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Research Article

Prevalence and Profile of Amblyopia in Children at Bharatpur Eye Hospital

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- Amblyopia depth
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Abstract

Background: Amblyopia is the most common visual disorder in childhood. Its prevalence is often underestimated because of lack of awareness and proper study. This study aims to assess the magnitude and clinical profile of amblyopia in children attending Bharatpur Eye Hospital, Nepal.

Methods: This study included 113 amblyopic children among a total of 8,017 children below 16 years of age. Relevant demographic and ocular parameters were noted for each child. Visual acuity (VA) was taken with appropriate charts based on the age and cooperation level of the child. Amblyopic children underwent cycloplegic refraction, orthoptic evaluation and ocular examination. Severity of amblyopia was classified as mild moderate and severe based on the acuity line difference in Snellen's chart.

Results: The prevalence of amblyopia in the study was 1.40%. Amblyopia was more prevalent in males (1.47%) than females (1.11%). The mean age of the children was 9 years and 3.8 months with only 37(32.74%) presenting below the age of 8 years. More than 40 %(n-49) had no history of eye checks and were only detected amblyopic at the time of study. The majority of the children were amblyopic due to uncorrected refractive error, Forty (35.4%) were isoametropic, 34(30.1%) were anisometropic and only 12.4% were strabismic amblyopia respectively. Most children had severe (57.5%) and moderate (25.5%) amblyopia.

Conclusion: Uncorrected refractive error is a major cause of amblyopia in children. Early detection and correction of refractive error alone can reduce the burden of child's visual impairment due to amblyopia.

INTRODUCTION

Amblyopia has been defined as a unilateral or bilateral decrease of visual acuity caused by deprivation of pattern vision or abnormal binocular interaction without detectable cause [1]. Prevalence of amblyopia has been estimated between 1% and 4% [2] and it is the most common cause of monocular visual impairment in children, young adults and middle-aged adults [3,4]. Causes of amblyopia include strabismus, anisometropia, high refractive errors, and opacities of ocular media, or a combination of two or more etiologies in the same patient. The prognosis for obtaining and maintaining essentially normal vision in an amblyopic eye depends on many factors, including; the age of the patient at detection, the cause, the severity, the presence of complicating factors, the interval between the onset and the beginning of treatment and compliance with treatment [5]. Treatment regimen of amblyopia may include optical correction, patching, atropine, vision therapy and in case of sensory deprivation amblyopia, treatment of the cause.

Visual acuity loss due to amblyopia can be permanent if corrective measures are not taken. The most dire documented consequence of amblyopia is the risk of blindness if the unaffected eye becomes diseased or damaged later in life, resulting in significant health and social consequences [6-8]. The early detection of amblyogenic risk factor such as strabismus, refractive errors, and anatomic obstructions can facilate early treatment and increase the chance of recovery of VA. The timely treatment of amblyopia is effective as it reduces overall prevalence and severity of visual loss in children. Correction of the refractive error sometimes significantly improves VA to the point where further amblyopia treatment is not required [9].

With detection and treatment of amblyogenic conditions before 5 years of age, the prevalence of clinically significant amblyopia reduces to 2% [10]. The prevalence reduces to 1% with detection and treatment before 3 years of age [10]. These results suggest that early screening and treatment of amblyogenic conditions reduces the prevalence of amblyopia in school aged children and in the population as a whole.

There has, however been no Nepalese study elucidating the prevalence or clinical profile of children with amblyopia. Even less emphasis is given to amblyopia in the secondary eye hospitals, with more attention given to cataracts and other ocular conditions. This study aims to determine the prevalence and clinical profile of different subtypes of amblyopia in children attending Bharatpur Eye Hospital, one of the secondary eye hospitals of Nepal.

MATERIALS AND METHODS

Patient selection and examination

The study is a prospective, hospital based, observational study conducted from July 2011 to April 2012. All the children below 16 years of age attending the pediatric eye clinic of Bharatpur Eye Hospital were included in the study. The study was approved by the research board at Bharatpur Eye Hospital. Age, sex and other relevant demographic parameters were noted. The assessment included a detailed ocular history related to the age at which the first eye exam was performed and if treatment was undertaken (use of glasses, occlusion therapy or surgery).

Ocular examination included assessment of unaided and best corrected VA with the help of appropriate vision charts like Snellen's chart, HOTV chart and picture chart depending on the age and cooperation level of the child. Children who were too young to perform visual acuity testing were assessed to determine if they could follow objects or a light. Amblyopia was suspected in these children based on the presence of amblyogenic factors like congenital cataract or strabismus and high refractive errors in the absence of any pathological cause. Cycloplegic refraction was performed on all children with VA less than 6/6. Assessment of ocular alignment, fixation pattern and ocular motility was accomplished. A detailed fundus evaluation was completed on all amblyopic children to rule out any posterior segment pathology.

Study definition of amblyopia

Unilateral amblyopia was defined as 2-lines interocular difference in VA with at least 6/12 or worse in the worse eye (with unilateral amblyogenic factors).Bilateral amblyopia was defined as VA 6/12 or less in both eyes (with bilateral amblyogenic factors) [11].

Classification of amblyopia

For each patient amblyopia was classified as strabismic, anisometropic, aniso-strabismic, isoametropic and stimulus deprivation [12].

Strabismic Amblyopia was defined as amblyopia in the presence of heterotropia at distance and/or near or a history of strabismus surgery (or botulinium toxin injection) and in the absence of refractive error meeting the criteria for aniso-strabismic amblyopia.

Anisometropic Amblyopia was defined as amblyopia in the presence of anisometropia that was 1.00 diopter (D) or more in spherical equivalent for hypermetropia. 3.00 diopter (D) or more for myopia and 1.50D or greater difference in astigmatism in any meridian with no measurable heterotropia at distance or near [13].

Aniso-strabismic amblyopia was defined as amblyopia in the presence of either a heterotropia at distance and/or near fixation or a history of strabismus surgery (or botulinium toxin injection), and anisometropia that was 1.00 D or more in spherical equivalent for hypermetropia 3.00D or more for myopia and a 1.50 D or greater difference in astigmatism in any meridian [13].

Stimulus deprivation amblyopia includes patients with known documented cases of sensory deprivation (ptosis, cataract or other media opacities) with no primary heterotopias or refractive error that could be causally related to amblyopia.

Isoametropic amblyopia was classified as hypermetropia greater than 4.00D, myopia greater than 6.00D and astigmatism greater than 2.50D with no associated strabismus or ocular pathology [14].

Amblyopia was also categorized as mild moderate and severe based on the intraocular difference in visual acuity. In the study patients with VA of 2 lines difference between the two eyes were labeled as mild amblyopes, patients with VA of 3 and 4 lines differences between two the eyes were labeled as moderate and severe amblyopia respectively for unilateral amblyopia. In bilateral amblyopia VA of 2 lines, 3 lines and 4 lines worse than normal VA were categorized as mild, moderate and severe amblyopia respectively.

RESULTS/DISCUSSION

Prevalence of amblyopia

There were 8,017 children ranging in age from 0-15 years attended Bharatpur eye hospital from July 2011 to April 2012 (duration of 10 months). In our sample; 52.7% (n= 4, 229) were female and 47.3% (n= 3,788) were males. Of these, 1.4% (n=113) were detected as amblyopic.

Demographic profile of amblyopic children

Among 113 amblyopic children 58.4% (n=66) were males and 41.6% (n=47) were females. The difference in male and female was found to be statically significant (χ^2= 9.5, df=4, p=0.049). The mean age of children was 9.3±3.9 ranging from 1-15 years. Seventy- six percentage (n-86) of children were Caucasian and only 23.0% (n= 27) were Mongolian and 76.6% (n=90) of them were from Chitwan district where the hospital is located and only 20.4% (n=23) were from neighboring districts of Chitwan. More than half of the amblyopic children, 67.26% (n=76) were above 8 years of age. Treatment of amblyopia in these children may be difficult compared to younger children.

Distribution of amblyopia

Most of the children had isoametropic amblyopia 35.1% (n=40) followed by anisometropic 30.1% (n=34) and stimulus deprivation amblyopia 15% (n=17). Strabismic amblyopia was

detected in 12.4% (n=14) of the cases. Only 7.1% (n=8) had aniso-strabismic amblyopia (Table 1). Equal numbers of children with isoametropic amblyopia were hypermetropic and myopic. Most of the anisometropic amblyopes 53.0% (n=18) were due to hypemetropic error difference.

All the cases of stimulus deprivation amblyopia were due to congenital cataract and had undergone previous cataract surgery. Nystagmus was present in 70.6% (n=12) of the stimulus deprived amblyopes. Nystagmus was also associated with two cases of strabismic amblyopia. Of the total 14 cases of strabismic amblyopia 6 were exotropes and 8 were esotropes (Table 1). Only 2 cases had undergone strabismus surgery.

History of eye check up

More than 40% (n=49) of the amblyopic children had no previous history of an eye examination and were diagnosed with amblyopia at the time of presentation. (Table 2) Among these children only 9% were either detected during school screening or referred by the school teachers suspecting the vision problem in children due to the child's reduced academic performance. All the children with stimulus deprivation amblyopia had a history of an eye check up in the past and had undergone surgery. Majority of the children who had no previous eye check up were anisometropic amblyopes. Of the total amblyopic children only 50 % (n=57) were using spectacles and only 8 % (n=9) had undergone patching therapy for the treatment of amblyopia.

Visual status of amblyopic children

With first time or updated spectacle correction, improvement in VA (relative to presenting VA) was detected in 63.7% (n= 72) of amblyopic children, but VA was 6/12 or worse in all cases. Refractive amblyopes were among those whose VA was improved with initial correction. Improvement in VA was not found in either the stimulus deprived or strabismic amblyopes (Table 3). The children having eye check up at the earlier age had better best corrected VA than children having eye check up at the later age.

Severity of amblyopia

Most of the amblyopic children had severe and moderate depth of amblyopia and only few had mild form of amblyopia (Table 4).

Almost all the stimulus deprivation and aniso-strabismic amblyopia had severe form of amblyopia. The majority of children with mild amblyopia were anisometropic and isoametropic (Table 4). The relation between depth and type of amblyopia was statistically significant (Chi square =0.007, df 8)

DISCUSSION

Amblyopia is an important public health problem because of its prevalence among children, and because visual impairment from amblyopia can be lifelong and profound if it remains untreated [15]. The prevalence estimates range from 0.8% to 3% depending on the population studied and the definition used [16-20]. Prevalence of amblyopia in our study at Bharatpur Eye Hospital was found to be 1.4% in children age between 1-15 years. Amblyopia was more prevalent in males than females (P=0.049). Prevalence of amblyopia in a similar study done in Ethiopia was found to be 9.1%, much higher compared to our study [21].

The highest number of children in this study (83%) had moderate to severe visual impairment in one or both eyes due to amblyopia. 57.5% had severe amblyopia and 25.5% had a moderated form of amblyopia. The significant number of children with severe amblyopia was most likely influenced by the severity of amblyogenic factors, late presentation of children for their eye check up and lack of proper treatment for amblyopia. In our study it was found that only 8% of the amblyopic children were undergoing patching therapy for the treatment of amblyopia.

Uncorrected refractive error was a major cause of amblyopia in children. The majority of amblyopic children in our study (65.5%) had refractive amblyopia. Thirty-five percent and 30% of children had isoametropic and anisometropic amblyopia respectively. Strabismic amblyopia was present only in 12.4% of children with almost equal numbers of esotropes and exotropes. In contrast to our study strabismic amblyopia was a most common subtype (37.88%) in a study conducted at referral strabismology practice in India [22]. In a study conducted among 1100 school children of Kathmandu valley in Nepal 8.1% of ocular morbidity was due to refractive error and 12.4% of those with ocular morbidity had already developed amblyopia [23]. In another

Table 1: Etiological distribution of amblyopia.

Amblyopia type	Cause of amblyopia	Number (percentage)	Total
Anisometropic	hypermetropia	18(53%)	34(30%)
	myopia	10(29.4%)	
	astigmatism	6(17.6%)	
Isoametropic	hypermetropia	17(42.5%)	40(35.5%)
	myopia	17(42.5%)	
	astigmatism	6(15%)	
Stimulus deprivation	Congenital cataract	17(100%)	17(15%)
Strabismic	esotropia	8(57%)	14(12.4%)
	exotropia	6(43%)	
Aniso-strabismic	Exo+myopia	1(12.5%)	8(7.1%)
	Eso+hypermetropia	6(75%)	
	Exo+Hypermetropia	1(12.5%)	
Total		113	113(100%)

Table 2: Eye check up history and amblyopia type.

h/o eye check up	Type of amblyopia					
	Anisometropic	Strabismic	Isoametropic	Aniso-strabismic	Stimulus deprivation	Total
Yes	15(44.1%)	5(35.7%)	22(55%)	5(62.5%)	17(100%)	64(56.6%)
No	19(55.9%)	9(64.3%)	18(45%)	3(37.5%)	0(0%)	49(43.4%)
Total	34(100%)	14(100%)	40(100%)	8(100%)	17(100%)	113(100%)

Table 3: Presenting and Best corrected VA and amblyopia type.

Type of amblyopia	Visual Acuity Range in Amblyopic eye					
	(6/12-6/18)		(6/24-6/36)		(6/60->6/60)	
	PVA	BCVA	PVA	BCVA	PVA	BCVA
Anisometropic	3	18	9	12	22	4
Strabismic	2	3	3	2	9	9
Isoametropic	10	21	5	10	25	9
Stimulus Deprivation	0	0	2	5	15	12
Aniso-strabismic	0	0	1	3	7	5
Total	15(13.3%)	42(37.1%)	20(17.7%)	32(28.3%)	78(69%)	39(34.5%

PVA-Presenting Visual Acuity, BCV-Best Corrected Visual Acuity

Table 4: Depth and type of amblyopia.

Amblyopia type	Depth of Amblyopia n(%)			
	Mild	Moderate	Severe	Total
Anisometropic	9(26.5%)	12(35.2%)	13(38.3%)	34(100%)
Strabismic	1(7.1%)	3(21.4%)	10(71.5%)	14(100%)
Isoametropic	9(22.5%)	12(30%)	19(47.5%)	40(100%)
Stimulus deprivation	0(0.00%)	1(5.9%)	16(94.1%)	17(100%)
Aniso-strabismic	0(0.00%)	1(12.5%)	7(87.5%)	8(100%)
Total	19(16.8%)	29(25.7%)	65(57.5%)	113(100%)

study in Nepal out of 970 ametropic eye patients amblyopia was present in 6.0% (n=56) with anisometropias and high bilateral ametropias [24]. A study conducted in Israel found the rate of amblyopia among subjects who had refractive error was 14.6% among immigrants as opposed to 8% among native Israelis [25].

More than half of the children in our study had improvement in VA after appropriate correction at the time of presentation but not to the standard VA. Those with improvement in visual status were mainly children with anisometropic and isoametropic amblyopia. However, in our study we considered children as amblyopic on the basis of VA immediately after correction, without considering that children may not be amblyopic after certain weeks of optical correction. This is one of the major limitations of our study that may have resulted in the overestimation of percentage of children with refractive amblyopia. Many studies have shown the improvement in VA of refractive amblyopia with appropriate refractive correction alone [26,27].

Another important finding of the study was the significant number 15% (n=17) of children with stimulus deprivation amblyopia. The stimulus deprivation was due to congenital cataract in all cases and they had undergone surgery in different tertiary eye care centers. All these children were wearing aphakic glass, but none had undergone patching therapy for amblyopia. Nystagmus was present in 70.6% of children with stimulus deprivation amblyopia and was more prevalent in those children whose cataract surgery was performed later. The findings of an experiment on monkeys has shown early pattern vision is necessary for the development of normal ocular alignment and gaze holding ability, with early vision deprivation resulting in persistent strabismus and nystagmus [28].

Even excluding those with previous treatments, the age of those presenting with amblyopia was relatively old. In our study the mean age of amblyopic children was 9 years. Although many PEDIG studies [29,30] have shown that children may respond to treatment at older ages, but treatment may be less effective than it would have been in younger ages. Recent studies have also found that plasticity in the adult visual system is present and different methods are used to induce such plasticity leading to improvement of VA in adult amblyopes [31-35].

Visual defects causing amblyopia remain undetected in many school children in Nepal, among 113 amblyopic children in our study 40% (n=49) were first diagnosed as amblyopic at the time of presentation and majority of them were refractive amblyopes.

School screening programs exist in Nepal. The aim of screening programs at schools is early detection and treatment of visual problems to reduce the overall ocular morbidity in

children. School screenings programs are being conducted each year with the supported of many government and non-government organizations; however these school screening programs are not able to cover all areas of Nepal and are limited to city areas and places nearby. There are no vision screening programs for preschool children and because of lack of awareness among parents on the need of early eye check up visual defects in children remain undetected and untreated for long time, leading to development of amblyopia.

CONCLUSION

Majority of the children in our study were found to have developed amblyopia due to uncorrected refractive error, which could be avoided simply by detecting and correcting error on time. Lack of knowledge and awareness about amblyopia and its appropriate timely management has been the cause for late presentation and significant visual impairment associated with amblyopia.

This study highlights the need for effective implementation of pre-school and school screening programs even to the remote areas of Nepal along with the awareness programs on the need of early eye check up for children. It should be mandatory that every child have his/her eye tested before admitting them to school. This will help in reducing the prevalence of visual impairment in children due to amblyopia

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