Original Research Article

Determination of the pervasiveness of amblyopia and strabismus in children

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Received: 10-03-2021 / Revised: 10-04-2021 / Accepted: 25-05-2021

Abstract

Introduction: We decided to investigate whether the Prevalence of amblyopia as well as strabismus, a major advantage for detecting medical eye conditions in children. We also followed patients during treatment to determine whether their performance on the screening test would improve when vision was restored after treatment.**Materials and Methods:** 138 children diagnosed with horizontal strabismus after taking informed consent from their parents and approval from institutional ethical committee. Complete ocular examination was carried out for each child by qualified clinical optometrists. Socio - demographic data were also collected using a structured questionnaire before ocular examination. Anterior segment evaluation was assessed at class room prepared for the purpose of the study using direct ophthalmoscope and handheld slit lamp bio-microscope.**Results:** 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 52 % (n=61) were using spectacles and only 9 % (n=11) had undergone patching therapy for the treatment of amblyopia.**Conclusion:** 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.

Keywords: Awareness, amblyopia, strabismus, children, Management

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Introduction

It is believed that the sensitive period for binocularity begins at 10-16 weeks of age and peaks at 1-3 years[1]. Any disruption of ocular fusion and binocularity may lead to ocular misalignment and strabismus. Prevalence of strabismus in population with predominantly white ethnicity was generally higher than those of East Asian descent. Children from Mexico, Iran and African, American and Latino-Hispanic children in USA have strabismus rates ranging from 2-2.5%[2].Population based studies from India reported that refractive errors were a major cause of visual impairment in 61% of eyes in rural and 81.7% of eyes in urban population. In a review of population based and school-cohort studies, the global estimates of prevalence of amblyopia range from 0.20%-6.2%[3].Amblyopia or lazy eye is a disorder of sight due to the eye and brain not working together[4].Amblyopia develops during the maturation of the visual system, generally thought to take place up to 6 years of age[5]. Early detection and treatment of amblyopia improves the likelihood that vision can be restored to normal. However, despite current screening programs used by health services worldwide, many children are not treated before school age due to lack of detection[6].Anisometropic amblyopia (caused by asymmetry in refractive error) may be the only identifiable factor contributing to amblyopia in as many as a third of all cases,[7-9] is especially likely to go undetected because the eyes are clinically aligned, and primary care doctors are unable to estimate refractive error.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[10-12]. 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[13].Vision therapy consists of eye exercise that helps patients gain improved control of their eye movements. Vision therapy has been shown to be helpful in treating amblyopia and strabismus. Vision therapy in adults has not been thoroughly studied although two case studies of successful vision therapy treatment of childhood onset intermittent basic exotropia in adults have been documented[14]. Most surgeons will consider surgery for an esotropia more than 15 PD, exotropia greater than 20 PD. Strabismus surgery can involve resecting or recessing one or more extraocular muscles. Botulinum toxin inj. into extraocular muscle to weaken it is an alternative to traditional surgery. Botulinum toxin is most often used for infantile esotropia treatment but it has also been used for acute onset starbismic deviation in adults[15].We therefore decided to investigate whether the Prevalence of amblyopia as well as strabismus, a major advantage for detecting medical eye conditions in children. We also followed patients during treatment to determine whether their performance on the screening test would improve when vision was restored after treatment.

Materials and methods

138 children diagnosed with horizontal strabismus after taking informed consent from their parents and approval from institutional ethical committee. Complete ocular examination was carried out for each child by qualified clinical optometrists. Sociodemographic data

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were also collected using a structured questionnaire before ocular examination. Anterior segment evaluation was assessed at class room prepared for the purpose of the study using direct ophthalmoscope and handheld slit lamp bio-microscope. Visual acuity was assessed in a well lit room using log MAR acuity chart. Refractive error was objectively assessed using retinoscope refined subjectively using both sphere and cylindrical lenses.

Inclusion Criteria: Children with horizontal squint, age less than or equal to 9 years

Exclusion Criteria: Vertical strabismus, Phorias, Squint due to sensory causes, Age more than 9 years, Babies lost to follow-up, children with incomplete record.

Children were evaluated for age at onset of strabismus, type of strabismus, pre and post- operative visual acuity, deviation at first presentation, deviation at 3 months postoperatively and status of binocularity. Visual acuity was tested in verbal Children by Snellen's Chart or Illiterate E letters. Amblyopia was categorized as Mild, Moderate and severe according to following table.All the children had undergone detailed history related to the age of onset, as noticed by the patient or his guardian. Ophthalmic examination included visual acuity by Snellen vision chart, cycloplegic refraction by streak retinoscope, auto-refrectometer (Righton Speed 01), thorough anterior and posterior segment and examination by slit lamp biomicroscopy, ophthalmoscopy and assessment of the ocular alignment by cover-uncover test and ocular motility. Assessment of the binocular status of the eye was performed with the help of Worth's four –dot test and synaptophore .The criteria used for each subtype and the diagnosis were

For ametropic amblyopia: Patients with refractory errors more than > 1.0D spherical in both eyes resulting in vision less than 6/12 or equal to 6/12 in one or both eyes and no associated strabismus or any other ocular pathology.

Anisometric amblyopia: Who had amblyopia in the presence of anisometropia that was 1 D or greater than 1 D in spherical or 1.5 D or greater difference in astigmatism between both the eyes that had persisted for more than 4 weeks after spectacle correction, in the absence of any measurable hetrophoria.

Meridional amblyopia: Who had regular astigmatism equal or more than 1.5 D of astigmatism in both eyes, resulting in decrease of vision in one or both eyes and no associated strabismus. Patients with significant anisometropia (as defined above) along with the difference of 1.5 Diopter =/> between the two eyes were excluded from this category

Statistical Analysis

A chi-square test was used to compare the proportions of children with a given diagnosis between ethnic groups and genders. The association of strabismus and amblyopia prevalence with age was examined by the Cochran trend test, stratifying by age into 6 categories. Strabismus prevalence as related to age was also evaluated by chi-square testing after stratifying by age into 2 categories. A secondary analysis of strabismus and amblyopia prevalence was performed by randomly selecting one child from each household to test for clustering effects. All analyses employed SAS 9.1 software (SAS Institute, Inc., Cary, NC) and a 0.05 significance level. P values refer to chi- square testing unless otherwise specified.

Results

All the cases of stimulus deprivation amblyopia were due to congenital cataract and had undergone previous cataract surgery. Nystagmus was present in 71.8% (n=18) of the stimulus deprived amblyopes. Nystagmus was also associated with two cases of strabismic amblyopia. Of the total 16 cases of strabismic amblyopia 7 were exotropes and 9 were esotropes (Table 1). Only 2 cases had undergone strabismus surgery.

Table 1: Etiological distribution of amblyopia

Amblyopia type	Cause of amblyopia	Number(percentage)	Total
Anisometropic	hypermetropia	20(51.2%)	39(28.2%)
	myopia	12(30.7%)	
	astigmatism	7(17.9%)	
Isoametropic	hypermetropia	19(42.2%)	45(32.6%)
	myopia	19(42.2%)	
	astigmatism	7(15.5%)	
Stimulusdeprivation	Congenital cataract	22(100%)	22(15.9%)
Strabismic	esotropia	11(57.8%)	19(13.7%)
	exotropia	8(42.1%)	
Aniso-strabismic	Exo+myopia	2(15.3%)	13(9.4%)
	Eso+hypermetropia	8(61.5%)	
	Exo+Hypermetropia	3(23.0%)	
Total		138	138(100%)

More than 42% (n=54) 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 13% 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 52 % (n=61) were using spectacles and only 9 % (n=11) had undergone patching therapy for the treatment of amblyopia.

Table 2: Eye checkup history and amblyopia type

h/o eye checkup	Type of amblyopia					
	Anisometropic	Strabismic	Isoametropic	Aniso-strabismic	Stimulus deprivation	Total
Yes	17(42.5%)	8(40%)	24(53.3%)	8(57.1%)	19(100%)	76(55.0%)
No	23(57.5%)	12(60%)	21(46.6%)	6(42.8%)	0(0%)	62(44.9%)
Total	40(100%)	20(100%)	45(100%)	14(100%)	19(100%)	138(100%)

Most of the amblyopic children had severe and moderate depth of amblyopia and only few had mild form of amblyopia (Table 3).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 3). The relation between depth and type of amblyopia was statistically significant (Chi square =0.007, df 8)

Table 3: Depth and type of amblyopia

Amblyopia type	Depth of Amblyopia n(%)			
	Mild	Moderate	Severe	Total
Anisometropic	11(28.2%)	14(35.8%)	14(35.8%)	39(100%)
Strabismic	2(10.5%)	5(26.3%)	12(63.1%)	19(100%)
Isoametropic	11(24.4%)	14(31.1%)	20(44.4%)	45(100%)
Stimulus deprivation	0(0.00%)	2(9.0%)	20(90.9%)	22(100%)
Aniso-strabismic	0(0.00%)	2(15.3%)	11(84.6%)	13(100%)
Total	24(17.3%)	37(26.8%)	77(55.7%)	138(100%)

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[16]. The prevalence estimates range from 0.8% to 3% depending on the population studied and the definition used[17-21]. 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[22].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.The higher prevalence of strabismus and, specifically, of esotropia in older children than in younger children in both Hispanic/Latino and African American populations is unlikely to be an artifact of the difficulty of detecting strabismus in younger children, because strabismus prevalence increases with age even when excluding small-angle deviations. We know of no previous study that has demonstrated a relationship of strabismus with age, although it is consistent with studies showing little strabismus in the first year of life[23].Increasing esotropia prevalence with age may reflect the development of accommodative esotropia in hyperopic children once they begin consistently accommodating to compensate for their hyperopia, revealing the accommodative convergence associated with these efforts.Esotropia is a less common form of strabismus than exotropia in both African American and Hispanic children. However, constant ocular misalignment at both distance and near—which precludes any normal binocular function—is more often due to esotropia than exotropia.Small-angle deviations <10 PD, which may be compatible with subnormal but not absent binocularity, represent only a small proportion of strabismus cases.Amblyopia prevalence does not vary significantly with age between 30 months and 72 months. There is a suggestion of lower prevalence in the 30- to 35-month age group; however, the sample size is smaller than for other age groups, due to the shorter age span and lower optotype testability rates, with confidence intervals overlapping broadly with those of older age groups. Furthermore, in this age group children who completed VA testing were less likely to have amblyopia risk factors than those who could not be tested, biasing toward lower prevalence estimates. Finally, variability of test performance in normal eyes at younger ages could mask true interocular acuity differences, again biasing toward lower amblyopia prevalence. The retest protocol minimizes amblyopia overdiagnosis but leaves room for underdiagnosis, because children with normal-for-age VA and no interocular difference are not retested even if they have an amblyopia risk factor and room for an interocular difference to develop upon retesting. Above 3 years of age, amblyopia prevalence appears stable. Assuming there are no significant cohort differences between younger and older participants, such a cross-sectional pattern implies either a low incidence of new cases of amblyopia after age 3 or an incidence rate that is matched by resolution of existing cases. Because amblyopia treatment is uncommon in this population and amblyopia is not known to resolve spontaneously,[24] our data suggest that most cases of amblyopia have developed and can be detected by 3 to 4 years of age. This, in turn, implies that preschool vision screening should detect most cases of amblyopia.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 checkup 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. So it is concluded from above study that it is not mandatory to treat amblyopia prior to surgery in horizontal strabismus. However, amblyopia therapy must be continued post-operatively. More studies involving longer follow-ups and large sample size are required to be done to increase the validity of results.

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Conflict of Interest: Nil
Source of support:Nil