Magnitude and Causes of Low Vision Disability (Moderate and Severe Visual Impairment) among Students of Al-Noor Institute for the Blind in Al-Hassa, Saudi Arabia

A case series

Fahad Al-Wadani,1,2 Rajiv Khandekar,3 Muneera A. Al-Hussain,2 Ahmed A. Alkhawaja,2 Mohammed Sarfaraz Khan,4 Ramzy A Alsulaiman4

The study aimed to estimate the magnitude and causes of low vision disability (severe visual impairment [SVI] and moderate visual impairment [MVI]) among students at Al-Noor Institute for the Blind in Al-Hassa, Saudi Arabia in 2006. METHODS: An optometrist conducted refraction of 122 eyes of the 61 students (27 boys and 34 girls) with MVI (vision ≤6/18 to 6/60) and SVI (vision ≤6/60 to 3/60). Ophthalmologists examined the anterior and posterior segments, and evaluated the outcomes of additional investigations to finalise the diagnosis. RESULTS: The results were categorised as 'preventable', 'treatable' and 'not amenable to treatment.' The low vision care was also reviewed. CONCLUSION: Retinal disease was the main cause of SVI and MVI in our series. Some students at Al-Noor Institute for the Blind have curable low vision conditions. Rehabilitation of low vision disability should be different from that offered to the absolutely blind.

Keywords: Blindness; Low Vision; Children, Rehabilitation; Saudi Arabia.
As the study of community-based prevalence of childhood blindness needs a large sample, researchers have studied the anatomical and aetiological causes of blindness among students of schools for the blind.\(^1\)\(^2\)\(^3\) A large number of children with low vision also study in these schools, either due to lack of facilities for low vision care, or to lack of awareness regarding integrated education for those with low vision disability. Often these children are only assessed at the time of admission and not subsequently revaluated. Hence the progress of their eye condition often goes unnoticed and even those whose sight could be improve are deprived of the advances in management; hence, periodic eye examination of all students is recommended.\(^4\)

In Saudi Arabia, visual acuity and refraction services are given to all students through the Ministry of Education (MoEd).\(^5\) The schools for the visually challenged are also governed by the MoEd. In Al-Hassa region of Saudi Arabia, there are two such schools (one for male and other for female children). We conducted a study to estimate the rate of low vision disability and causes of severe visual impairment (SVI) and moderate visual impairment (MVI) among these students. We accordingly recommended policies to improve their eye care.

### Methods

The Ethical Committee of Al-Jabr Eye and Ear Hospital at Al-Hassa gave permission to undertake this study. This ‘case series’ type of study was conducted from June to December 2006. Of the 120 Saudi students attending the male and female schools for the blind, which make up the Al-Noor Institute for the Blind in Al-Hassa, Saudi Arabia, 61 students with either MVI or SVI were included in the present study. The remaining 59 students with absolute blindness (no light perception) were excluded from our study.

The eye examination was conducted in two phases. In Phase I, a team of an optometrist and an ophthalmologist examined the subjects at the eye department of Al-Jabr Eye and Ear Hospital. Further special ophthalmic and neurologic evaluation and investigations were conducted as advised by the paediatric ophthalmologist.

### Advances in knowledge

1. A large number of students at Al-Noor Institute for the Blind in Al-Hassa, Saudi Arabia, suffer from low vision disability and need rehabilitation which should be different from that offered to those with absolute blindness.
2. Posterior segment pathologies that could not be treated constituted 75% of children, with moderate and severe visual impairment (MVI and SVI).
3. Refractive error as a single condition was noted in only nine (15%) children. Even after correction of refractive error, these children had low vision and hence rehabilitation was needed.
4. Comprehensive visual function assessment of children with SVI and MVI is essential for proper low vision care.

### Application to patient care

1. A total of 75% of the children with MVI and SVI at Al-Noor Institute for the Blind in Al-Hassa, Saudi Arabia had posterior segment pathologies.
2. It is important to carry out comprehensive and periodic visual function assessment of students with MVI and SVI at schools for the blind.
3. Rehabilitation of children with low vision disability should differ from that for children with absolute blindness (no light perception).
They included computed tomography (CT) and magnetic resonance imaging (MRI) scanning, electroretinography (ERG), and electrooculography (EOG).

The classification of causes of childhood blindness was per the recommendation of the World Health Organization (WHO) expert group. Both the anatomic site of the principal cause of visual impairment (VI), and the disease causing VI were used to classify the causes in our study. The data was collected on a pre-tested form and was then entered into a spreadsheet (Microsoft Excel). Frequency and percentage proportions were calculated for qualitative variables. For quantitative variables, we calculated the mean and the standard deviation.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Eyes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hereditary retinal disorders</td>
<td>68</td>
<td>55.7</td>
</tr>
<tr>
<td>Congenital glaucoma</td>
<td>16</td>
<td>13.1</td>
</tr>
<tr>
<td>Cataract and uncorrected aphakia</td>
<td>9</td>
<td>7.4</td>
</tr>
<tr>
<td>Primary optic atrophy</td>
<td>6</td>
<td>4.9</td>
</tr>
<tr>
<td>Subluxated lens</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Aniridia</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>Other *</td>
<td>19</td>
<td>15.6</td>
</tr>
<tr>
<td>Undetermined</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>Refractive error</td>
<td>112</td>
<td>91.8</td>
</tr>
</tbody>
</table>

Note: * Other includes: ptosis, retinal detachment, phthisis bulbi, cryptophthalmos and corneal scars

Table 1: Causes of visual impairment (vision <6/18 to 3/60)

Students with eye conditions that were amenable to treatment were offered free treatment. Those in need of rehabilitation were provided with low vision aids and training by experts. The outcomes of the study were discussed with the health and education authorities of the region to improve the quality of life of children with MVI and SVI.

Results

Our series had 61 students and their 122 eyes. There were 27 (44.2%) male and 34 (55.8%) female students. The mean age of the students was 13.59 years (standard deviation 3.97 years). A history of consanguinity was found among parents of 53 students (87%). In 12 (9.8%) eyes, the BCVA was ≥6/18 and in 28 (23%) eyes, it was <3/60. MVI and SVI were found in 82 eyes (67.2%).

The causes of visual impairment are given in Table 1. The retina was the main anatomical site of pathologies responsible for visual disabilities. Hereditary retinal disorders were the cause of low vision in 68 (58%) eyes. Retinitis pigmentosa was found in 30 (44.1%) eyes. Other causes included hereditary vitreoretinal degenerations; Stargardt’s disease and cone-rod dystrophy—each of these were found in 8 eyes (11.7%); chorioretinal degenerations in 6 (8.8%) eyes; congenital hypoplastic macula in 4 (5.9%) eyes, and foveal hypoplasia in 4 (5.9%) eyes.

Refractive errors were found in 112 (91.8%) of the total 122 eyes; however, it was the single identifiable cause of the visual impairment in only 17 (14%) eyes. The refractive errors of hyperopia, myopia and astigmatism were found in 54 (44.2%) eyes, 55 (45%) eyes and 3 (2.5%) eyes respectively. We could not determine the type of refractive error in 10 (8%) of eyes. Most of these cases had an associated pathology responsible for the low vision.

Table 2: Low vision aids and care given to children with moderate and severe visual impairment

<table>
<thead>
<tr>
<th>Low Vision aid</th>
<th>Number of children</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnifiers</td>
<td>38</td>
<td>62.3</td>
</tr>
<tr>
<td>Telescopes</td>
<td>27</td>
<td>44.3</td>
</tr>
<tr>
<td>Filters</td>
<td>6</td>
<td>9.8</td>
</tr>
<tr>
<td>Non-optical low vision devices</td>
<td>52</td>
<td>85.2</td>
</tr>
<tr>
<td>Close circuit television (CCTV)</td>
<td>10</td>
<td>16.4</td>
</tr>
<tr>
<td>Continuation with same spectacles</td>
<td>6</td>
<td>9.8</td>
</tr>
<tr>
<td>Prescribed change in spectacle power</td>
<td>3</td>
<td>4.9</td>
</tr>
<tr>
<td>Counselling to children and parents</td>
<td>61</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Low vision aids and care given to children with moderate and severe visual impairment

Figure 1: Distribution of children with visual impairment by type of intervention
Hyperopia of ≥+4.00 D was detected in two eyes (1.6%); myopia of ≥-5.00 D was noted in eight (6.5%) eyes, while in seven (5.7%) eyes anisometropia of ≥3.00 D sph or ≥1.50 D astigmatism were present.

Seven students (11.47%) had bilateral ptosis with a variable degree of amblyopia in the eye with more severe ptosis. All these 7 children were close relatives. They were referred to paediatric ophthalmologists for further care. Two underwent surgery while the others refused surgery as the visual prognosis was poor.

Isolated refractive error (9 students) and ptosis (7 students) were considered as potentially avoidable causes of visual impairment. Those with eye conditions ‘not amenable to treatment at present’, and having MVI or SVI, were grouped as cases that needed separate low vision care [Figure 1].

The details of low vision care provided to the children with MVI and SVI are given in Table 2. Low vision aids (optical and non-optical) seem to be useful for children with residual vision. Two out of 6 children who were advised to have corrective surgery underwent ptosis surgery. The others, when offered a guardedly optimistic prognosis, opted not to undergo an operation. We compared the rate

Table 3: Rate and causes of severe visual impairment (SVI) among children at school for the blind in different studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Year</th>
<th>Student Nos.</th>
<th>Rate (%) of SVI</th>
<th>Causes of Visual Impairment</th>
<th>Remark</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeCarlo DK, et al.</td>
<td>USA</td>
<td>1999</td>
<td>123</td>
<td>Optic nerve 31%, optic atrophy 24.1%, glaucoma 8%, lens 14%</td>
<td>SVI + Blind</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Kocur I, et al.</td>
<td>Czech Republic</td>
<td>2001</td>
<td>229</td>
<td>Retina 54%, optic nerve 15%, globe 11%, lens 9%, ROP 42%</td>
<td>SVI + Blind</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Titiyal JS, et al.</td>
<td>India</td>
<td>2003</td>
<td>703</td>
<td>Globe 27%, cornea 22%, lens 11%, retina 15%</td>
<td>SVI + Blind</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Mirdehghan S, et al.</td>
<td>Iran</td>
<td>2005</td>
<td>362</td>
<td>Retinal diseases 51%</td>
<td>Low vision</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Liu B, et al.</td>
<td>China</td>
<td>2007</td>
<td>177</td>
<td>ROP 38%, retina 12%, lens 4%, globe 3%, cornea 3%</td>
<td>SVI + Blind</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Haddad M, et al.</td>
<td>Brazil</td>
<td>2007</td>
<td>3,210</td>
<td>Toxoplasma 21%, retinal dystrophy 12%, ROP 12%</td>
<td>Visually impaired children</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Muhit MA, et al.</td>
<td>Bangladesh</td>
<td>2007</td>
<td>1,935</td>
<td>Lens 33%, cornea 27%, globe 13%</td>
<td>SVI + Blind</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Gogate P, et al.</td>
<td>India</td>
<td>2009</td>
<td>891</td>
<td>Anomalies 36%, cornea 15%, retina 20%, lens 11%</td>
<td>SVI + Blind</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Present study</td>
<td>Saudi Arabia</td>
<td>2011</td>
<td>61</td>
<td>Retinal 66%, glaucoma 13%, Lens 7%</td>
<td>SVI + Blind</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
of SVI and causes documented in the literature to compare our study outcomes with these studies and the results are shown in Table 3. The magnitude and causes of visual impairment among students of the Al-Noor Institute for the Blind in the Al-Hassa province of Saudi Arabia matched the pattern found in other Gulf Cooperation Council countries and in industrialised countries.

**Discussion**

This is the first study to focus on visually impaired children enrolled in schools for the blind in the Al-Hassa region of Saudi Arabia. Previous studies in other parts of Saudi Arabia covered both blind and low vision children.\(^8-11\) We have noted that the disabled students with a useful residual vision can be provided with low vision aids to improve their quality of life. Zamzam *et al.* in Kuwait and Al Alawi *et al.* in Bahrain also noted that the majority of the partially sighted children were given the same educational programme as their normal peers in ordinary schools.\(^12,13\) Low vision students must not be trained along with the blind. An integrated educational approach for these children within the routine educational system is recommended.\(^14\)

Our study suggests that genetic and hereditary diseases are significant causes of childhood visual impairment in the Al-Hassa region. This matched with the changing trends, from nutritional and infectious causes, to non-curable causes, contributing to visual disabilities in children of Saudi Arabia as noted by Tabara *et al.* and worldwide by Gogate *et al.*.\(^15,16\) It was challenging to compare our study outcomes to the findings of other researchers as most other studies conducted in schools for the blind, in developing as well as industrialised countries, had grouped blind and SVI students together. In developing countries, blindness and SVI were due to avoidable causes like poor nutrition and lack of timely treatment.\(^2,17-21\) By comparison, in industrialised countries, they were mainly due to retinal, optic nerve diseases and birth defects.\(^22-24\) A study in Iran showed an unusually high rate (81%) of SVI among children studying in schools for the blind and suggested that half of these cases were due to retinal diseases.\(^3\)

The consanguinity rate in the Saudi population has been documented to be as high as 56%.\(^25\) Our subjects had a consanguinity rate of 87%. As the former study was community-based and the present one is focusing on parents with at least one child with visual impairment (mainly due to hereditary causes) the difference in consanguinity rate is logical. Genetic counselling and explanation of the risk of birth defects among offspring of closely related parents is recommended.\(^26\)

In our study, the focus was on visual acuity for distance and the correction of refractive error. Assessment of visual functions like contrast sensitivity, near vision, colour vision, glare, and field of vision was not carried out. More detailed assessment of visual functions for all children with sensory disability is recommended in the future.\(^27\)

More than 10% of the eyes in our series had visual impairment due to congenital glaucoma. Trained primary physicians can easily detect this early on. Referring the patient to a paediatric ophthalmologist would confirm the diagnosis and lead to initiation of treatment at an earlier stage which would minimise visual disability.\(^28\) Congenital cataract and aphakia contributed to the cause of visual impairment in 6.2% of those children reviewed at a tertiary eye centre in Saudi Arabia.\(^29\) In our study, 7.4% of eyes had cataract or aphakia related visual impairment.

In spite of benefiting from free rehabilitative services, the study sample is less likely to be the representative of low vision children of the Al-Hassa Region of Saudi Arabia. Many students with visual disabilities could have double or multiple disabilities and hence might not be attending a school for the blind. Further studies to include all children with visual disabilities are suggested.

Although a large number of children in our series had a refractive error, many of them could not attain corrected vision due to the presence of co-morbidities. As children with high myopia experienced magnification after removing spectacles, they did not accept the use of spectacles. Thus care should be taken when prescribing visual aids to children with MVI or MVI with other co-morbidities.

In our study, we noted that 50% of the students had MVI or SVI. There are almost three million children worldwide who have the potential to benefit from low vision care,\(^30\) yet many are rehabilitated along with the blind. Children with MVI or SVI must be trained separately from the absolutely blind children. Once they are proficient...
in using low vision aids, they could be integrated into schools for sighted children.\textsuperscript{31}

\section*{Conclusion}

Retinal diseases were the main cause of SVI and MVI in our series. Children at the Al-Noor Institute for the Blind have low vision disabilities. The method of rehabilitating children whose SVI or MVI are due to causes for which there is no treatment should be different from that used for rehabilitating absolutely blind children.

\section*{CONFLICT OF INTEREST}

The authors declared no conflict of interest.

\section*{ACKNOWLEDGMENTS}

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\section*{References}


