ocular examination but had poor vision or were not fixing or following light. These children were followed up after 6 months. On follow up, 15 cases showed improvement in visual acuity whereas 9 cases showed no improvement.

On analyzing the severity of developmental delay and ocular manifestations, it is found that poor vision (ie inability to fix and follow or unsteady fixation) was seen in 27 children with global delay and majority of ocular manifestations like squint (28 cases) and optic atrophy (12 cases) were seen in children with global developmental delay. In a study by Nielson et al, it was found that refractive errors and squint correlated with the level of IQ.

**Conclusions**

- Of the 150 children with developmental delay examined at Regional Institute of Ophthalmology and Child Development Centre, SAT Hospital, Trivandrum, over a period of 18 months, **97 children (64.6 \%)** had ocular manifestations.
- Most common mode of presentation was that the child was not looking at objects.
- In this study, **Refractive errors (41.3 \%)** was the major cause of visual impairment, followed by squint (40 \%) and optic atrophy (9.3 \%).
- 10\% children showed delay in visual maturation.
- Visual impairment and ocular manifestations like Squint and Optic Atrophy were more in children with **Global Developmental Delay**.
- The major **treatable** causes were Refractive errors (41.3 \%), Squint (40 \%), Cataract (2.6 \%) and Retinopathy of Prematurity (4 \%).
- Consanguinity was present in 3 \% cases.
- Antenatal risk factors were identified in 10 \% cases. They were Pregnancy induced Hypertension (3 \%), Fever with rash (3 \%), Trauma (2 \%), Gestational Diabetes (1 \%) and Threatened abortion (1 \%).
- There was history of Preterm delivery in 17 \%, Birth Asphyxia in 16.7 \%, Neonatal seizures in 12.6 \%, history of Oxygen administration in 8 \% and Neonatal jaundice in 4.7 \%.
- Global Developmental Delay was seen in 36 \% children, whereas 30 \% showed delay in motor development, 9 \% showed delay in language and 22 \% showed delay in both motor and language development.
- A full ophthalmic examination should be an essential part of evaluation of all children with developmental delay even when no gross ocular abnormalities are noticed by the attending Paediatrician. Early identification of such defects may prove crucial in institution of therapy in all cases which are amenable to treatment.
- Delayed visual maturation is closely associated with developmental delay. Occasionally infants fail to develop visual fixation for upto 6-12 months but develop normal visual behaviour at a later stage. Supportive treatment and reassurance is vital in such cases.

**References**

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