Refractive Errors Causing Amblyopia in Children

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Abstract

Background: To categorize the refractive errors of school children into Myopia, Hypermetropia, Astigmatism and Anisometropia and to determine the rate of Amblyopia in these refractive errors for a more generalized use.

Methods: In this cross sectional study visual acuity of eyes of the school children was checked. Those having visual acuity (VA) less than 6/6 in any eye were refracted and the glasses tried. Children unable to read 6/9 or above on Snellen's chart, or having a difference of two or more lines between the two eyes in spite of using prescribed glasses were scheduled for detailed ophthalmic examination.

Results: A total of 7413 children aged 5-14 years including males and females in equal proportions and comparable ages from 1383 schools were screened by using Snellen's chart. 2523 (3.4%) children were found to be subnormal in their vision and 2504 (3.378%) of total study population were declared having refractive errors after complete ocular examination. 1850 (2.5%) were myopic, 654 (0.88%) hypermetropic and 140 (0.189%) were amblyopics. Of the 140 cases of amblyopia in our study, the cause was anisometropia in 85 (60.7%) cases, ametropia in 29 (20.7%) and mixed astigmatism in 26 (18.5%) cases. Of the 1850 myopic, 1345 (72.7%) were < -1.0 D, 462 (25%) were between -1.0 D to -4.75 D, 43 (2.3%) were -5.0 D or more, 120 (6.4%) were having myopic astigmatism (≥ -1 D) and 61 (3.3%) were amblyopics.

Introduction

Amblyopia is a unilateral or rarely bilateral reduction of best corrected visual acuity resulting from vision deprivation or abnormal interocular interactions during early years of life, in the absence of an ocular or its posterior visual pathway abnormalities. It can arise from squint (example of an abnormal interocular interaction), or any form of a form vision deprivation e.g. dense corneal or lenticular opacity, high ametropia, anisometropia or astigmatism. Early institution of treatment is essential to improve/correct the vision in amblyopia. The success rates are better if treatment of amblyopia is instituted latest by 7-8 years of life in strabismic amblyopia and early teens in refractive amblyopias. It is here that amblyopia gains importance for its early detection and prompt treatment. In case the treatment is started after the age limit, visual improvement may range from unsatisfactory to nil.

Patients and Methods
This cross sectional study was conducted during the period July 2011 through Jan. 2013. Total number of students included in this study was 74,133 from class nursery to 8th from 1383 different schools. Male and female school children (aged 5 years to 14 years) of Govt. schools of Rawalpindi city. The mobile team consisting of one post graduate trainee doctor, one optometrist, one data entry operator and one attendant conducted the vision testing of the school children each eye separately by the use of a pediatric trial frame and occluder. Those having visual acuity (VA) less than 6/6 in one or both eyes were refracted and the glasses tried. Children having vision 6/9 or less with glasses or a difference of two lines or more between two eyes were scheduled for detailed ophthalmic examination at eye department of Benazir Bhutto Hospital, Rawalpindi, to look for the cause of poor vision. Final diagnosis of Amblyopia was made by the consultant and the patient was handed over to the orthoptics department for follow up visits.

Anisometropia was a difference of more than 1.0D spherical equivalent between the two eyes. Myopic and hypermetropic astigmatism was a cylindrical correction requiring equal to or more than 1.0D in at least one eye, while those having cylindrical correction more than spherical power of different sign were assorted as mixed Astigmatism.

### Results

A total of 74133 children aged 5-14 years randomly including both sex in about equal proportions and of comparable ages from 1383 schools were checked for their vision using Snellen’s test chart. 2523 children were found to be subnormal in their vision and 2504 (2.5%) were having refractive errors.

Ametropia: 1850 (2.5%) were myopic, 654 (0.88%) hypermetropics (Myopia to hyperopia ratio 3:1), 136 anisometropia (0.183%), 46 mixed astigmatism (0.062%) and 140 (0.189%) were amblyopics.

Amblyopia: In our study, there were 85 anisometropia (60.7%), 29 ametropia (20.7%) and 26 mixed astigmatism (18.5%) cases. Of the 1850 myopic, 1345 (72.7%) were < -1.0D, 462 (25%) were between -1.0D to -4.75D, 43 (2.3%) were ≤ -5.0D or more, 120(6.4%) were having myopic astigmatism, 66 Anisometropia (3.5%) and 61 (3.3%) were amblyopics. In the 654 hypermetropic children the figures were 468 (71.5%), 161 (24.6%), 25 (3.8%), 94 (14.3%), 70 (10.7%) and 79 (12.08%) for hyperopia < +1.0D, +1.0 to +3.75D, +4.0D or more, hyperopic Astigmatism, Anisometropia and Amblyopia, respectively. Number of cases of mixed Astigmatism was 46/74133 (0.062%) in which 10 children were having a cylinder equal to or less than 1.0D, and 36 were having more than 1.0D cylinder. Amblyopia was present in 26 cases (56.5%) of mixed astigmatism. Amblyopia was present in 0.189% (140/74133) of our total patient population. 5.6% (140/2504) (Table 2).

In the population having any level of refractive error, 3.2% (61/1850) in the myopic population and 12.08% (79/654) of hypermetropic population, 56.50% (26/46) of mixed Astigmatism and 62.5% (85/136) in the anisometropia patients.

### Table 1: Distribution of refractive errors and amblyopia in total patient population.

<table>
<thead>
<tr>
<th>Myopia = 1850</th>
<th>Hypermetropia = 654</th>
<th>Anisometropia = 136</th>
<th>Amblyopia = 140</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -1.0D</td>
<td>+1.0D to -4.75D</td>
<td>+2.0D to +4.0D</td>
<td>+5.0D or more</td>
</tr>
<tr>
<td>1850</td>
<td>161</td>
<td>66</td>
<td>79</td>
</tr>
<tr>
<td>62.5%</td>
<td>24.6%</td>
<td>6.4%</td>
<td>12.08%</td>
</tr>
</tbody>
</table>

### Table 2: Distribution of Amblyopia

<table>
<thead>
<tr>
<th>In total patient population</th>
<th>In total refractive error cases</th>
<th>In Myopia</th>
<th>In Hyperopia</th>
<th>In Ametropia &gt;1.0D</th>
<th>In mixed Astigmatism</th>
<th>In Anisometropia</th>
</tr>
</thead>
<tbody>
<tr>
<td>140/74133</td>
<td>140/2504</td>
<td>61/1850</td>
<td>79/654</td>
<td>29/23</td>
<td>26/46</td>
<td>85/136</td>
</tr>
<tr>
<td>0.189%</td>
<td>5.6%</td>
<td>3.2%</td>
<td>12.08%</td>
<td>1.25%</td>
<td>56.5%</td>
<td>62.5%</td>
</tr>
</tbody>
</table>

### Table 3: Relative contribution of different causes of Amblyopia (n=140)

<table>
<thead>
<tr>
<th>Causes of Amblyopia</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anisometropia</td>
<td>85(60.7%)</td>
</tr>
<tr>
<td>Ametropia</td>
<td>29 (20.7%)</td>
</tr>
<tr>
<td>Mixed Astigmatism</td>
<td>26(18.5%)</td>
</tr>
</tbody>
</table>

Of the 61 Amblyopia cases in myopic group, anisometropia was present in 34 (55.7%) cases, while ametropia and mixed astigmatism were present in 16 (26.2%) and 11 (18.0%) cases of amblyopia. Of the 79 amblyopics in hyperopic group, the relative contribution of anisometropia, ametropia and mixed astigmatism was 51 (64.5%), 13 (16.4%) and 15 (19.0%) respectively. Of the 140 cases of Amblyopia in our study, the cause was anisometropia in 85(60.7%) cases, ametropia in 29 (20.7%) and mixed Astigmatism in 26(18.5%) cases (Table 3).
Discussion

Prevailing rates of amblyopia in different populations is reported differently in literature. It may be due to different target populations, age groups, facilities for vision checkup, literacy rate, and racial and geographical factors affecting the results. Thus Andrey Chia and colleagues reported a rate of 0.8% amblyopia in their population of 6-72 month children, while another Chinese study conducted by Jing Fu and associates calculated it to be 2.5% and its target population was average age of 12.4 years.4,5

A Turkish study revealed it to be 5.5% in the target population of 7-8 years children6 and an Iranian study7 concluded it to be 1.9% in the target population of students 13.2 years old school children.6,7 Our patient population was 5—14 year and it included all the children including those already using corrective glasses. Myopia appears to be a more common refractive error than hypermetropia in our study (2/3:1/3) and amblyopia was found to be commoner in hypermetropia as compared to myopia (12.0% vs. 3.4%). Looking at different causes of amblyopia resulting from some form of a visual blur, excluding medial opacities, anisometropia was the most common contributor 85/140 (60.7%) as compared to ametropia 29/140 (20.7%) and mixed astigmatism 26/140 (18.5%). Results are comparable to many national and international studies.8-11

Conclusions

1. Amblyopia occurs in the presence of different types of refractive errors if present during the early years of life. It was present in 5.6% of population with refractive errors as compared to 0.189% of total patient population.

2. Anisometropia contributing the most (60.7%) followed by about equal contribution by ametropia (20.7%) and mixed astigmatism (18.5%).

3. There is more occurrence of amblyopia in hypermetropic population as compared to myopic population (12.08% vs 3.2%).

References


