

EFFECT OF REFRACTIVE ERROR CORRECTION ON VISUAL ACUITY AND FREQUENCY OF VARIOUS OCULAR DISORDERS IN LEGALLY BLIND CHILDREN

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ABSTRACT

Objective: To see the effect of refractive error correction on visual acuity and to observe the various causes of blindness in visually impaired children.

Study Design: Quasi experimental study.

Place and Duration of study: The study was carried out at Combined Military Hospital (CMH)/CMH Institute of Medical Sciences (CIMS) Multan, from Jun 2017 to Jun 2018.

Methodology: The administration authorities of Al-Noor Special education School, Multan were approached regarding establishment of free eye screening camps biannually. Parents of all the students were informed and consent was taken regarding this study. A total of 124 visually impaired children were included in the study. Children were examined by a consultant ophthalmologist and optometrist. Demographic details and related family history was noted. Visual acuity was assessed by Snellen chart and refractive error was assessed after achieving cycloplegia with 0.5% cyclopentolate eye drops. Detailed slit lamp examination of anterior and posterior segments was carried out by consultant ophthalmologist and the main cause of visual impairment was noted.

Results: A total of 124 students were assessed in this study. The age of students varied from 6 to 16 years with a mean of 9.48 ± 2.92 years. Out of total 79 (63.7%) were male while 45 (36.3%) were female students. Visual acuity of all the students was worse than 6/60. Considering the cause of blindness in children, retina was the most commonly affected organ contributing 62.9% of the cases. The leading retinal pathology appeared to be Leber's congenital Amaurosis and pigmentary retinopathies.

Conclusion: Retinal disorders appeared to be the most common cause of childhood blindness in our study, however detailed community based visual screening surveys need to be carried out for more comprehensive results.

Keywords: Childhood blindness, Inherited retinal disorders, Low vision, Leber congenital amaurosis.

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INTRODUCTION

World Health Organization (WHO) has defined visual acuity of less than 3/60 and visual field of less than 5 degree as blindness or severe visual impairment (SVI)¹. Childhood blindness is considered as a critical medical problem that has socioeconomic and psychosocial implications and effects. Individuals who are blind from early childhood need special education, support and care from family as well as society^{2,3}. Although childhood blindness is relatively less common

than blindness in elderly population, the importance of childhood cases is yet much more as it affects the physical, mental and social wellbeing of those children particularly and the family in general. Almost 30% of blind population in India are under 20 years of age, which signifies the importance of early diagnosis and treatments of childhood ocular diseases³.

"Vision 2020—the right to sight" and Oslo low vision workshop in 2004 are global campaigns to control and eliminate avoidable blindness by year 2020. The global prevalence of childhood blindness varies from 0.3/1000 to 1.5/1000 in developed and under developed countries respectively⁴. Similarly the causes of blindness

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also varies in different parts of the world. The total number of blind children was estimated to be 1.4 million in year 2000, which was supposed to increase by 50,000 per year. Although there was a decline from previous estimates in year 2010, which revealed a total 1.26 million blind children worldwide, the number of blind children increased in under privileged third world countries⁵⁻⁹.

Causes of childhood blindness show remarkable variation in different parts of the world depending upon socioeconomic conditions and childhood mortality rates^{9,10}. Xerophthalmia, measles and ophthalmia neonatorum are the major causes in under developed poorest nations while retinal dystrophies and retinopathy of prematurity are common in developed countries¹⁰. Inherited retinal diseases are common cause of childhood blindness and 30% of them are associated with systemic syndromes¹⁰. Among the retinal diseases, photoreceptors dystrophies are the commonest among children and responsible for childhood visual morbidity^{3,4}.

Unfortunately, the data available about the prevalence of childhood ocular morbidities in our part of the world is inadequate. Moreover, the causes of blindness in children are also diverse and needs proper assessment and follow up. The rationale of publishing this study was to examine the patients with childhood blindness in order to reach the exact cause and diagnosis. This will help to know the prognosis as well as plan intervention and treatment of curable diseases.

METHODOLOGY

This quasi experimental study was carried out at Combined military hospital, Multan from June 2017 to June 2018. In order to get informed consent, initially the administration authorities of the school were approached regarding establishment of free eye screening camps biannually. Parents of all the students were informed and consent was taken regarding this study. Sample size was calculated by WHO calculator and appeared to be 120 patients. Sample was collected by non probability purposive sampling. A total of

124 visually impaired children of Al-Noor special education school were included in the study. After approval of hospital ethical committee, children were examined by a consultant ophthalmologist and optometrist. Demographic details and related family history was taken. Visual acuity was assessed by Snellen chart and refractive error was assessed after achieving cycloplegia with 0.5% cyclopentolate eye drops. Detailed slit lamp examination of anterior and posterior segments was carried by consultant ophthalmologist and the main cause of visual impairment was noted. The causes of visual loss were anatomically categorized on the basis of main target organ that was damaged such as cornea, lens, retina, optic nerve or whole globe. Parents were informed about the visual prognosis of their children. Those students who required any optical, medical or surgical intervention were referred to combined military hospital Multan for further management.

SPSS-21 was used for statistical analysis. The continuous variables were analyzed in terms of mean \pm SD while categorical variables were described by frequency distribution. Chi square test was used to compare the various categories before and after refractive error correction.

RESULTS

A total of 124 students were assessed in this study. The age of students varied from 6 to 16 years with a mean and standard deviation of 9.48 ± 2.92 years. Out of total, Seventy nine (63.7%) were male while forty five (36.3%) were female students. Visual acuity of all the students was worse than 6/60. The best corrected visual acuity (BCVA) of the patients before and after refraction was recorded. Before treatment, 8.9% students had BCVA of 3/60 or better while in 49.6% students it was Hand movements or worse. There was significant improvement of BCVA after treatment with glasses; 12% patients had BCVA better than 3/60 and the BCVA of Hand movements or worse was found in only 39.52% (table-I). Considering the cause of blindness in children, retina was the most commonly affected organ

contributing 62.9% of the cases. The leading retinal pathology appeared to be Leber's congenital Amaurosis and pigmentary retinopathies. The proportion of each component of eye responsible for blindness in these children were given in table-II. The presence of various refractive errors

Table-I: Distribution of students on the basis of visual acuity before and after treatment (correction of refractive error with glasses) (n=124).

Visual Acuity	Before Treatment	After Treatment	p-value
3/60 or better	11 (8.9%)	12 (9.67%)	<0.01
<3/60 but better than Hand movements	51 (40.8%)	62 (49.6%)	
Hand movements or worse	62 (49.6%)	49 (39.51%)	

Table-II: Various anatomical sites of visual loss and refractive errors in children (n=124).

Cause of Visual loss	n	Percentage
Whole globe	6	4.8
cornea	19	15.3
Lens	7	5.6
Retina	78	62.9
Optic nerve	14	11.2
Refractive errors with other disease	52	41.9

Table-III: Various refractive errors in children (n=52).

Refractive Error	n	Percentage
Myopia	09	17.3
Myopic astigmatism	23	42.2
Hypermetropia	09	1.9
Hypermetropic astigmatism	11	21.1

are given in table-III.

DISCUSSION

The aim of this study was to find out the causes of childhood blindness (BL) and the presence of various refractive errors among in children of special education school. The main advantage of examining children in special schools was to examine relatively larger number of patients over a short period of time, however the results are potentially biased. It is estimated that half of the causes of childhood blindness are preventable but in poor developing countries the inaccessi-

bility to advanced healthcare and poverty make the situation worse. Only 10% of the blind children are admitted in special education school in our part of the world, therefore the causes of the blindness identified in this study may not be generalized to whole blind population¹¹⁻¹⁴.

High refractive errors alone or in association with other ocular disorders are very common among these children^{15,16}. Fifty two (41.9%) of patients were suffering refractive errors. Out of various types of refractive errors, myopic astigmatism was the most common. Only 8.9% of our patients had vision better than 3/60, however, 20% of the patients were suffering from high refractive errors and were advised glasses along with low vision rehabilitation services. Correcting the refractive errors and providing low vision aids along with other vision rehabilitation services can improve the quality of life in these patients^{17,18}. When patients were re-examined after 06 months during follow up, significant number of patients with refractive error showed improvement in each category as evidenced by (table-I). Before treatment, eleven (11) students had BCVA of 3/60 or better, fifty one students had BCVA of worse than 3/60 and better than hand movements, while in sixty two students it was Hand movements or worse. After treatment with glasses for 06 month, twelve (12) students had BCVA of 3/60 or better, sixty two students had BCVA of worse than 3/60 and better than hand movements, while in forty nine students, it was Hand movements or worse.

Considering the results of our study, retinal pathologies contributed the major portion of blind population. Almost 62.9% of the BL children were suffering from hereditary retinal dystrophies. Bulls eye maculopathy especially Leber congenital Amaurosis and its complications was the most common retinal disorder followed by other pigmentary retinopathies. The absence of electrophysiological investigations and difficulty in examining the children and their families made it further difficult to classify and identify subtypes of retinal dystrophies in almost half of the children. Like Bhalerao SA and Bhattacharjee

H in their studies in India, we also found corneal blindness to be the second most common cause of childhood BL and it was identified in 15.2% of our study sample^{2,3}. However, it is difficult to find out the exact underlying pathology of corneal scarring at this stage. WHO has categorized, Pakistan among the countries with severe sub-clinical vitamin A deficiency and various studies conducted in different parts of the country also confirmed that 32-43% of children under the age of 5 years are vitamin A deficient^{18,19}.

This study carried out investigations of corneal blindness and found out that none of the children in our study was suffering from vitamin A deficiency. The probable reason for this disparity can be a relatively older age group and financially privileged class in our sample. Other than retinal pathologies and corneal disorders, 11% of the patients had optic atrophy while lens was involved in 5.6% of the patients. Whole globe involvement was seen in 4.8% of the patients. Out of total, none of the patient was suffering from a curable condition. Patient who were having congenital cataract, when investigated with ultrasonography revealed other ocular disorders and therefore a guarded prognosis.

The causes of childhood blindness varies among different countries worldwide. Many authors in their studies found out hereditary and genetic disorders as common underlying problems in developed countries while infectious and nutritional diseases were more prevalent in the developing countries. Santos-Bueso *et al* in his study revealed the main causes of childhood blindness in Morocco were hereditary disorders while in Ethiopia they were trauma and corneal diseases²⁰. Similarly Heijthuijsen *et al* and Aghaji *et al* in their studies found out similar causes in developed and undeveloped part of the world²¹.

We tried to evaluate the children of special education school in the best possible way but due to lack of investigations and paucity of resources there were some limitations in our study. Firstly retinal disorders/dystrophies were not further categorized into various subtypes as we could

not have access to electrophysiological investigations. Secondly, the sample of our study cannot be a true projector of the population as only affording and relatively wealthy and educated families send their children to special education schools. We think our study has produced significant results that are comparable to other national and international literature. However, the importance of genetic counseling and treatment of preventable causes of blindness need a serious concern at all levels.

RECOMMENDATION

Community based screening surveys and mobilization of socioeconomic groups is required to not only spread the awareness of preventable ocular disorders but also approach and access the under privileged blind children of rural population. This will present the true burden of childhood blindness in our part of the world.

CONCLUSION

Refractive errors were present in significant number of legally blind children. Correcting unidentified refractive errors in these patients by performing cycloplegic refraction every 6 months and advising the required prescription of glasses can improve vision and their quality of life. Moreover, retinal pathologies contributed as the major cause of childhood blindness followed by corneal disorders and optic nerve pathologies.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author

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