



Prevalence, Causes and Associated Risk Factors of Childhood Blindness – A Study in Tertiary Care Centre of Central India

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Abstract

Purpose: *This study aims to determine prevalence and incidence of childhood blindness in a tertiary care centre of central India and study of various causes and risk factors of childhood blindness.*

Material and Method: *It is prospective observational institution-based case study. Children who met inclusion criteria were enrolled and thoroughly examined. All the data obtained were analyzed to know the clinical profile of childhood blindness in terms of age and sex presentation, various involved risk factors, causes and pattern of diseases occurrence.*

Results: *47 case of childhood blindness were included in this study with prevalence of 1.06 per 1000 patients and incidence of 0.34 per 1000 patients for year 2015. Majority of cases of childhood blindness were from 0-5 years of age group (40.4%) with female child (53.2%) predominance. Corneal causes were responsible in 31.9% cases of childhood blindness with predominance of Keratomalacia (46.7%). In 53.2% cases preventable and treatable causes were responsible for childhood blindness in which chronic malnutrition leading to Vitamin A deficiency (14.89%) and trauma (14.89%) were major causes. Keratoplasty was excellent treatment option in 14.89% cases.*

Conclusion: *Major causes of childhood blindness are either preventable or treatable which include Malnutrition and Vitamin A deficiency predominantly in rural India. Our efforts should be guided to increase awareness for risk factors in society and to provide adequate treatment and care facilities at rural areas to prevent childhood blindness.*

Keywords: *childhood blindness, keratomalacia, corneal cause, keratoplasty.*

Introduction

Blindness is a devastating physical condition with deep emotional and economic implications, as the consequences of blindness not only affects the individual but also the family and the community. As per the WHO standard definition of blindness - Visual acuity (VA) less than 3/60 or inability to count fingers at a distance of 3 meters or a corresponding visual field loss to less than 10

degree, in the better eye with the best possible correction.¹

Applying the WHO criteria for definition of Blindness approximately 45 million people in the world are estimated to be blind. Another 135 million people are deemed to be visually disabled. A blind child is an individual aged less than 16 years, who has visual acuity in the better eye of <3/60 according to WHO. Childhood blindness is

an important public health problem in developing countries due to its social and economic implications.²

It is estimated that 1.5 million children suffer from severe visual impairment and blindness and of these 1 million lives in Asia.³ The incidence of blindness in children is very difficult to ascertain, requiring very large longitudinal studies, accurate registers of the blind, or reliable active surveillance systems. Data from industrialized countries suggest that the incidence of blindness in children resulting from acquired conditions has declined over the last few decades, but there are no reliable data from developing countries.⁴

Common causes of visual impairment and childhood blindness are Vitamin A deficiency, Measles, Conjunctivitis, Ophthalmia-neonatorum, Injuries, Congenital cataract, Retinopathy of prematurity (ROP), Childhood glaucoma and Refractive errors are the commonest cause of visual impairment in children. The major causes of blindness in children vary widely from region to region, being largely determined by socioeconomic development, and the availability of primary health care and eye care services. Five percent of worldwide blindness involves children younger than 15 years of age; in developing countries 50% of the population is in this age group. By World Health Organization criteria, there are 1.5 million children worldwide who are blind: 1.0 million in Asia, 0.3 million in Africa, 0.1 million in Latin America, and 0.1 million in the rest of the world.⁵ There are marked differences in the causes of pediatric blindness in different regions, apparently based on socioeconomic factors. In developing countries, 30% to 72% of such blindness is avoidable, 9% to 58% is preventable, and 14% to 31% is treatable.⁶ Vision 2020-The Right to Sight^[6] was launched in Geneva on February 18, 1999. The mission of the VISION 2020 Global Initiative is to eliminate the main causes of all preventable and treatable blindness as a public health issue by the year 2020.⁷

Aims and Objectives

Purpose of this study was following

1. To study the prevalence and incidence of childhood blindness in patients attending
2. To study the avoidable (preventable and curable) causes of childhood blindness
3. To study the age and sex wise ratio of childhood blindness.
4. To study the various risk factors of childhood blindness.

Methods and Materials

In this study all the children's age below 16 years who had defective vision less than 6/60 in their better eye (childhood blindness) were enrolled and thoroughly examined in each of details in the department of Ophthalmology to reveal any underlying cause behind and made the final diagnosis after getting necessary relevant investigation. All the data obtained were analyzed to know the clinical profile of childhood blindness in terms of age and sex presentation, various involved risk factors, various causes and the pattern of occurrence of diseases.

Inclusion criteria were age less than 16 years, attending eye OPD at the study center and best corrected visual acuity less than 6/60 in better eye. Exclusion criteria were patient above 16 years of age, lost patients after first follow up and patient who had best corrected visual acuity >6/60 in better eye.

Results

This study is a prospective observational institution-based case study conducted to assess the clinical profile of patients with childhood blindness. From 2014 to 2016, 47 cases of childhood blindness were included in this study. During this period total no. of OPD patients were 44064, thus institution-based prevalence in this study is 1.06/1000 patients. Z score when calculated for prevalence came out to be 0.61 which is not significant so that the difference between the prevalence calculated in our study and the overall prevalence of childhood blindness

in India (0.8) is not significant. Total number of OPD patients attended department of ophthalmology in the year 2015 was 23005 and newly detected cases of childhood blindness in same year was 8 thus incidence of childhood blindness in this study of year 2015 was 0.34 per 1000 patients.

In this study majority of cases of childhood blindness were from 0-5 years of age group i.e. 19 cases (40.43%) followed by 14 cases (29.79%) in 5-10 years age group, 12 cases (25.53%) in 10-15 years of age group and 2 cases (4.25%) from >15 years of age group. In this study we included 25 (53.20%) female and 22 (46.80%) male blind children, showing female children predominance in childhood blindness. In our study out of total 47 cases of childhood blindness majority of cases 31 (65.96%) were from rural areas while the remaining 16 cases (34.04%) were from urban areas which showed high occurrence of childhood blindness among rural population as compared to urban population. In this study the majority of cases were belonging to families with low income group followed by middle income group and high-income group i.e. 29 cases (61.70%), 16 cases (34.04%) and 2 cases (4.26%) respectively. In our study parents of 28 cases (59.57%) were illiterate while parents of the rest 19 cases (40.43%) were literate, showing the childhood blindness is more prevalent among children of illiterate parents. (Table 1)

In this study out of 47 cases of childhood blindness the frequency of the presence of risk factors were Malnutrition 14 cases (29.78%), Trauma 7 cases (14.89%), Chronic systemic illness 6 cases (12.76%), Family history of blindness 10 cases (21.27%), history of intrauterine infection 4 cases (8.51%), history of consanguineous marriage 3 cases (6.38%) which shows malnutrition is one of the risk factors of childhood blindness. (Table 2)

In our study out of 15 cases of corneal childhood blindness in 6 cases (40%) history of associated chronic systemic illness (Protein energy malnutrition (PEM), Vit. A deficiency and worm

infestation were also present while in rest 9 cases (60%) there is no such history. (Table 3)

In our study out of total 47 cases of childhood blindness, 11 cases (23.40%) of congenital globe anomalies, 7 cases(14.90%) of trauma, 6 cases (12.77%) of congenital cataract, 7 cases (14.90%) of Keratomalacia, 3 cases (6.38%) of Healed keratitis, 3cases (6.38%) of Anterior staphyloma, 1 case(2.13%) of Stevens Johnson Syndrome, 1 case(2.13%) of ophthalmia neonatorum, 3 cases (6.38%) of optic nerve diseases, 3 cases (6.38%) of retinal dystrophies and 1 case (2.13%) of retinoblastoma were present. (Table 4)

In this study out of total 47 cases of childhood blindness 7 cases (14.89%) of trauma were present and out of these 7 cases, 5 cases (71%) were male and 2 cases were (29%) female which indicates more male children suffer from childhood blindness as compared to females due of traumatic causes. (Table 5)

In our study out of total 47 cases of childhood blindness, 15 cases were due to corneal pathology in which Keratomalacia with 7 cases (46.66%) predominated followed by 3 cases (20%) of healed keratitis, 3 cases of (20%) Anterior staphyloma, 1 case (6.67%) of Stevens Johnson Syndrome and 1 case (6.67%) of ophthalmia neonatorum. (Table 6)

In this study 25 cases (53.19%) were of preventable and treatable cause of blindness. Vitamin A deficiency (keratomalacia) and trauma, 7 cases (14.89%) each are the major causes here followed by 6 cases (24%) of congenital cataract, 3 cases (12%) due to optic atrophy secondary to infections, 1 case (4%) due to ophthalmia neonatorum and 1 case (4%) of congenital glaucoma. (Table 7)

In this study of childhood blindness 3 (6.38%) cases of keratomalacia, 2 (4.25%) cases of anterior staphyloma, 1 (2.12%) case of healed keratitis and 1 case of chemical burn can be corrected through corneal transplantation. (Table 8)

Table 1 Characteristics of cases with childhood blindness (n= 47)

Characteristics		No. of Cases	Percentage
Age groups	0-5	19	40.43%
	5-10	14	29.79%
	10-15	12	25.53%
	>15	2	4.25%
Gender	Male	22	46.80%
	Female	25	53.20%
Demographic pattern	Urban	16	34.04%
	Rural	31	65.96%
Socioeconomic Status	Low income group	29	61.70%
	Middle income group	16	34.04%
	High income group	2	4.26%
Educational Status of Parents	Literate	19	40.43%
	Illiterate	28	59.57%

Table 2 Correlation between risk factors and childhood blindness (n=47)

Risk factor	No. of cases	Percentage
Malnutrition	14	29.78%
Trauma	7	14.89%
Chronic systemic illness	6	12.76%
Family history of blindness	10	21.27%
History of intrauterine infection	4	8.51%
History of consanguineous marriage in family	3	6.38%

Table 3 Correlation between chronic systemic illness and corneal causes of blindness (n=15)

History of Chronic systemic illness	No. of cases of corneal blindness	Percentage
Present	06	40 %
Absent	09	60%
Total	15	100%

Table 4 Clinical presentation of childhood blindness (n=47)

Diseases	No. of cases	Percentage
Keratomalacia (vitamin A deficiency)	7	14.90%
Healed keratitis	3	6.38%
Anterior staphyloma	3	6.38%
Ophthalmia neonatorum	1	2.13%
Stevens Johnson syndrome	1	2.13%
Congenital globe anomalies	11	23.40%

Congenital Cataract	6	12.77%
Congenital Glaucoma	1	2.13%
Optic nerve diseases	1	6.38%
Retinal dystrophy	3	6.38%
Retinoblastoma	1	2.13%
Trauma	7	14.89%
Total	47	100%

Table 5 Gender-wise distribution of traumatic cases of childhood blindness (n=7)

Gender	No. of cases of trauma	Percentage
Male	5	71.42%
Female	2	28.58%
Total	7	100%

Table 6 Corneal diseases responsible for causing childhood blindness (n=15)

Corneal causes	No. of cases	Percentage
Keratomalacia	7	46.66%
Healed keratitis	3	20.00%
Anterior staphyloma	3	20.00%
Stevens Johnson syndrome	1	6.67%
Ophthalmia neonatorum	1	6.67%
Total	15	100%

Table 7 Distribution of cases with preventable and treatable causes of childhood blindness (n= 25)

Characteristics	No of cases	Percentage
Keratomalacia	7	28%
Trauma	7	28%
Congenital cataract	6	24%
Optic atrophy secondary to infection	3	12%
Congenital glaucoma	1	4%
Ophthalmia neonatorum	1	4%
Total	25	53.19%

Table. 8 Causes of corneal blindness which requires corneal transplantation (keratoplasty) (n=47)

Cause of corneal blindness	No. of Cases	No. of cases require keratoplasty (%)
Keratomalacia	7	3 (6.38%)
Anterior staphyloma	3	2 (4.25%)
Healed keratitis	3	1 (2.12%)
Chemical burn	3	1 (2.12%)
Total	16	7 (14.89%)

Discussion

WHO bulletin 2001 says that incidence of blindness in children is very difficult to ascertain, requiring very large longitudinal studies, accurate registers of the blind, or reliable active surveillance systems.⁴ In this study prevalence of childhood blindness was found to be 1.06 per 1000 patients.

As per National Programme for Control of Blindness⁸ 2006-07 Survey prevalence of childhood blindness⁴ in India was estimated to be 0.8/1000 children by using the correlation between under five mortality rate and prevalence. A study conducted by Dorairaj SK et al showed prevalence of childhood blindness in a rural population in southern India was 1.06.⁹

In our study maximum proportion (40.43%) of cases of childhood blindness belong to child group 0-5 years and rest are almost equally divided in 5-10years, 10-15years and above age groups. Possible reason for this majority of patients in 0-5 age group is because of keratomalacia (vitamin A deficiency) and as Vitamin A deficiency affects mostly children's below 6 years of age group, also 11 cases of congenital globe anomalies were detected in our study for which parents took early medical advice as congenital globe anomalies are easily recognized because of facial disfigurement associated with these anomalies. Similar age-wise distribution of childhood blindness was seen in the study of PG Steinkuller et al.⁵

In our study male and female patients of childhood blindness were 46.80% and 53.20% respectively. Malnourishment, vitamin A deficiency negligence and delay in seeking treatment for female child in family with low socioeconomic status are the most probable reasons behind increased female childhood blindness cases in our study. Similar observations were seen in the study conducted by S Misra et al¹⁰ and R Dandona et al¹¹.

In our study majority of cases of childhood blindness were from rural area (65.96%) than urban area (34.04%), so rural urban ratio was 1.93:1. The reasons of increased cases of childhood blindness from rural area are delay in seeking medical advice, lack of hygiene, ignorance, poverty, lack of

awareness and availability of health care facilities in rural areas. Similar results were seen in a study done by R Dandona et al¹¹ and Venkata S Murthy et al¹² where rural and urban ratio was 1.89:1 and 2:1 respectively.

In our study 61.70% cases of childhood blindness belong to lower socio-economic class whereas 34.04% belongs to middle socioeconomic class and only 4.26% belongs to high socio-economic class. The reason for this variation is limited resources like lack of health care facilities, lack of proper immunization, malnutrition and education among families with low socio-economic status. Studies conducted by PG Steinkuller et al⁵ and Rakhi Dandona et al¹³ showed similar results.

In our study in 59.57% cases of childhood blindness, parents were illiterate and in 40.43% cases parents were literate which is showing that illiterate parents are not aware of risk factors and causes of visual impairment. Global data on blindness by Thylefors B et al¹⁴ suggested that prevalence of blindness is inversely related to education status of population of any region, around three times higher risk of blindness is reported in illiterates in studies from India, China and Nepal. Similar pattern of childhood blindness cases was observed by Rahi JS et al.¹⁵

In our study malnutrition was present as the major risk factor in 29.78% cases. We found that 12.76% cases were associated with chronic systemic illness, a contributor of malnutrition. J.S.Rahi et al¹⁵ in their study on childhood blindness in 1995 also observed malnutrition to be the most important risk factor in childhood blindness. 14.89% of cases of childhood blindness were associated with trauma which makes this as second most common risk factor for childhood blindness.

In our study 14 (29.78%) cases were undernourished. This shows that there is increased risk of childhood blindness among malnourished children, as malnutrition leads to deficiency of vitamins like Vitamin A deficiency and which leads to keratomalacia and in developing countries like India and that is most important cause of avoidable childhood blindness. Study conducted by Reddy V,

Bhaskaram P in slum children shows malnutrition and associated measles infection as a major cause of childhood blindness among those children.¹⁶ As per Rahi JS et al¹⁵ malnutrition is an important cause of childhood blindness especially in developing countries of Asia and Africa.

In our study out of 15 cases of corneal childhood blindness, 7 cases (46.66%) cases were of keratomalacia found which is associated chronic systemic illness (PEM, worm infestation). This shows close relationship between corneal blindness and chronic systemic illness. Chronic systemic illness is a major risk factor of childhood blindness; these can be prevented by appropriate and timely intervention. Rahi JS et al¹⁵ also found close association of corneal causes of childhood blindness with Protein energy malnutrition, worm infestations or diarrheal diseases which further worsens the Vitamin A deficiency and ultimately leads to Keratomalacia.

In our study 31.91% patients had corneal causes of blindness and in those, keratomalacia (46.66 %) was leading cause which shows that majority of cases of corneal blindness are avoidable. Second leading cause of childhood blindness was congenital globe anomalies (23.40%) followed by Congenital cataract (12.77%). Study conducted by J L Rahi et al¹⁵ and Titiyal et al¹⁸ showed similar results with leading cause of childhood blindness of corneal origin followed by congenital globe anomalies and congenital cataract.

In our study of childhood blindness 15 cases (32%) are due to preventable blindness which include 7 cases (28%) each in keratomalacia and trauma followed by 1 case (4%) of ophthalmia neonatorum. Treatable causes of childhood blindness were responsible in 10 cases (21.2%) which include 6 cases (60%) of congenital cataract, optic atrophy due to infection 3 cases (30%) and 1 case (10%) of congenital glaucoma. So together both Preventable and Treatable causes are responsible for about 53.2% of cases of childhood blindness. Similar observations were seen in studies conducted by J L Rahi et al¹⁵ and Titiyal et al¹⁸. % which shows that if this portion of childhood blindness is targeted

specifically the overall burden of childhood blindness can be effectively reduced from the society.

In our study keratoplasty can be done in 3 cases (6.38%) of keratomalacia (other 4 cases have active infection present), 2 cases (4.25%) of anterior staphyloma, 1 case (2.12%) of healed keratitis and 1 case (2.12%) of chemical burn which shows that cornea transplantation can be beneficial in corneal causes of blindness thus general population should be educated to promote eye donation.

Conclusion

Childhood blindness is an important problem in the community and it should be dealt with proper planning. High percentage (53.2%) of childhood blindness is either preventable or treatable, if proper steps are taken at the right time to deal with it. Malnutrition and Vitamin A deficiency are still major causes of childhood blindness in India and are also present in our study thus efforts should be made to prevent these. Efforts should be made to increase awareness among rural population and to provide proper treatment and care facilities at rural areas to decrease childhood blindness. Awareness should spread in society about risk factors and causes of blindness to avoid it.

Conflict of interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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