Original Article

A causal assessment of blindness in schools for blind in southern Rajasthan

Hardik Kiri, Lipa Mohanty, Seemal Goyal
Department of Ophthalmology, Geetanjali Medical College, Udaipur, Rajasthan India.

Abstract

Aims: *To determine the causes of blindness and major anatomical site of lesion leading to blindness in schools for blind in Southern Rajasthan.*

Study Design: *Survey based observational study.*

Methods: *All the students (114) of blind schools were included in study. All data were recorded using a modified World Heath Organization Prevention of Blindness (WHO/PBL) eye examination record for children, including the anatomical and aetiogical classification. This was used to categorize the causes of blindness and to record the findings using the definitions in the coding instructions.*

Statistical analysis used: *The data were entered into a database and analyzed using SPSS version 21 for Windows.*

Results: *Whole globe was affected in majority of the students (36.9%) which led to blindness, followed by uvea (15.8%), lens (14.9%), cornea (14%), optic nerve (9.6%), and retina (8.8%). In majority of students exact aetiology which led to blindness could not be determined (62.3%). 14% students had hereditary factors, 2.6% had neonatal factors and 21.1% had childhood factors which led to vision loss.*

Conclusions: *52.7% students had avoidable cause of blindness. 33.4% students had preventable causes and 19.3% students had treatable causes. Childhood factors have become increasingly significant as causes of visual loss in children who became blind after the year 2000.*

Delhi J Ophthalmol 2021; 31; 40-45; Doi http://dx.doi.org/10.7869/djo.686
Keywords: Schools For Blind, Childhood Blindness, Hereditary Diseases, Avoidable Blindness

Introduction

The number of blind children in the world was 1.5 million in 1990, which reduced to 1.14 million in 2015.[1] Childhood blindness is the second largest cause of blind-person years, followed by cataract. Globally, approximately 70 million blind person years are caused by childhood blindness. Approximately 500 000 children become blind every year and about half of them die within one or two years of becoming blind.[2]
In developing countries range of 31% - 70% childhood blindness is avoidable; range of 10% - 58% treatable; and range of 3% - 28%, preventable blindness.[3]

Despite considerable efforts in many developing countries, through national blindness prevention programmes, the number of blind and visually disabled seems to be growing globally, mainly as an effect of population increase.[4] Blindness in childhood has far reaching implications for the affected child and family and throughout life profoundly influences educational, employment, personal and social prospects.

It is estimated that in every minute a child goes blind somewhere in the world . This is indeed troubling in view of the attendant problems and hopelessness associated with blindness especially in children. Childhood blindness describes a number of disorders and conditions that occur in childhood. Most of them can be prevented or avoided. When they do occur and even after treatment or if left untreated they can result in lifetime blindness.[5]

The prevalence of childhood blindness ranges from approximately 0.3/1000 children in wealthy regions to 1.5/1000 in the poorest communities.[6]

India has an estimated 320,000 blind children, highest in the world.[7] Even though this represents a small portion of the total blindness, the control of blindness in children is one of the priority areas of the World Health Organization's (WHO) "vision 2020: The right to sight" program. This global initiative was launched by WHO in 1999 to eliminate avoidable blindness worldwide by the year 2020.[8]

The global financial cost of blindness with an onset in childhood, in terms of loss of earning capacity (per capita GNP), is greater than the cost of adult blindness and has recently been estimated to be between US$6000 million and $27 000 million.[9] Most of this is accounted for by children living in high income countries, where the prevalence is less, but life expectancy and earning capacity greater, than in low income countries. However, these financial costs alone, provide only one perspective of the public health burden of blindness.

Reliable population based data on the causes of blindness in children are difficult to obtain in developing countries as registers of blind do not exist, and very large sample sizes would be required for formal cross sectional surveys. The advantages of blind school studies are that many children can be examined in a standard manner by a limited number of observers.

Examination of children in institutions has increasingly been used to provide data on the causes of blindness in children, but possible sources of bias need to be borne in mind. The standard reporting form for recording the causes of visual loss in children, developed by the international center for eye health, London for WHO/PBL program[10] has been used in various states of India.[11,12]

Aims & Objectives

To determine the causes of blindness and major anatomical site of lesion leading to blindness in schools for blind in Southern Rajasthan. And to identify the changing pattern of causes of blindness in Southern Rajasthan.

Methods

Study Design

Survey based observational study.

Study Setting

After getting the clearance from Human Research Ethics Committee (HREC), the study was conducted at three schools for blind in Udaipur, Mount Abu and Dungarpur.

Study period

March 2017 to September 2018

Sample size

Students (114) of 3 schools for the blind were included in study.

Inclusion criteria

- All students aged 16 years or less in the schools were included in study.
- Students older than 16 years but who become blind at/ before the age of 16 were also included in study.

Exclusion criteria

Best corrected visual acuity in better eye >3/60.

All data were recorded using a modified World Health Organization Prevention of Blindness (WHO/PBL) eye examination record for children , including the anatomical and aetiogical classification. This was used to categorize the causes of blindness and to record the findings using the definitions in the coding instructions.

The required consent for screening of the children was obtained from the principal of each school. The concerned authorities of each school were briefed about the aims and objectives of the study. Relevant information regarding history of blindness and systemic illness was collected from the class teachers, parents (whenever possible) and by reviewing school medical records. In case of unavailability of parents, telephonic conversation was made if needed and possible.

A brief history of onset of visual loss, family history and history of eye surgery was taken.

Anterior segment examination was done using flashlight and magnifying loupe. Posterior segment examination was done using a direct and/or indirect ophthalmoscope (if mydriasis was not contraindicated). Additional disabilities like hearing loss, physical handicap, epilepsy and others were recorded according to child's medical records.

Visual acuity was assessed in each eye using a Snellen tumbling 'E' visual acuity test chart. Students who were not able to read with the 'E' chart, were assessed for the ability to fix and follow light. Near vision was assessed using figures equivalent to N18. Working distance was not specified in the near vision measurement, encouraging children to adopt their usual posture when attempting to read.

The student's functional vision was assessed by - the ability to walk unaided around chairs set 2 meters apart, to recognize faces at a distance of 3 meters, and to recognize the shape of three 2 cm symbols at any near distance. If child was able to perform any two or more functional vision tests then his functional vision was recorded as good otherwise as poor.

The anatomical classification of causes of visual loss defined that part of the eye which had been damaged leading to visual loss (such as cornea, lens, retina, optic nerve, whole globe). Where two or more anatomical sites were involved the major site was selected, or where two sites contributed equally, the most treatable condition was selected.

Examination of the children was done in the presence of teachers because all the parents were not present. Further, previous medical records were not available, hence diagnosis was made based on history and as per coding instructions given in WHO/PBL eye examination record and suspected causes of blindness were identified.

To identify changing pattern of blindness in southern Rajasthan students were divided in two groups.

Group A – Students who became blind in/before year 2000.

Group B - Students who became blind after year 2000.

These groups are compared by major anatomical sites which led to blindness, aetiology of diseases and avoidable blindness. Hence the causes of childhood blindness before and after the year 2000 can be identified.

The data were entered into a database and analyzed using SPSS version 21 for Windows.

Results

A total 127 students were examined in 3 schools for blind in southern Rajasthan during March 2017 to September 2018. After initial vision assessment, out of which 13 students were excluded from the study because their best corrected visual acuity in better eye was >3/60. So the total number of students(n) included in study was 114. List of schools for blind with number students is as follows:

1. Pragya Chaksu Sikshan Shansthan Andh Vidyalaya, Udaipur.(77)
2. Nab-Phiroze & Noshir Merwanji Rehabilitation Centre for the Blind, Mount Abu.(11)
3. Swami Vivekanand Netrahin Vidyalaya, Faloj, Dist – Dungarpur.(26)

There were 85 students (74.56%) in the age group of 10 to

19 years. Only 6 students (5.26%) were less than 10 years of age and 23 students (20.18%) were above the age of 20 years. The students above 16 years were included in study because they became blind before the age of 16. Out of 114 students 101(88.6%) were male and only 13 (11.4%) were female.

Among 114 students 20 students had history of blindness in family members and 94 students did not have history of blindness in family members. Since birth 85 students were blind, while 2 students became blind during 1st month of life and 27 students became blind after 1st month of life but before the age of 16 years. Out of 114 students 34 students had no perception of light and 80 students had visual acuity of less than 3/60 to light perception. In all 114 students who participated in study, 30 students had good functional vision and 84 had poor functional vision. Out of 114 students 3 students had history of epilepsy, 1 student was physically handicapped and 1 student had hearing loss. 109 students had no additional disability.

19 students had history of previous eye surgery. Among which 11 students had history of eye surgeries in both eyes and 8 had unilateral eye surgeries. 17 eyes were operated for cataract, 4 eyes were removed (enucleation/evisceration), 2 had keratoplasty and in 7 eyes type of surgery could not be identified. Whole globe was affected in majority of the students 42(36.9%) which led to blindness, followed by uvea (15.8%), lens (14.9%), cornea (14%), optic nerve (9.6%), and retina (8.8%). Microphthalmos was the commonest cause in 21.9% students followed by cataract (15%) and coloboma (14%) (Table 1). In majority of students exact aetiology which led to the blindness could not be determined (62.3%). 14% students had hereditary factors, 2.6% had Neonatal factors and 21.1% had childhood factors which led to vision loss(Table 2). Out of 114 students 8 had improvement for near vision with low vision aids (LVA) magnifiers. With use of LVA working distance for near was reduced and they were prescribed for the same. 4 students had severe conjunctival and corneal xerosis for which they were prescribed vitamin A supplementation. 60 students (52.7%) had avoidable cause of blindness. In which 38 students (33.4%) had preventable causes and 22 students (19.3%) had treatable causes. Most common preventable cause was hereditary diseases and treatable cause was cataract (Table 3).

Table 1: Anatomical site of lesion leading to Blindness

Anatomical site	Frequency	Percentage
Whole Globe – 42(36.9%)		
Phthisis	6	5.3
Anophthalmos	4	3.5
Microphthalmos	25	21.9
Buphthalmos	5	4.4
Disorganised	1	0.9
Cryptophthalmos	1	0.9
Cornea – 16(14%)		
Staphyloma	5	4.4
Scar	3	2.6
Other Opacity	8	7.0
Lens – 17(14.9%)		
Cataract	17	15.0
Uvea – 18(15.8%)		
Coloboma	16	14.0
Uveitis	2	1.8
Retina – 10(8.8%)		
Dystrophy	9	7.9
Retinoblastoma	1	0.9
Optic Nerve – 11(9.6%)		
Atrophy	11	9.6
Total	**114**	**100.0**

Table 2: Aetiological classification of visual loss

Aetiology	Frequency	Percentage
Hereditary Disease – 16(14%)		
Autosomal dominant	14	12.3
Autosomal Recessive	2	1.8
Perinatal / Neonatal Factor – 3(2.6%)		
Cerebral hypoxia/injury	2	1.8
Other	1	0.9
Postnatal / Infancy / Childhood Factor – 24(21.1%)		
Vitamin A deficiency	7	6.1
Measles	2	1.8
Trauma	3	2.6
Other (Meningitis, etc)	12	10.5
Cannot determine (unknown aetiology) – 71(62.3%)		
Cataract	13	11.4
Glaucoma / Buphthalmos	7	6.1
Retinoblastoma	1	0.9
Abnormality since birth	49	43.0
Other	1	0.9
Total	**114**	**100.0**

Table 3: Avoidable (Preventable + Treatable) causes of blindness

	Frequency	Percentage
Preventable causes – 38(33.4%)		
Autosomal dominant	14	12.3
Cerebral hypoxia/ Injury	2	1.8
Vitamin A deficiency	7	6.1
Measles	2	1.8
Trauma	3	2.6
Meningitis	6	5.3
TORCH	4	3.5
Treatable causes – 22(19.3%)		
Cataract	13	11.4
Uveitis	2	1.8
Glaucoma	7	6.1
Avoidable causes	**60**	**52.7**

Table 4: Comparison of Anatomical lesion which led to blindness between Group A and B

		Group A	Group B
Whole Globe			
Phthisis	Count	1	5
	Percentage	2.9%	6.3%
Anophthalmos	Count	2	2
	Percentage	5.9%	2.4%
Microphthalmos	Count	12	13
	Percentage	35.3%	16.3%
Bupthalmos	Count	1	4
	Percentage	2.9%	5%
Disorganised	Count	0	1
	Percentage		1.2%
Cryptophthalmos	Count	0	1
	Percentage		1.2%
Cornea			
Staphyloma	Count	2	3
	Percentage	5.9%	3.8%
Scar	Count	0	3
	Percentage		3.8%
Other Opacity	Count	1	7
	Percentage	2.9%	8.8%
Lens			
Cataract	Count	6	11
	Percentage	17.7%	13.8%
Uvea			
Coloboma	Count	7	9
	Percentage	20.6%	11.3%
Uveitis	Count	0	2
	Percentage		2.4%
Retina			
Dystrophy	Count	2	7
	Percentage	5.9%	8.8%
Retinoblastoma	Count	0	1
	Percentage		1.2%
Optic Nerve			
Atrophy	Count	0	11
	Percentage		13.8%
Total	Count	**34**	**80**
	Percentage	**100%**	**100%**

Changing pattern of blindness

Students were divided in two groups.

Group A – Students who became blind in/before 2000.

Group B - Students who became blind after 2000.

This will enable us to study the changing pattern of blindness in Southern Rajasthan. In group A Anophthalmos (5.9%), Microphthalmos (35.3%) and Coloboma (20.6%) had higher incidence than compared with group B where Anopthalmos was seen in 2.4% students, Microphthalmos in 16.3% students and Coloboma in 11.3% students. In group A Optic Atrophy was not seen in any case where in group B 13.8% students had Optic Atrophy(Table 4).

Abnormality since birth was seen in 55.9% students in group A and 37.5% students in group B. Childhood factors have significance in the study as their Chi-Square (P value) is 8.33(0.04). P value less than 0.05 is significant. Group A had 26.5% of preventable causes and group B had 36.9% of preventable causes. Group A and B had 44.1% and 56.3% avoidable causes respectively. Total avoidable causes among 114 students was 52.7%.

Discussion

This is a survey based observational study of 114 students in 3 blind schools of Southern Rajasthan. Those students who had BCVA of <3/60 in better eye were included in study. Blind school studies have the advantage that a large number of children can be examined in a short time, are relatively inexpensive, can be done by a single observer, and provide an indication of relative importance of the different causes of blindness.

Our study revealed that girls constituted only 11.4% of the total number of blind students. Hence encouragement of girls should be enhanced for admission in blind schools so that their quality of life can improve. 17.5% students had positive family history. 73.7% students had poor functional vision. In our study major anatomical site for vision loss was whole globe (36.9%), similar to the result of the study done by Titiyal et al (2001) which showed that 32.3% of students had whole globe as major site of abnormality. The result of our study differs from that school based study of Javed et al (2004)[13] in which the whole globe was the major site of abnormality in only 20.1% of the total number of students (Table 5).

Table 5: Comparison of major anatomical site leading to vision loss in different studies

	Southern Rajasthan	North India	Uttar Pradesh	Gujarat	Myanmar	Karachi
	Present study	**Titiyal et al[6] 2001**	**Agarwal et al[14] 2015**	**Danayak et al[12] 2011**	**Meucke et al[15] 2007**	**Javed et al13 2004**
Whole globe	42(36.9%)	210(32.3%)	29(40.3%)	76(42.4%)	54(26.6%)	29(20.1%)
Cornea	16(14%)	141(21.7%)	19(26.4%)	43(24%)	88(43.6%)	9(6.3%)
Lens	17(14.9%)	71(10.9%)	5(6.9%)	13(7.3%)	29(14.4%)	26(18.1%)
Uvea	18(15.8%)	57(8.8%)	8(11.1%)	7(3.9%)	5(2.5%)	1(0.7%)
Retina	10(8.8%)	98(15.1%)	6(8.3%)	21(11.7%)	15(7.4%)	59(41%)
Optic Nerve	11(9.6%)	69(10.6%)	3(4.2%)	19(10.6%)	8(4%)	13(9%)
Other	0	5(0.8%)	2(2.8%)	0	3(1.5%)	7(4.9%)
Total	**114(100%)**	**650(100%)**	**72(100%)**	**179(100%)**	**202(100%)**	**144(100%)**

In our study majority of the cases of childhood blindness were of unknown etiology (62.3%). This is similar to the study of Danayak et al (2011)[12] (63.1%). Study of Agarwal et al (2015)[14] had least number of cases with unknown aetiology (29.1%). Hereditary diseases were found in 14% of cases in our study, similar to studies of Titiyal et al (2001) and Meucke et al (2007)[15] i.e. 13.4% and 11.9% respectively. According to the study of Agarwal et al (2015), 56.9% students had hereditary diseases(Table 6).

In our study 52.7% cases had avoidable causes of blindness. This is similar to the study done by Javed et al (2004)[13] in which 53.5% students had avoidable causes of blindness. Our study shows preventable causes in 33.3% students and treatable causes in 19.3% students.(Table 7).

2000; in whom the occurrence was 2.4%, 16.3% and 11.3% respectively.

Childhood factors have become increasingly significant as causes of visual loss in children who became blind after the year 2000.

Conclusion

In this study, it was found that 52.7% students had avoidable cause of blindness. In which 33.4% students had preventable causes and 19.3% students had treatable causes, indicating the need of new focused public health strategies. Childhood factors have become increasingly significant as causes of visual loss in children who became blind after the year 2000 (P value = 0.04).

Out of 114 students 8 had improvement for near vision with LVA devices. Hence similar studies should be encouraged to improve the quality of vision, thereby improving the quality of life of such visually impaired students all over the country.

Table 6: Comparison of aetiology of visual loss in different studies

	Southern Rajasthan	**North India**	**Uttar Pradesh**	**Gujarat**	**Myanmar**	**Karachi**
	Present study	**Titiyal et al[6] 2001**	**Agarwal et al[14] 2015**	**Danayak et al[12] 2011**	**Meucke et al[15] 2007**	**Javed et al[13] 2004**
Hereditary Disease	16(14%)	87(13.4%)	41(56.9%)	18(10.1%)	24(11.9%)	47(32.6%)
Intrauterine factor	0	6(0.9%)	0	0	9(4.5%)	6(4.2%)
Perinatal/ Neonatal factor	3(2.6%)	8(1.2%)	0	3(1.7%)	14(6.9%)	6(4.2%)
Postnatal/ Infancy/ Childhood factor	24(21.1%)	182(28%)	10(13.8%)	45(25.1%)	67(33.2%)	14(9.7%)
Cannot determine (unknown aetiology)	71(62.3%)	367(56.5%)	21(29.1%)	113(63.1%)	88(43.6%)	71(49.2%)
Total	**114(100%)**	**650(100%)**	**72(100%)**	**179(100%)**	**202(100%)**	**144(100%)**

Table 7: Comparison of avoidable blindness in different studies

	Southern Rajasthan	North India	Gujarat	Myanmar	Karachi	Nine states of India
	Present study	Titiyal et al[6] 2001	Danayak et al[12] 2011	Meucke et al[15] 2007	Javed et al[13]2004	Rahi et al[16] 1993
Preventable	38(33.3%)	182(28%)	53(29.6%)	55(27.3%)	58(40.3%)	408(31%)
Treatable	22(19.3%)	101(15.5%)	30(16.8%)	33(16.3%)	19(13.2%)	214(16.3%)
Total Avoidable	60(52.7%)	283(43.5%)	83(46.4%)	88(43.6%)	77(53.5%)	622(47.3%)

In our study 8 students had visual improvement with LVA devices. 4 students had xerophthalmia which was treated with Vitamin A supplementation and artificial tears. This study suggests there is still a scope of visual improvement by optical devices even in students of schools of blind. Further preventable causes of blindness like Vitamin A deficiency and measles can be treated if diagnosed early. Hence similar studies should be encouraged to improve the quality of vision, thereby improving the quality of life of such visually impaired students all over the world.

In our study, Anophthalmos (5.9%), Mircrophthalmos (35.3%) and Coloboma (20.6%) were observed to be more common in students who became blind in/before year 2000, as compared with the students who became blind after year

References

1. Gilbert C, Bowman R, Malik AN. The epidemiology of blindness in children: changing priorities. Community eye health. 2017;30(100):74.
2. World Health Organization. Report of WHO/IAPB scientific meeting, Hyderabad, India 13-17th April. Childhood Blindness Prevention. WHO/PBL/87. 1999.
3. Kong L, Fry M, Al-Samarraie M, Gilbert C, Steinkuller PG. An update on progress and the changing epidemiology of causes of childhood blindness worldwide. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2012 Dec 1;16(6):501-7.
4. Thylefors B. A global initiative for the elimination of avoidable

blindness. Community Eye Health. 1998;11(25):1.
5. Omolas CO, Aina AS, Omolase BO, Omolade EO. Causes of blindness and visual impairment at the school for the blind Owo, Nigeria. Annals of Ibadan postgraduate medicine. 2008;6(1):49-52.
6. Titiyal JS, Pal N, Murthy GV, Gupta SK, Tandon R, Vajpayee RB, Gilbert CE. Causes and temporal trends of blindness and severe visual impairment in children in schools for the blind in North India. British journal of ophthalmology. 2003 Aug 1;87(8):941-5.
7. Gilbert C, Rahi J, Quinn G. Visual impairment and blindness in children. In: Johnson G, Minassian D, Weale W, West S, editors. Epidemiology of Eye Disease. 2nd ed. UK: Arnold Publishers; 2003.
8. World Health Organization. Global Initiative for the Elimination of Avoidable Blindness. WHO/PBL/97.61. Geneva: WHO; 1997.
9. Smith AF, Smith JG. The economic burden of global blindness: a price too high! Br J Ophthalmol 1996;80:276–7.
10. Gilbert C, Foster A, Negrel AD, Thylefors B. Childhood blindness: a new form for recording causes of visual loss in children. Bulletin of the World Health Organization. 1993;71(5):485.
11. Bhalerao SA, Tandon M, Singh S, Dwivedi S, Kumar S, Rana J. Visual impairment and blindness among the students of blind schools in Allahabad and its vicinity: a causal assessment. Indian Journal of Ophthalmology. 2015 Mar;63(3):254.
12. Danayak PM, Patel RB. Avoidable blindness and its correction in schools for the blind in Gujarat, India. International Journal of Advances in Medicine. 2017 Jan 22;2(4):370-4.
13. Khan SJ, Hassan A, Khalid L, Karim U, Hashmi E, Gul F, Jehan I. Blindness in children at the Ida Rieu school for the blind and deaf. JPMA. 2007 Jul;57(7):334-7.
14. Agarwal P, Maan V, Omaer M, Gupta K, Chauhan L, Khurana A. Clinical profile of childhood blindness and inappropriate enrolment of children in schools for visually impaired in Uttar Pradesh, India. Indian journal of ophthalmology. 2018 Oct;66(10):1456.
15. Muecke J, Hammerton M, Aung YY, Warrier S, Kong A, Morse A, Holmes M, Yapp M, Hamilton C, Selva D. A survey of visual impairment and blindness in children attending seven schools for the blind in Myanmar. Ophthalmic epidemiology. 2009 Dec 1;16(6):370-7.
16. Rahi JS, Sripathi S, Gilbert CE, Foster A. Childhood blindness due to vitamin A deficiency in India: regional variations. Archives of disease in childhood. 1995 Apr 1;72(4):330-3.

Cite This Article as: Hardik Kiri, Lipa Mohanty, Seemal Goyal, A causal assessment of blindness in schools for blind in southern Rajasthan, Delhi J Ophthalmol 2021;32; (1) 40 - 45.

Acknowledgments: Nil

Conflict of interest: None declared

Source of Funding: None

Date of Submission: 29 Aug 2019
Date of Acceptance: 11 Sep 2019

Address for correspondence

Lipa Mohanty **Professor and Head,**
Department of Ophthalmology,
Geetanjali Medical College,
Udaipur,Rajasthan, India.
Email: drlipamohanty@gmail.com

Quick Response Code