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RESEARCH ARTICLE

ANTERIOR SEGMENT CAUSES OF BLINDNESS AMONG CHILDREN IN BLIND SCHOOLS

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ABSTRACT

India has the highest number of irreversibly blind children than any other country. Nearly 70% of the childhood blindness in India is avoidable. This study was conducted to find out the anterior segment causes of blindness among 204 children attending blind schools in Chittoor and adjacent districts of Andhra Pradesh. A predesigned interview schedule was used to collect the required information. Anterior segment examination was done using a torch and magnifying loupe with slit lamp examination in necessary cases. It was found that in 39.3% cases, the blindness was avoidable (treatable -27.0%; preventable-12.3%). Anterior segment causes accounted for majority of causes of blindness (46.6%) with lens being the most commonly involved anatomical site (20.6%) followed by cornea (17.2%). Thus anterior segment causes are the major contributory factors for blindness in children. A significant proportion of them like congenital cataract, Vitamin A deficiency and congenital glaucoma can be treated or prevented.

INTRODUCTION

It is estimated that there are 1.5 million irreversibly blind children in the world out of which 1 million are in Asia alone(World Health Organization, 2014). The prevalence of irreversible childhood blindness ranges from as low as 0.3/1000 children in high income countries to as high as 1.5/1000 children in low income countries(Gilbert *et al*, 1999),(Shamanna*et al*, 2004). India has the highest number of blind children (around 3,200,000) than any other country(Gilbert *et al*, 2003).

Vision 2020, the Right to Sight Program of International Agency for Prevention of Blindness envisages control of childhood blindness as one of five priorities. Nearly 70% of the childhood blindness is avoidable(Gilbert *et al*, 2001a).

In high income countries, congenital glaucoma, hereditary retinal dystrophies and lesions of optic nerve are predominant causes. In middle income countries, retinopathy of prematurity, congenital glaucomaand lesions of optic nerve are predominant causes while in low income countries, corneal scarring from Measles, Vitamin A deficiency, use of harmful traditional remedies, ophthalmic neonatorum and rubella cataract are the major causes(Gilbert *et al*, 2001b).

Reliable epidemiological data on causes of blindness in children in India are not available. It is necessary to identify important avoidable causes of severe visual impairment and blindness in children which will be useful for planning and control of blindness. There is a paucity of data available on childhood blindness in India and population based studies are difficult and expensive. Survey of children in blind schools is a cost effective and useful option for this purpose. Hence this present study was conducted to find out the anterior segment causes of blindness in children attending blind schools in Chittoor and neighboring districts of Andhra Pradesh.

MATERIAL AND METHODS

This is a cross sectional study conducted among four blind schools from three districts of Chittoor, Nellore and Kadapa in Andhra Pradesh. Permission for conducting the study was obtained by the Institutional Ethics Committee of SV Medical College, Tirupati. Prior permission was obtained from the Principals of the respective schools for conducting the study. Written consent from the parents/guardian was obtained for conducting the study. Using a predesigned interview schedule, the socio-demographic information, consanguinity of marriage, age of onset of visual loss was collected from study subjects. The study was conducted during July 2014 to June 2015 among

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204 blind children aged 6-16 years of age. Those children with mental retardation were excluded from the study. Detailed eye examination was performed by the same investigator to avoid bias. Distance visual acuity was measured using a Snellen E chart while visual acuity was tested separately and together for both eyes. Functional vision was assessed to determine if the child had useful remedial vision for independent mobility (the ability to navigate without assistance between two chairs set 2 meters apart in a well-lighted room), social contact (the ability to recognize known faces at a distance of 2 meters) and near vision (the ability to recognize or describe the shape of three 5 mm size symbols at any near distance). Anterior segment examination was done using a torch and magnifying loupe. Slit lamp examination was done wherever necessary.

The World Health Organization Program for Prevention of Blindness (WHO/PBL) protocol for blindness and low vision examination was used to categorize the causes of blindness and to record findings using the definitions in the coding instructions. A major anatomical site and underlying cause was selected for each eye and for each child. Those children requiring further investigations and treatment were referred to Sri Venkateswara Ram Narayan Ruia Hospital which is the teaching hospital attached to SV Medical College, Tirupati. The data was analyzed using MS excel and Epiinfo 7 version statistical software.

RESULTS

A majority of the children were aged 13-16 years (45.1%) followed by 9-12 years (39.7%). A higher proportion of them was males (63.7%) than females. Family history of blindness was noted in 26.0% cases only while consanguinity was reported in 29.9% cases. (Table1).

Table 1 Age, gender, family history and consanguinity in children (N=204)

S.No		Variable	Number of cases	Percentage
1.		**Age group (years)**		
	(a)	5 – 8	31	15.2
	(b)	9 – 12	81	39.7
	(c)	13 – 16	92	45.1
2.		**Gender**		
	(a)	Male	130	63.7
	(b)	Female	74	36.3
3.		**Family history**		
	(a)	Yes	53	26.0
	(b)	No	151	74.0
4.		**Consanguinity**		
	(a)	Yes	61	29.9
	(b)	No	112	54.9
	(c)	Not known	31	15.2

The visual acuity of majority of cases ranged from 3/60 to perception of light (52.0%) followed by visual acuity range of 6/60 to 3/60 (27.0%). It was found that a majority of them belong to the WHO grade of 'blindness' (73.0%). In a large majority of the cases, (83.7%), the onset of blindness was since birth (congenital) (Table 2). The etiology of blindness was 'unknown' in a majority of the cases (57.4%) while hereditary causes accounted for 24.5% of cases. It was found that in 39.3% of cases, the blindness was due to avoidable causes (treatable-27.0% and preventable -12.3%) (Table 3).

Table 2 Visual acuity, grading of vision and onset of blindness of children (N=204)

S.No		Variable	Number of cases	Percentage
1.		**Visual acuity**		
	(a)	6/60 – 3/60	55	27.0
	(b)	3 /60 – Perception of light	106	52.0
	(c)	No perception of light	43	21.0
2.		**Grading of vision**		
	(a)	Blindness	149	730.
	(b)	Severe visual impairment	51	27.0
3.		**Onset of blindness**		
	(a)	Congenital	170	83.7
	(b)	Acquired	34	16.7

Table 3 Etiological causes and extent of avoidable blindness in children (N=204)

S.No		Variable	Number of cases	Percentage
1.		**Etiological causes**		
	(a)	Unknown	117	57.4
	(b)	Hereditary	50	24.5
	(c)	Childhood	30	14.7
	(d)	Perinatal	4	1.9
	(e)	Intrauterine	3	1.5
2.		**Avoidable causes**		
	(a)	Preventable causes	25	12.3
	(b)	Treatable causes	55	27.0
		Total	**80**	**39.3**

Table 4 Anatomical site of cause of blindness in children (N=204)

S.No		Variable	Number of cases	Percentage
1.		**Anterior segment causes**		
	(a)	Lens	42	20.6
	(b)	Cornea	35	17.2
	(c)	Uvea	9	4.4
	(d)	Glaucoma	9	4.4
2.		**Posterior segment causes**		
	(a)	Retina	39	19.1
	(b)	Optic nerve	29	14.2
3.		**Other causes**		
	(a)	Whole globe	32	15.7
	(b)	Refractive error	9	4.4

Overall, anterior segment causes accounted for majority of the cases (46.6%) while posterior segment causes were responsible in 33.3% instances. Among the anterior segment causes, lens was the most common anatomical site (20.6%) followed by cornea (17.2%). Among the posterior segment causes, retina was the most commonly involved anatomical site (19.1%) followed by optic nerve (14.2%). Among the other causes, 'whole globe' was the common anatomical site involved (15.7%). (Table 4). It was found that within lens, the common reason for blindness was found to be 'single eye operated' (17.9%) followed by 'both eyes operated' (13.7%) while cataract in both eyes constituted 12.6% of cases. Among the cornea, corneal scarring was the most common reason (24.2%) followed by cloudy cornea (5.3%). Within the uveal causes, coloboma was the common reason (8.4%). Glaucoma as the cause of blindness accounted for 9.5% of cases (Table 5).

Table 5 Detailed anatomical sites of anterior segment causes of blindness in children (N=95)

S.No		Anatomical site	Number of cases	Percentage
1.		**Lens**		
	(a)	Cataract in both eyes	12	12.6
	(b)	Operated in both eyes	13	13.7
	(c)	Single eye operated	17	17.9
2.		**Cornea**		
	(a)	Corneal scarring	23	24.2
	(b)	Cloudy cornea	5	5.3
	(c)	Corneal dystrophy	2	2.1
	(d)	Post PK	2	2.1
	(e)	Keratoconus	2	2.1
	(f)	Anterior staphyloma	1	1.1
3.		**Uvea**		
	(a)	Coloboma	8	8.4
	(b)	Uveitis	1	1.1
4.		**Glaucoma**	9	9.5

DISCUSSION

In the present study, a majority of children were in the age group of 13-16 years (45.1%) followed by 9-12 years (39.7%). This may be due to parents admitting children to blind schools only after the age of 10 years with concerns that the child may not be able to adjust and cope up in a blind school before the age of 10 years. The findings are comparable to a study in done in nine states of India (Rahi *et al*, 1995) which found that 56.0% belonged to 13-16 years and 40.0% belonged to 9-12 years.

A higher proportion of male children (63.7%) was found in this present study. This finding was comparable to studies in Andhra Pradesh (Hornby *et al*, 2000) (65.0%),north east India (Bhattacharjee *et al*, 2008) (58.9%), nine States of India (58.0%)(Rahi *et al*, 1995) and another study in North eastIndia(Titiyal *et al*, 2003) (61.5%). This may be attributed to selective school admission of male children compared to female children.

In this study, a majority of children had visual acuity from 3/60 to perception of light (52.0%) which is comparatively higher than that of Coastal AP study (Krishnaiah *et al*, 2012) (47.8%) and rural areas of Andhra Pradesh study (Hornby *et al*, 2000)(36.8%). The differences may be attributed to differences in the degree and prevalence of blindness in these areas. In the present study, a majority of children had WHO grade of blindness (73.0%) which was comparable to studies in Andhra Pradesh, (60.8%) (Hornby *et al*, 2000), Nine states of India (Rahi *et al*, 1995)(85.4%) and North eastIndia (Bhattacharjee *et al*, 2008) (92.3%). Family history of blindness was found in only 26.0% of children in this present study which correlates with other studies done in Andhra Pradesh (Hornby *et al*, 2000)(29.2%) and North east India (Bhattacharjee *et al*, 2008) (10.0%). In the current study, only 29.9% of children gave history of consanguinity. A relatively higher proportion was reported in Coastal AP study (Krishnaiah *et al*, 2012)(48.7%) while a lower proportion was reported in North east Indiastudy (Bhattacharjee *et al*, 2008) (6.4%). In the present study, the etiology was unknown in majority of cases (57.4%) which correlates well with findings in two studies done in North east India (Bhattacharjee *et al*, 2008), (Titiyal *et al*, 2003)(which found that the etiology was unknown in 51.9% and 56.5% respectively). This may be attributed to lack of certain investigations required in children and also lack of examination of family members in many cases. In the current study, hereditary causes were found in 24.5% subjects which correlate with study in nine states of India (Rahi *et al*, 1995) (22.9%). Overall the present study had found that 39.3% children had potentially avoidable causes of blindness. A comparable proportion of 35.9% was reported in AP study (Hornby *et al*, 2000). A higher level was found in studies in nine states of India study (Rahi *et al*, 1995) (47.0%), both studies in North East India (48.5% and 43.5% respectively) (Bhattacharjee *et al*, 2008 &Titiyal *et al*, 2003). A lower proportion of 28.3% was found in Coastal AP study (Krishnaiah *et al*, 2012).

In the present study, the lens was the most common anatomical site among anterior segment causes of blindness (20.6%). Among these, 25% children had unoperated cataract in both eyes while another 25% had complications following cataract surgery and/or amblyopic as a result of late surgery or inadequate treatment. The remaining children were operated for single eye only. These findings indicate the need for specialist pediatric surgical and ophthalmic services for detection and treatment of cataract in infancy to avoid severe visual impairment. A study in Pune (Israfil *et al*, 2014) has found lens as the anatomical site of cause in similar proportion of 20.6% while AP study(Hornby *et al*, 2000) found it only in 7.9% cases.

The current study had found that cornea was the anatomical site of blindness in 17.2% cases. It was found that Measles and Vitamin A deficiency are the important contributory factors. Both these conditions are preventable by means of immunization and supplementation respectively. The other anatomical sites of anterior segment causes of blindness in this study were found to be uvea (4.4%) and congenital glaucoma (4.4%). The results correlated with Coastal AP (Krishnaiah *et al*, 2012) and nine states of India study (Rahi *et al*, 1995).

The present study is not population based and might have missed many cases of blindness in the areas studied. Further, many preschool children with multiple disabilities, those living in tribal areas and who died before the school age is not represented in the study. This study is also subject to selective bias like any other study in blind schools. Therefore the findings of this study are to be interpreted with caution. However the pattern of anterior segment causes of blindness studied reflects the current situation prevailing in Andhra Pradesh.

CONCLUSIONS AND RECOMMENDATIONS

The present study has found that the leading cause of blindness is inadequately treated and managed cataract. Hence specialist pediatric ophthalmic services are to be provided for best quality cataract surgery for children with cataract. Corneal scarring was found to be another major preventable cause of blindness. Hence Measles immunization, Vitamin A supplementation and proper antenatal care must be universal. The conditions predisposing to Vitamin A deficiency like acute diarrheal

diseases and respiratory tract infections must be promptly diagnosed and adequately treated. There should be regular screening for early detection of congenital glaucoma for appropriate referral for specialist treatment.

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