



Evaluation of Amblyopia in School Children

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Abstract: Background: Amblyopia is a form of cortical visual impairment which can result from many condition which prevents normal visual stimulation in children in younger age group causing childhood visual impairment. The term “lazy eye” is often used for Amblyopia. It accounts to be the second common cause of blindness. **Materials and Methods:** A cross sectional study was conducted during the school health check up visits conducted by ophthalmology department of tertiary care teaching hospital for screening of eye disorders in school children who belongs to the age group of 5-15 years over a period of 1 year in which 813 children underwent screening ,among them 110 children with the reduced vision were referred to hospital for detailed ophthalmic evaluation which includes cycloplegic refraction and dilated fundus examination. Amblyopia was detected in children with reduced best corrected visual acuity. **Results:** A total of 813 study subjects were screened. Out of them 110 (13.5%) were found to have diminished vision. When the study subjects with diminished vision were subjected for further tests, 18 (2.2%), (p value is 0.494)of them were found to have amblyopia. Amblyopia was present in 10 (18.9%) of females and 8(14%) of males. Anisometropic amblyopia was the most common type of amblyopia found in 10 (55.6%) of the study subjects, followed by meridional and strabismus type of amblyopia in 4 cases each (22.2%). Among strabismus ,exotropia was seen in more study subjects 4(0.5%) than esotropia in 2 cases(0.2%). A higher number of moderate grade of amblyopia was seen than mild grade of amblyopia. **Conclusion:** The prevalence of amblyopia in our study is 2.2%. Anisometropic refractive errors are the most common underlying cause in our study subjects. We recommend implementation of visual screening programs for children of school going age group for early detection and proper management of Amblyopia.

Keywords: Amblyopia, Prevalence, Strabismus, Anisometropia, Astigmatism, Myopia.

INTRODUCTION

Amblyopia is the most common cause of decreased vision in childhood due to various reasons. ^[1] The term amblyopia is derived from the Greek language means dull vision: amblys = dull, ops = eye. ^[2] Amblyopia refers to reduced best corrected visual acuity caused by abnormal visual development secondary to abnormal visual stimulation. It has been

otherwise called as functional amblyopia and amblyopia ex anopsia. Children are usually susceptible to amblyopia between birth and 7 years of age. ^[3]

The basic mechanisms occurs in amblyopia could be due to interactive anomaly between the two eyes or dissociative disorder in one or both eyes. It is either anisometropic, strabismic, meridional or visual deprivation in nature. ^[4]

Anisometropia, high refractive errors, strabismus, ocular media opacities, or their combinations are the various causes of amblyopia commonly seen in outpatient departments. The prognosis of amblyopic patients depends on multiple factors, which include the age of the patient at the time of detection, cause of amblyopia, grade of amblyopia, the interval between the onset, diagnosis, initiation of treatment, and the patient compliance. ^[5]

Early detection of amblyogenic risk factors such as anisometropia, strabismus, uncorrected refractive errors, and ocular media opacities along with awareness of the disease among the parents is also essential to detect the disease early and to initiate appropriate treatment to reduce the burden of low vision in later life of a child. This will reduce the overall prevalence of amblyopia and severity of visual loss in children. Correction of uncorrected Refractive error can significantly improve visual acuity (VA) of the affected eye so that further amblyopia treatment may not be required. ^[6]

Early intervention of amblyopia is very essential to obtain a good best corrected visual acuity. Providing a clear retinal image is the basic strategy for the treatment of amblyopia. Correction of ocular dominance must be done as early as possible during the period of visual plasticity i.e from birth to 8 years of age group. If not done timely it can cause permanent morphological changes in the visual cortex and lateral geniculate nucleus (LGN). Correction of ocular dominance is done by forcing fixation of the amblyopic eye by patching the sound eye or blurring the vision of the sound eye by atropinisation.^[7]

The gold standard treatment for amblyopia is patching the better eye to force the brain to use the affected eye. Depriving the visual stimulation of sound eye forces the amblyopic eye to strike suppression and to use the visual cortex corresponding to the eye to recover connections for better vision. Optical penalization with atropine eye drops, filters to blur the sound eye, optical defocus using glasses or contact lenses, and dichoptic video games are normally used as other alternative to eye patching.^[8]

MATERIALS AND METHODS:

A cross sectional study was conducted during the school health check-up visits conducted at ophthalmology department of tertiary care teaching hospital for screening of eye disorders in school children who belongs to the age group of 5-15 years over a period of 1 year in which 813 children underwent screening, among them 110 children with the reduced vision were referred to hospital for detailed ophthalmic evaluation which includes cycloplegic refraction and dilated fundus examination. Amblyopia was detected in children with reduced best corrected visual acuity.

Method of Collection of Data

Vision testing of both the eyes were done for distant vision and near vision using Snellen's chart. Ocular movements test, Hirschberg's test, cover-uncover test, anterior segment examination was done by torch light. Students with poor vision would be noted down in a separate register. A prescription slip will be given to each student. A note will be given to the teachers which they would be asked to hand over to the respective parents, regarding their problem and importance of correction and a fixed date will be given to visit tertiary hospital ophthalmology outpatient department along with their parents for detailed ophthalmic evaluation.

Detailed ophthalmic evaluation in hospital includes:

- 1) Vision testing using Snellen's chart for both distant and near vision.
- 2) Hirschberg's test, cover, uncover test, note any ocular deviations.
- 3) Ocular movements examination.
- 4) Colour vision testing using Ishihara test.

- 5) Anterior segment examination using slit lamp biomicroscopy.
- 6) Squint evaluation for children with the ocular deviation.
- 7) Cycloplegic refraction after using 2% Homide eye drops with Welch Allyn streak retinoscope.
- 8) Dilated funduscopy examination using direct ophthalmoscope and indirect ophthalmoscope.

Refractive correction will be given to the children who accepts the correction fully. Children who are not accepting the refractive correction fully will be considered as Amblyopics. They will be given a maximum accepted refractive correction and eye patching was advised for their sound eye and advised to do near work.

Inclusion criteria: Children in the age group of 5-15 years in the selected schools of field practice area.

Exclusion criteria: Children with defective vision due to other reasons. Absentees on the day of examination. School children aged less than 5 years and school children aged more than 15 years. Those who are not willing to participate.

Statistical Analysis

SPSS (Statistical Package for Social Sciences) version 20 was used to perform the statistical analysis. Data was entered in the excel spread sheet. Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables. Inferential statistics like Chi-square test / Fisher's exact test was applied for categorical variables. P value <0.05 was considered statistically significant.

RESULTS:

In our study, a total of 813 study subjects were screened. 110 (13.5%) children were found to have diminished vision. When the study subjects with diminished vision were subjected for further tests, 18 (2.2%) were found to have amblyopia.

Table 1: Gender wise distribution of the study subjects

Gender	Frequency	Percent
Male	409	50.3
Female	404	49.7
Total	813	100.0

In the present study, out of 813 study subjects screened, 409 (50.3%) were males and 404 (49.7%) were females.

Table 2: Mean age distribution of the study subjects according to gender.

Gender	N	Age	
		Mean	Std. Dev
Male	409	10.37	3.162
Female	404	10.47	2.995
Total	813	10.42	3.079

In our study, the mean age of males and females screened was 10.37 ± 3.162 years and 10.47 ± 2.995 years respectively.

Table 3: Distribution of the study subjects according to diminished vision and amblyopia.

Amblyopia	Diminished vision		Total
	No	Yes	
Absent	703	92	795
	86.5%	11.3%	97.8%
Present	0	18	18
	0.0%	2.2%	2.2%
Total	703	110	813
	86.5%	13.5%	100.0%

Among the study subjects (n –110, 13.5%) who had diminished vision, amblyopia was found to be present and absent in 18 (2.2%) and 92 (11.3%) respectively in our study.

Table 4: Study subjects according to age and presence or absence of amblyopia

Age	Amblyopia		Total
	Absent	Present	
5	54	0	54
	6.80%	0.00%	6.60%
6	64	2	66
	8.10%	11.10%	8.10%
7	63	0	63
	7.90%	0.00%	7.70%
8	65	1	66
	8.20%	5.60%	8.10%
9	67	0	67
	8.40%	0.00%	8.20%
10	77	2	79

	9.70%	11.10%	9.70%
11	70	1	71
	8.80%	5.60%	8.70%
12	76	3	79
	9.60%	16.70%	9.70%
13	99	2	101
	12.50%	11.10%	12.40%
14	98	6	104
	12.30%	33.30%	12.80%
15	62	1	63
	7.80%	5.60%	7.70%
Total	795	18	813
	100.00%	100.00%	100.00%

With respect to age of the study subjects who were screened, majority of the study subjects who were amblyopic belonged to the age of 14 years (33.3%), followed by 16.7% with age of 12 years, 11.1% each with 6,10 and 13 years of age.

Table 5: Types of amblyopia.

Amblyopia	Frequency	Percent
Anisometropic amblyopia	10	55.6
Meridional amblyopia	4	22.2
Strabismic amblyopia	4	22.2
Total	18	100.0

In this study, Anisometropia amblyopia was the most common type of amblyopia found in 10 (55.6%) of the study subjects, followed by meridional and strabismus type of amblyopia in 4 cases each (22.2%).

Table 6: Laterality of Amblyopia.

Amblyopia	Frequency	Percentage
Unilateral	14	77.77
Bilateral	4	22.22
Total	18	100

In this study, 14 (77.77%) and 4 (22.22%) study subjects had unilateral and bilateral amblyopia.

Table 7: Vision of the study subjects who had diminished vision

Vision		6/12.	6/18.	6/24.	6/36.	6/6.	6/60.	6/9.	CF - 1 mt	CF - 2 mt	CF- 3 mt	Total
Right Eye	n	32	12	13	12	3	2	33	-	-	3	110
	%	29.1	10.9	11.8	10.9	2.7	1.8	30	-	-	2.7	100
Left Eye	n	29	17	5	1	4	-	49	2	1	1	110
	%	26.4	15.5	4.5	0.9	3.6	-	44.5	1.8	0.9	0.9	100

In table 7, total 33 (30%) and 49 (44.5%) had diminished vision of 6/9, followed by 32 (29.1%) and 29 (26.4%) in right and left eye respectively.

Table 8: Treatment provided for amblyopics

Treatment	Amblyopia		Total
	Absent	Present	
Spectacles	92	2	94
	100.0%	11.1%	85.5%
Spectacles and patch	0	16	16
	0.0%	88.9%	14.5%
Total	92	18	110
	100.0%	100.0%	100.0%

In this study, Spectacles was provided to 94 (85.5%) of the study subjects who had diminished vision, of which 2 (11.1%) had amblyopia.16 (14.5%) were treated with both spectacles and patch, of which 16 (88.9%) had amblyopia.

DISCUSSION:

Amblyopia is one of the common causes of childhood visual impairment. Among them Children constitute 35-40% of the general population. Considering the fact that 30% of the people with low vision lose their sight before the age of 20 years, the importance of early detection and treatment of Amblyopia in children is mandatory. Therefore School going children, form an important large target group and school vision screening plays an important part in early detection of amblyopia and initiation of appropriate therapy, which is of immense value towards preventing the development of lifelong visual morbidity. Vision screening in children is recommended for detection of potentially treatable disorders which causes amblyopia in school children. [10-14]

According to Vision 2020, amblyopia is a major preventable and treatable cause of low vision in paediatric age group. If not treated early, paediatric amblyopia may result in monocular and binocular low vision with associated deterioration in Quality of Life indices in adulthood. According to World Health

Organization (WHO) uncorrected refractive errors among the leading causes of blindness and vision impairment worldwide and the most important risk factor for the development of amblyopia in pediatric age group. Amblyopia is a major health issue as it can lead to permanent visual impairment if not treated on time. [15] Hence measures for early identification and rehabilitation of amblyopia should be given a priority . This should be the hallmark of the blindness control programme in India . [16]

In the present study, out of 813 study subjects screened, 409 (50.3%) were males and 404 (49.7%) were females. The mean age of males and females screened was 10.37 ± 3.162 years and 10.47 ± 2.995 years respectively.

In our study, among the study subjects (n=110, 13.5%) who had diminished vision, amblyopia was found to be present in 18 (2.2%) and absent in 92(11.3%) respectively. p value is 0.494 which is statistically insignificant. So the, the prevalence of amblyopia in our study is 2.2%, which is consistent with international results of 1.6–3.6%. It is very comparable to regional developing countries like Saudi Arabia (1.85% in 6–12 years children) and Central China with nearly similar prevalence of severe amblyopia to ours (2.16% in primary school children). [17,18] It is quite similar to countries as Sweden where prevalence of amblyopia ($VA \leq 0.3$) is 2%, reduced to 0.2% after the treatment. [19]

It is also consistent with the Multi-ethnic pediatric eye disease study (MEPEDS) conducted on African-Americans and Hispanics, amblyopia was detected in 2.6% of Hispanic/Latino children and 1.5% of African American children. [20] In South-Asian region the Chinese studies showed prevalence rate which varies between 0.8% to 2.5% in different subsets of population done by Andrey Chia et al and Jing Fu et al. respectively. [21]

With respect to gender, in our study, percentage of amblyopia was more in females (18.9%) than males (14%). Which is consistent with the study conducted by, Seema Sharma et al found that prevalence of refractive error was 23.7% in girls and only 12.2% in boys. [22] Similar results were found by Tay MT et al in their study on young Singaporeans. They related this high prevalence to the higher rate of growth in girls and also because girls attain puberty earlier than boys. [23] Our results are also consistent with the study conducted by Valeria Mocanu et al Romania which shows 68.8% of the amblyopics in their study were girls. [24]

With respect to age of detection of Amblyopia in our study subjects who were screened, majority of the study subjects who were amblyopic belonged to the age of 14 years (33.3%), followed by 16.7% with age of 12 years, 11.1% each with 6, 10 and 13 years of age. Leon et al. in his study, showed that older children had increased risk of amblyopia as compared to younger children for moderate anisometropia. These studies emphasize the importance of early vision screening and improving treatment compliance as a result of timely intervention, meaning that the reduction in visual acuity caused by amblyopia can be completely or partially reversed. [25] And also Study conducted by Hussein et al., stated that age of six years or older at the onset of Amblyopia, observed that treatment was a risk factor for failure to achieve functional success. [26] Baltimore pediatric eye disease study (BPEDS) showed a slight increase in the prevalence of amblyopia with advancing age whereas a Singaporean Chinese study reported similar prevalence in different age groups. [27]

In our study, the most common refractive error found with amblyopia was hypermetropia which contributes about 33.3%, followed by astigmatism and myopia with strabismus (16.7%), myopia with astigmatism or strabismus (11.1%). Hence anisometropic amblyopia secondary to hypermetropia (55.6%) was more common in our study than anisometropic amblyopia due to myopia followed by meridional and strabismus type of amblyopia which contributes only 22.2% of study subjects. Which is consistent with study conducted by Sapkota.K.et.al [105] in Nepal and Mohammed A. Rashad et al Cairo, [28] Egypt The reason for development of amblyopia in anisometropia is a chronically blurred image in one or both eye prevents the normal development of visual acuity. Even after the anisometropia is optically corrected, anisokenia may be another amblyogenic factor for development of amblyopia in them. Severity and prevalence of amblyopia increases as the amount of anisometropia increases. [29] Hypermetropic patients with anisometropia of one Diopter difference may have amblyopia, while myopic anisometropic usually do not have amblyopia until anisometropia is large. [30] whereas in case of meridional amblyopia the mild

degree of astigmatism greater than 1.5 Diopter can be amblyogenic.

Our study shows slightly similar report as the, study done by Menon et al., amblyopia due to hypermetropia was highest (51.65%). Anisometropia amblyopia was second most common cause of amblyopia which is about 22.1% strabismus amblyopia being 37.38%, followed by ametropic amblyopia 12.88%, and meridional amblyopia was 5.56%. [31]

In our study 14 (77.77%) had unilateral amblyopia and 4 (22.22%) study subjects had bilateral amblyopia. Which is similar to the Study done in Nepal eye hospital by Kishore Sapkota et al (71% unilateral amblyopia) [11], in Andhra Pradesh by K Anjaneyulu et al., [31] and it is opposite to the study done by Menon et al., where 7% cases were bilateral [10] and study done by Chung et al., where (49%) amblyopia was bilateral. [32]

Amblyopia is graded as "Mild" amblyopia if the visual acuity being 6/9 to 6/12, "Moderate" amblyopia as visual acuity being worse than 6/12 to 6/36 and "Severe" amblyopia if visual acuity being worse than 6/36. [33] A higher percentage of mild amblyopia (61.1%) is seen when compared to the moderate amblyopia which is only 38.9% in our study, may be because higher percentage of anisometropic amblyopia was found when compared to meridional amblyopia and strabismic amblyopia.

In our study Spectacles was provided to 94 (85.5%) of the study subjects who had diminished vision, of which 2 (11.1%) had amblyopia. 16(14.5%) were treated with both spectacles and patch, of which 16(88.9%) had amblyopia.

A multicentric study by PEDIG, they found that augmenting the optical correction with part-time occlusion doubled the responder rate which is about 53% with occlusion 25% without occlusion and the response to treatment was seen irrespective of the severity of amblyopia. [34] According to Lee et al., who studied about the effect of part-time occlusion therapy in older children (29 eyes) aged 8-12 years beneficial effect of part-time occlusion therapy is seen nearly 96% of the amblyopic eyes. Visual improvement and occlusion time showed a significantly positive correlation. [35]

CONCLUSION:

In this study, the prevalence of amblyopia was 2.2%. Out of which Anisometric amblyopia (55.6%) and meridional amblyopia and strabismic amblyopia constitutes about 22.2% each. Uncorrected refractive error is the major cause of amblyopia and if it is not detected and corrected timely, can cause permanent visual morbidity. Lack of awareness and knowledge about amblyopia and its timely management leads to

late presentation and significant visual impairment especially in children.

Screening programmes in school going children helps to detect amblyogenic factors such as strabismus, ametropia and visual deprivation in children apart from already developed Amblyopia which helps us to prevent amblyopia and subsequent vision loss in future.

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