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Original Research Article

Avoidable Causes of Severe Visual Impairment and Blindness in Children of Western Rajasthan

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Abstract: Childhood blindness refers to a group of diseases and conditions occurring in childhood or early adolescence (<16 years of age), which, if left untreated, result in blindness or severe visual impairment that are likely to be untreatable later in life. The prevalence ranges from 0.3/1000 children aged 0–15 years in affluent countries to 1.5/1000 children in very poor communities. This study was conducted over a period of 18 months from January 2015 to June 2016 at Department of Ophthalmology, MDM hospital, Jodhpur. It is non randomized observational study in which all blind or children with severe visual impairment aged less than 15 years attending outdoor of department of Ophthalmology at MDM Hospital and children living in blind schools within and near Jodhpur were enrolled after receiving informed written consent by their parents/guardian. In this study we found that the most important causes of preventable blindness were genetic in 160(56.34%) patients followed by TORCH infections in 6(2.11%), trauma in 4(1.41%) measles in 4(1.41%) and meningitis in 3(1.06%) patients. Most important treatable cause of blindness was cataract in 76(26.76%) patients followed by glaucoma in 12(4.23%) and ROP in 2(0.70%) patients. We concluded that the most important causes of preventable blindness were genetic in 160(56.34%) patients and most important treatable cause of blindness was cataract in 76(26.76%) patients. Early recognition and treatment is essential to prevent development of dense amblyopia.
Keywords: Childhood blindness, severe visual impairment, Avoidable blindness

INTRODUCTION

Childhood blindness refers to a group of diseases and conditions occurring in childhood or early adolescence (<16 years of age), which, if left untreated, result in blindness or severe visual impairment that are likely to be untreatable later in life [1]. Blindness in children can be defined as a visual acuity of <3/60 in the eye with better vision or central visual field each eye < 10 degree in a child under 16 years of age [2]. This generally means that the child cannot see something three feet (about one meter) away, that another child could see if it was 60 feet (about 20 meters) away [3].

Most blind children are either born blind or become blind before their fifth birthday. Owing to demographic differences, the number of children who are blind per 10 million populations varies from approximately 600 in affluent countries to approximately 6000 in very poor communities [2]. About 40% of the causes of childhood blindness are preventable or treatable [2].

Childhood blindness is one of the priorities in "Vision 2020" the Right to Sight. This is a global initiative, which was launched by WHO in 1999 to eliminate avoidable blindness worldwide by the year 2020 [1]. The prevalence of blindness in children ranges from approximately 0.3/1000 children in developed regions to 1.5/1000 in under developed regions [2]. It is estimated that there are 1.4 million blind children in the world, out of which two thirds live in the developing countries, and that the causes of blindness in children vary according to region and socioeconomic development [2].

Blindness in children is more common in poor regions for two main reasons: firstly, there are diseases

and risk factors which can lead to blindness from causes that do not now occur in industrialized countries (e.g., measles, vitamin A deficiency, ophthalmia neonatorum, malaria), and, secondly, there are fewer well equipped eye departments with ophthalmologists, nurses and ophthalmic paramedics trained in managing treatable causes of blindness (e.g., cataract and glaucoma). The incidence is therefore higher, and fewer blind children have their sight restored. Overall, there are probably 2, 80, 000–3, 20, 000 blind children in India. In developed countries, there are approximately 60 blind children/million total population whereas in India they are likely to be between 100 and 400 [4].

Childhood blindness could be grouped according to the anatomical structure affected or by the principal cause of visual disability [5]. Both are important while evaluating the impact of public health initiatives.

Avoidable causes of childhood blindness are:

A. Preventable
1. Corneal scarring due to:
a. Vitamin A deficiency
b. Measles
c. Ophthalmia neonatorum
d. Traditional practices
e. Infective corneal ulcers

2. Intrauterine factors:
a. Rubella
b. Toxoplasmosis
c. Other teratogens: alcohol
3. Perinatal factors:
a. ROP
b. Birth hypoxia
4. Hereditary diseases:
a. Consanguineous marriages
b. Genetic factors

B. Treatable causes of childhood blindness are
1. Cataract
2. Glaucoma
3. ROP
4. Uveitis
5. Corneal disease (corneal ulcers and opacity)

Blindness (involving the cornea) due to complications of measles, Vitamin A deficiency, ophthalmia neonatorum and harmful traditional eye medicines was common in the past in countries with poor economies.

Uncorrected refractive error is also a major contributor to the visual disability that could be managed at primary health care level. Congenital cataract and Retinopathy of Prematurity (ROP) affect visual functions in very early ages and they can be prevented or treated. Modalities to prevent, diagnose and manage these conditions are available [6, 7]. Visual prognosis after cataract surgery in young children has improved considerably. But, congenital and infantile cataracts are still responsible for 10% of global childhood blindness and the leading cause of blindness in many countries of Africa. For children with bilateral dense cataract, urgent surgery is recommended to avoid dense amblyopia. In eyes with congenital and developmental cataract that are associated with microphthalmos, micro cornea, coloboma, as part of syndrome or if there is unilateral cataract, the visual outcomes are not very promising following their management [8, 9]. Risk of delayed complications like glaucoma, even after successful cataract surgeries in children often compromises the visual outcomes. Hence these children should be followed for long time. Proper counseling of parents to ensure better compliance and follow up and setting up effective mechanisms to follow these operated children is crucial.

ROP is the fifth leading cause of childhood blindness globally. But fortunately, at risk infants who are screened and treated for ROP have better functional as well as structural results. Unfortunately, inadequate data is available on causes and prevalence of ocular morbidities among children of the developing world. Therefore, aim of this research is to study the prevalence and causes of ocular morbidity among children with a view to amassing data that can be used to plan interventional measures that can stem the tide of avoidable blindness.

MATERIAL & METHODS

The study was conducted to identify the major preventable and treatable causes of blindness in the children of Western Rajasthan. This study was conducted over a period of 18 months from January 2015 to June 2016 at Department of Ophthalmology, MDM hospital under Dr S. N. Medical College, Jodhpur. Department of Ophthalmology at MDM hospital is a tertiary care centre with facilities for diagnosis and management of common eye disorders.

All children less than 16 years of age coming to eye OPD of MDM hospital and attached group of hospitals with visual problems and found to be blind or severe visual impairment were enrolled for the study. Children living in blind schools within and near

Jodhpur were also enrolled for this study to get adequate sample size.

The schools for blind children in the western Rajasthan near and within Jodhpur were identified. The required permission for examination of the children was obtained from the principal/headmaster of each school. The concerned authorities of each school were briefed about the aims and objectives of the study. The school authorities were requested to inform the parents of the children at the time of examination.Children were enrolled in the study after getting informed written consent from parent/guardian.

Blindness is defined as presenting visual acuity in the better eye of less than 0.05 (3/60; 10/200), and severe visual impairment as presenting visual acuity in better eye of less than 0.1 (6/60; 20/200) to 0.05 (3/60; 10/200) "functional" low vision as presenting visual acuity in the better eye of less than 0.3 (6/18; 20/60) to light perception.

We included students of the blind school with less than 16 years of age as per inclusion criteria. The relevant information was collected from the class teachers and parents (whenever possible). Brief demographic details, medical and family history of each child were recorded.

Detailed eye examination of each child was conducted. Visual acuity was assessed in each eye using a Snellen tumbling E visual acuity test chart. The child who did not cooperate with the E chart, were assessed for the ability to percept and follow light. The visual status of children was recorded using WHO categories of visual impairment before and after refraction. To categorize a child under low visual category, simple tests of functional vision were used. They were, the ability to navigate around two chairs set two meters apart unaided with a visual acuity of <20/60 to light perception and to recognize faces at a distance of three meters.

Anterior segments of the eye were examined using a light and/or with slit-lamp. The posterior segment was examined using direct and indirect ophthalmoscope after dilatation of pupil. Information or observation are recorded in standard form, WHO/PBL Eye Examination Record for Children with Blindness and Low Vision, according to the Coding Instructions provided by WHO for the same [3].

The part of the eye which had been damaged and leading to visual loss is identified (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. The etiological factor is identified and categorized depending on the time of onset of the condition leading to blindness (hereditary, intrauterine, perinatal, childhood and unknown). For each child, the need of optical, medical or surgical interventions was recorded and the visual prognosis was assessed. Children requiring further investigations and treatment procedures were referred accordingly.

Statistical analysis: Appropriate statistical tools and technique were applied as per data collection.

Inclusion criteria:

- Children aged 0 to 15 years.
- Child with best corrected visual acuity of <6/60 i.e. equal to 6 m finger count.
- Child whose parents/ guardians gave consent for the study.

Exclusion criteria:

- Children who have low vision and best corrected visual acuity >6/60 in better eye are excluded from this study.
- Children with unilocular blindness.
- Parents/ guardians refused for consent

OBSERVATIONS

Table 1: Age (at the onset of visual loss) and sex wise distribution of blind children

Time of visual loss	Males (%)	Female (%)	Total (%)
Since birth (Hereditary/Intrauterine)	164(57.75%)	62(21.83%)	**226(79.58%)**
First year of life (Perinatal/New born/Infancy)	05(01.76%)	02(00.70%)	**07(02.46%)**
1 – 15 year (Childhood)	28(09.86%)	12(04.23%)	**40(14.08%)**
Unknown/Undetermined	08(02.82%)	03(01.06%)	**11(03.87%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 2: Blind school Vs Outdoor patients

	Males (%)	**Females (%)**	**Total (%)**
From Blind School	47(16.55%)	09(03.17%)	**56(19.72%)**
Hospital OPD Patients	158(55.63%)	70(24.65%)	**228(80.28%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 3: Rural Vs Urban patients

	Males (%)	**Females (%)**	**Total (%)**
Rural	93(32.75%)	26(09.15%)	**119(41.90%)**
Urban	112(39.44%)	53(18.66%)	**165(58.10%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 4: Family history of same eye condition in any other family member

	Males (%)	**Females (%)**	**Total (%)**
Positive family history	31(10.92%)	16(05.63%)	**47(16.55%)**
Negative family history	174(61.27%)	63(22.18%)	**237(83.45%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 5: History suggestive of consanguineous marriage in parents

	Males (%)	**Females (%)**	**Total (%)**
Consanguineous marriage	09(03.17%)	04(01.41%)	**13(04.58%)**
Non-consanguineous marriage	196(69.01%)	75(26.41%)	**271(95.42%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 6: Categories of visual impairment and blindness

Category	**Males (%)**	**Females (%)**	**Total (%)**
Severe visual impairment	21(07.39%)	05(01.76%)	**26(09.15%)**
Blind	184(64.79%)	74(26.06%)	**258(90.85%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 7: Avoidable causes Vs Non avoidable causes of severe visual impairment and blindness

Cause	**Males (%)**	**Females (%)**	**Total (%)**
Avoidable	193(67.96%)	74(26.06%)	**267(94.01%)**
Non-avoidable	12(04.23%)	05(01.76%)	**17(05.99%)**
Total	**205(72.18%)**	**79(27.82%)**	**284(100%)**

Table 8: Avoidable causes of severe visual impairment and blindness

Cause	**Males (%)**	**Females (%)**	**Total (%)**
Preventable			
Genetic causes	115(40.49%)	45(15.85%)	**160(56.34%)**
Vitamin A deficiency/Measles	04(01.41%)	00	04(01.41%)
TORCH	04(01.41%)	02(00.70%)	06(02.11%)
Meningitis	02(00.70%)	01(00.35%)	03(01.06%)
Harmful traditional eye remedies	00	00	00
Trauma	03(01.06%)	01(00.35%)	**04(01.41%)**
Subtotal	**128(45.07%)**	**49(17.25%)**	**177(62.32%)**
Treatable			
Cataract	56(19.72%)	20(07.04%)	76(26.76%)
Glaucoma	07(02.46%)	05(01.76%)	12(04.23%)
Uveitis	00	00	00
ROP	02(00.70%)	00	**02(00.70%)**
Subtotal	**65(22.89%)**	**25(08.80%)**	**90(31.69%)**
Total avoidable	**193(67.96%)**	**74(26.06%)**	**267(94.01%)**

DISCUSSION

Children who are blind need to be identified as early as possible so that they can be examined, treated, referred, or rehabilitated. This is crucial if they are to have the best possible chance of proper childhood development, education, and participation inbroader social life. In order to set priorities in control programs of blindness, baseline epidemiological data of the prevalence and major causes of childhood blindness are essential. Indeed, it is necessary to identify major preventable and treatable causes in each country and to monitor the changing patterns over time.

At least half and possibly up to three-quarters of causes of childhood blindness are avoidable. Infants are unable to verbalize their complaints, and history from parents and care takers may lack important details. The first year of life is also the time when the visual system develops and binocular vision is formed [10]. Nearly75% of early learning comes from vision. Early onset visual loss can have profound consequences on a child's motor, social, emotional, and psychological development [11]. If a visual deficit at this age is not treated in a timely manner, amblyopia and permanent visual deficit can occur. Hence, early diagnosis and prompt treatment is essential.

In our study out of total 284 enrolled patients 205(72.18%) patients were males and 79(27.82%) patients were females. This difference is probably due to the greater value accorded to male children in this part of the countryand visit hospitals and blind schools to seek medical treatment or rehabilitate them.

In our study 226(79.58%) patients were blind since birth due to hereditary or intrauterine factors, 7(2.46%) patients developed blindness in first year of life and 40(14.08%) patients developed blindness in between 1-15 years of age. We were not able to determine exact time of onset of blindness in 11(3.87%) patients.

Visual loss in infants can be either prenatal (ie, occurring at the time of conception or during the intrauterine period) or postnatal (during or afterbirth).

Prenatal causes are congenital anomalies – anophthalmos, microphthalmos, and coloboma; congenital cataract, retinal dystrophies such as Leber's congenital amaurosis, infantile glaucoma, and congenital cloudy cornea. In the perinatal period (ie, from the 28th week of gestation through to 1-4 weeks afterbirth), the following conditions can occur: cortical impairment from birth asphyxia, ophthalmia neonatorum, and retinopathy of prematurity. Postnatal conditions (ie, those acquired after birth) are unusual during infancy [12].

Out of total enrolled patients 228(80.28%) patients were enrolled from the patients visiting outdoor of MDM hospital. Rest 56(19.72%) patients were enrolled from blind schools present in vicinity of Jodhpur. Most blind schools do not admit children below 5 years of age so we enrolled patients visiting OPD of our hospital along with blind school children.

Out of total enrolled patients 119(41.90%) patients were residents of rural areas of western Rajasthan. Rest 165(58.10%) patients were residents of urban areas. Positive family history of similar eye condition was present in 47(16.55%) patients. Most of the patients had positive family history in their siblings.

History suggestive of consanguinity in parents was present in only 13(4.58%) patients. In our study 271(95.42%) of patients were born to parents who were not had history suggestive of consanguineous marriage. Out of total enrolled patients 258(90.85%) patients were blind. They had vision less than 3/60-PL or believed blind if aged less than 3 years (if vision could not be tested) in better eye according to WHO criteria. Severe visual impairment was present in 26(9.15%) patients. Severe visual impairment is considered if child had vision less than 6/60-3/60 in better eye according to WHO criteria.

We found that avoidable causes of blindness were present in 267(94.01%) patients. We found that in 177(62.32%) patients blindness was preventable and in 90(31.69%) patients blindness was treatable. The most important causes of preventable blindness were genetic in 160(56.34%) patients followed by TORCH infections in 6(2.11%), trauma in 4(1.41%) measles in 4(1.41%) and meningitis in 3(1.06%) patients. Most important treatable cause of blindness was cataract in 76(26.76%) patients followed by glaucoma in 12(4.23%) and ROP in 2(0.70%) patients.

With the availability of newer diagnostic modalities of genetic disorders, prenatal diagnostic techniques and genetic counselling it is now possible to identify the genetic defects leading to congenital globe abnormalities, congenital and developmental cataract, congenital glaucoma and inherited retinal disorders. So in our study we considered genetic factors as a preventable cause of blindness, however facilities for genetic testing is available only at few centers in our country.

Studies worldwide show that many of the causes of blindness in children are either preventable or treatable (ie, avoidable) [13]. Even children, who have visual loss that cannot be clinically treated, can be helped with low vision devices and rehabilitation. Childhood blindness affects the individual, their family, and the community. Blindness also has implications for infants' development, education, and future social, marital, and economic prospects.

Early recognition and referral is essential to prevent development of dense amblyopia. Retinoblastoma is the most common intraocular malignancy in early childhood. It usually presents after infancy as leukocoria, esotropia, or masquerades as uveitis. Lesions detected early can be treated with chemotherapy with preservation of the globe; however, larger lesions may need enucleation [14, 15].

Retinopathy of prematurity (ROP) is responsible for up to 15% of all causes of blindness in developed countries and upto 60% in middle income countries [16]. A number of risk factors are implicated in the development of ROP. However, the most commonly identified risk factors are the degree of immaturity measured by birth weight (BW), gestational age (GA), and prolonged exposure to supplementary oxygen [17]. The improvement in neonatal care can lead to an increase in survival rates of premature infants in middle-income countries and major metropolises of even poorer countries. As a consequence, ROP has become a very important cause of childhood in these developing economies, where quality of neonatal care still needs to improve.

There is a narrow window of opportunity in treating a visually impaired infant. Binocular single vision develops by 6 months of life and a visual deficit, if not detected and treated in time, may leave the child bereft of stereopsis. The amblyopia that develops from visual deprivation of early onset, irrespective of the cause, can be dense and difficult to treat. Pediatricians, general practitioners, and midwives should be educated and encouraged to perform the red reflex test. Using the direct ophthalmoscope, they should be taught to detect any opacity seen in the infant's red reflex. All healthcare personnel working for the care of the infant should be sensitized to the eye conditions in infancy and on the causes of childhood blindness and visual impairment. Their training curricula should emphasize on the importance of early detection and treatment of such children. Training of midwives, traditional birth attendants, healthcare workers working for child health and immunization would be of immense help in early detection of such children.

Even when the infant has been referred for treatment appropriately, many parents believe that their infant is too small to undergo surgery or wear spectacles and, in some communities, visual loss in infants is not considered a priority for the family, especially for females. However, a child who cannot be helped by medicine or surgery may still benefit from use of spectacles and/or low vision aids. Completely and irreversibly blind children can benefit by rehabilitation and special school education. This should be emphasized during parent counseling.

Blindness and severe visual impairment in infants is not that difficult to detect and diagnose. With proper care, most of these infants can be helped and formation of dense amblyopia prevented. Even if the ophthalmologist may not be able to help medically or surgically, optical aids and rehabilitation can help children reach their full capacity.

CONCLUSION

In this study the most important causes of preventable blindness were genetic in 160(56.34%) patients followed by TORCH infections in 6(2.11%), trauma in 4(1.41%) measles in 4(1.41%) and meningitis in 3(1.06%) patients. Most important treatable cause of blindness was cataract in 76(26.76%) patients followed by glaucoma in 12(4.23%) and ROP in 2(0.70%) patients.

In this study we found that genetic counseling to educate individuals about hereditary diseases and their mode of transmission should be intensified and detailed genetic studies should be done to aid more precise diagnosis of these inherited disorders.

The importance of congenital cataract is increasing as a cause of blindness among children in developing countries, with other causes declining. Blindness from corneal scarring appears to have dropped because of interventions like vitamin A supplementation, Immunization, health education/nutrition, and breast feeding practices.

Early recognition and treatment is essential to prevent development of dense amblyopia. Primary health care programs should incorporate a wide range of cost-effective services such as eye examination at birth, eye screening for pre-school and school children, early management of congenital cataracts, vaccination for infectious diseases in children, and initiatives to train

health workers. Early referral to a tertiary care center should be done so that treatable causes of blindness can be treated timely and amblyopia can be prevented.

REFERENCES

1. Available at: http://www.who.int/mediacentre/factsheets/fs213/en/
2. Available at http://www.who.int/blindness/Vision2020_report.pdf
3. Available at http://www.cehjournal.org/wp-content/uploads/who-childhood-blindness/Coding-Instructions-June-23-2008.pdf
4. World Health Organization. WHO/PBL/97.61. Geneva: WHO; 1997. Global Initiative for the Elimination of Avoidable Blindness.
5. Gilbert C. New Issues in childhood Blindness. J Comm Eye Health. 2001; 14:53–56.
6. Dobson V, Quinn GE, Summers CG, Hardy RJ, et al. Visual acuity at 10 years in Cryotherapy for Retinopathy of Prema-turity (CRYO-ROP) study eyes: effect of retinal residua of retinopathy of prematurity. Arch Ophthalmol. 2006 Feb; 124(2):199–202.
7. Grant MB, Hansen R, Hauswirth WW, Hardy RJ, et al. Proceedings of the Third International Symposium on Retinopathy of Prematurity: an update on ROP from the lab to the nursery (November 2003, Anaheim, California) Mol Vis. 2006 May;23(12):532–580.
8. Rahi JS, Dezateux C. Congenital and infantile cataract in the United Kingdom: underlying or associated factors. British Congenital Cataract Interest Group. Invest Ophthalmol Vis Scix. 2000 Jul; 41(8):2108–2114.
9. Chak M, Wade A, Rahi JS. British Congenital Cataract Interest Group. Long-term visual acuity and its predictors after surgery for congenital cataract: findings of the British congenital cataract study. Invest Ophthalmol Vis Sci. 2006 Oct; 47(10):4262–4269.
10. Day S. Normal and abnormal visual development. In: David T, editor. Pediatric ophthalmology. Section 1. Chapter 2. Oxford UK: Blackwell Science; 1997: 13–28.
11. Dale N, Salt A. Early support developmental journal for children with visual impairment: The case for a new developmental framework for early intervention. Child Care Health Dev. 2007; 33:684–90.
12. Gogate P, Gilbert C, Zin A. Severe Visual Impairment and Blindness in Infants: Causes and Opportunities for Control. Middle East Afr J Ophthalmol. 2011 Apr-Jun; 18(2): 109–114.
13. Gilbert C, Rahi JS, Quinn GE. Visual impairment and blindness in children. In: Jhonson GJ, Minassian D, Weale RA, West SK, editors. Epidemiology of Eye Disease. 2nd ed. London: Arnold publishers; 2003: 260–86.
14. Shields CL, Honavar SG, Meadows AT, Shields JA, Demirci H, Naduvilath TJ. Chemo reduction for unilateral retinoblastoma. Archives of Ophthalmology. 2002 Dec 1; 120(12):1653-8.
15. Honavar SG. Emerging options in the management of advanced intraocular retinoblastoma.
16. Gilbert C, Fielder A, Gordillo L, Quinn G, Semiglia R, Visintin P, Zin A. Characteristics of infants with severe retinopathy of prematurity in countries with low, moderate, and high levels of development: implications for screening programs. Pediatrics. 2005 May 1; 115(5):e518-25.
17. Mccolm JR, Fleck BW. Retinopathy of prematurity: causation. InSeminars in Neonatology 2001 Dec 1 (Vol. 6, No. 6, pp. 453-460). WB Saunders.