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ORIGINAL RESEARCH

Screening and Evaluation of Cases of Amblyopia in a Tertiary Eye Care Centre

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Abstract

Background: Amblyopia is maldevelopment of the visual cortex in the brain during infancy or early childhood that leads to decreased central vision in the affected eye. Any abnormality that leads to irregular visual stimulation can cause amblyopia, including strabismus, refractive error or sensory visual deprivation. Amblyopia causes more unilateral cases of reduced vision in childhood than all other causes combined, and it affects approximately 2-5% of all children

Aim: To evaluate the cases of amblyopia in tertiary eye care centre in Government Erode Medical College Hospital, Perundurai, Tamil Nadu, in the department of Ophthalmology.

Material and Method: The present prospective observational study was conducted in Government Erode Medical College hospital, Perundurai, Tamil Nadu in the department of Ophthalmology from July 2019 to June 2020. Eye examination was done using Binocular Red Reflex (Brückner) and Binocularity/Stereoacuity Testing. Visual acuity is routinely tested at distance (10 to 20 feet or 3 to 6 meters) and at near (14 to 16 inches or 35 to 40 centimeters). For each patient, amblyopia was classified as refractive, strabismic or deprivation amblyopia. The diagnosis of refractive amblyopia was made when hypermetropia was >4.00 D, myopia >6.00 D, and astigmatism >2.50 D with no related strabismus or ocular pathology.

Results: Prevalence of amblyopia was 2.43% in our study. Astigmatism was seen in 5 subjects (17.24%). Congenital cataract was the most common cause of deprivation amblyopia in 4 subjects. Binocular vision was absent in 19 (30.15%) subjects while 44 (69.85%) subjects had some grade of binocular vision.

Conclusion: Based on our results, we do recommend obligatory regular screening of school children and young adults using simple distance VA chart by well-trained health care providers.

Keywords: Amblyopia, Prevalence, Prevention.

Introduction

Amblyopia is maldevelopment of the visual cortex in the brain during infancy or early childhood that leads to decreased central vision in the affected eye. Any abnormality that leads to irregular visual stimulation can cause amblyopia, including strabismus, refractive error or sensory visual deprivation. Amblyopia causes more unilateral cases of reduced vision in childhood than all other causes combined, and it affects approximately 2-5% of all children[1,2].

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The pathology of amblyopia generally occurs by one of the two mechanisms. First, a blurred or incomplete image on the retina during the period of visual development (from birth until approximately 10 years of age) inhibits cortical activity in the brain, ultimately leading to underdevelopment of vision in the affected eye. Second, in the setting of strabismus, misaligned eyes prevent the child from developing fusion of the images from each eye, which leads the brain to suppress the image from the deviated eye so as to avoid diplopia, which in turn reduces the visual potential of that eye[3]. Amblyopia can lead to permanent loss of vision if timely corrective measures are not taken.

Previous estimates of the prevalence of amblyopia have ranged from 0.2% to 5.3% of the population. Rates have varied with the visual acuity criterion used and the age group of the population sampled. Most previous studies suffer from selection bias, because they have included clinic groups, preschool or school population samples with low response rates, or military populations. Eye clinic populations may overestimate amblyopia prevalence because only persons with referred or self-selected eye problems are included[4,5].

However, there have been limited studies elucidating the prevalence, cause, and magnitude of amblyopia; and less emphasis is given to amblyopia in the tertiary eye hospitals, with more attention toward cataracts and other ocular morbidities. In our study we enrolled cases with no selection bias, including both children and adult so as to screen and evaluate the cases of amblyopia in tertiary eye care centre in Government Erode Medical College Hospital, Perundurai, Tamil Nadu, in the department of Ophthalmology .

Material and methods

The present prospective observational study was conducted in Government Erode Medical College Hospital, Perundurai, Tamil Nadu, in the department of Ophthalmology from July 2019 to June 2020. Patients were enrolled in the study after obtaining written informed consent and approval from Institutional Ethical Committee. Patients of either sex and of age 0-40 years diagnosed as amblyopia were included in the study. Patients having any abnormality in anterior and posterior segment, history of strabismus surgery, history of trauma to eye and any pathology in neural pathway were excluded from the study.

Diagnostic Criteria

Diagnostic criteria used for analysis of amblyopia are presented in table 1.

Assessment	Finding
Unilateral Amblyopia	
Response to monocular occlusion	Asymmetric Objection
Fixation Preference	Failure to initiate or maintain fixation
Preferential looking	Interocular difference* of two or more octaves
Best corrected visual acuity	Interocular difference of two or more lines
Bilateral Amblyopia	
Best corrected visual acuity	Age 3 to ≤4 years: Visual acuity worse than 6/18 Age 4 to ≤5 years: Visual acuity worse than 6/12 Age >5 years: Visual acuity worse than 6/9

Table 1: Diagnostic criteria for amblyopia

*A 2-octave difference is a 4-card difference in the full set of Teller Acuity Cards Testing

Demographic data, including sex, date of birth, and identity of parent/care giver were recorded. The chief complaints and reason for the eye evaluation namely current eye problems, ocular history, prior eye problems, diseases, diagnoses, and treatments was noted. Family history of ocular conditions and relevant systemic conditions were also recorded.

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Eye examination was done using Binocular Red Reflex (Brückner) and Binocularity/Stereoacuity. Visual acuity is routinely tested at distance (10 to 20 feet or 3 to 6 meters) and at near (14 to 16 inches or 35 to 40 centimeters).
Determination of refractive errors is important in the diagnosis and treatment of amblyopia or strabismus. Patients underwent cycloplegic refraction with retinoscopy, followed by subjective refinement when possible. Adequate cycloplegia is necessary for accurate retinoscopy in children because of their increased accommodative tone compared with adults.
The optic disc, macula, retina, vessels, and the choroid were examined, using an indirect ophthalmoscope and condensing lens after adequate dilation is achieved.
For each patient, amblyopia was classified as refractive, strabismic or deprivation amblyopia[6]. The diagnosis of refractive amblyopia was made when hypermetropia was >4.00 D, myopia >6.00 D, and astigmatism >2.50 D with no related strabismus or ocular pathology. Strabismic amblyopia was defined as amblyopia in the presence of heterotropia at a distance and in the absence of refractive error meeting the criteria for aniso‑strabismic amblyopia[7]. In our study, we defined aniso‑strabismic amblyopia as amblyopia associated with either a heterotropia at a distance and/or near fixation and anisometropia, 1.00 D or more in spherical equivalent.

Statistical analysis
Data so collected was tabulated in an excel sheet and analysed using SPSS version 24.00 for windows (SPSS inc, Chicago, USA). Difference between two groups was determined using chi square test and the level of significance was set at $p < 0.05$.

Observation and results
Table 1: Prevalence of amblyopia

Variables	N	%
Total Screened	2589	100
Amblyopia Present	63	2.43

Out of 2589 patients screened, 63 cases were diagnosed with amblyopia. Therefore the prevalence of amblyopia was 2.43% in our study (table 1). Number of male subjects and female subjects in our study were 34 (53.97%) and 29 (46.03%) respectively.

Age Group (in years)	Unilateral		Bilateral		Total	
	N	%	N	%	N	%
<4	6	85.70	1	14.30	7	11.11
4-10	28	96.56	1	3.44	29	46.03
11-20	18	100	0	0	18	28.57
>20	9	100	0	0	9	14.28
Total	61	96.82	2	3.18	63	100
Chi Square	2.79					
p value	0.18					
	Male		Female		p value	
	N	%	N	%		
Unilateral	33	97.06	28	96.55	0.28	
Bilateral	1	2.94	1	3.45		
Total	34	100	29	100		

Table 2: Age and gender distribution of the amblyopic subjects

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Amblyopia was unilateral in 100% of subjects in 11-20 years and >20 years age group; 96.56% of subjects in 4-10 years age group and 85.70% of subjects in <4-year age group. Amblyopia was bilateral in 14.30% of subjects in <4-years age group and 3.44% of subjects in 4-10 years of age group. Amblyopia was unilateral in 97.06% of the male subjects and 96.55% of the female subjects. When unilateral and bilateral amblyopia was compared according to different age group and gender distribution, it was found to be statistically insignificant as p>0.05 (table 2).

Refractive Amblyopia	**N=29**	**%**
Hypermetropia	13	44.83
Myopia	3	10.35
Anisometropia	8	27.58
Astigmatism	5	17.24
Strabismic Amblyopia	**N=25**	**%**
Esotropia	16	64
Exotropia	8	32
Vertical deviation	1	4
Deprivation Amblyopia	**N=9**	**%**
Congenital Cataract	4	44.45
Ptosis	2	22.22
Retinoblastoma	1	11.11
Corneal Opacity	2	22.22

Table 3: Distribution of different types of refractive, strabismic and amblyopia

Maximum cases of amblyopia i.e. 29 (46.03%) were diagnosed as Refractive amblyopia. Minimum cases of amblyopia i.e. 9 (14.29%) were diagnosed as Deprivation amblyopia. Maximum cases of refractive amblyopia were seen in hypermetropes i.e., 13 subjects (44.83%) followed by anisometropes i.e. 8 subjects (27.58%). Astigmatism was seen in 5 subjects (17.24%). Maximum cases of strabismic amblyopia were diagnosed as esotopia in 16 (64%) subjects followed by exotropia in 8 subjects (32%) Congenital cataract was the most common cause of deprivation amblyopia in 4 subjects(44.45%) followed by ptosis and corneal opacity in 2 subjects each (22.22%) (Table 3).

	Hypermetropia		**Myopia**		**Anisometropia**		**Emmetropia**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Refractive Amblyopia	13	44.82	3	10.34	13	44.82	0	0
Strabismic Amblyopia	12	48	3	12	7	28	3	12
Deprivation Amblyopia	2	22.22	2	22.22	3	33.33	2	22.22
Total	27	42.86	8	12.70	23	36.50	5	7.94

Table 4: Distribution of refractive status in the amblyopic eye of the subjects

Overall Hypermetropia was found to be the most common refractive error in 27 subjects (42.86%) followed by anisometropia in 23 subjects (36.50%). Myopia was found in 8 subjects (12.70%) (Table 4). There was no significant co-relation present between the refractive status of the eye and the type of amblyopia.

	Binocular Vision Absent		**Binocular Vision Present**	
	N	**%**	**N**	**%**
Refractive Amblyopia	5	17.24	24	82.76

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Strabismic Amblyopia	7	28	18	72
Deprivation Amblyopia	7	77.77	2	22.23
Total	19	30.15	44	69.85

Table 5: Distribution of binocularity status of the amblyopic subjects

Binocular vision was absent in 19 (30.15%) subjects while 44 (69.85%) subjects had some grade of binocular vision (Table 5).

Discussion

Early detection of amblyopia is important for effective treatment; however, it can be still treated in older age. Recent evidences on successful treatment of amblyopia in children up to 12 years old have encouraged for more screening programs for older children also. This helps discovering undiagnosed amblyopes who have been missed in earlier screening programs or those living in countries with poor medical services and no screening programs[8]. Although the global prevalence of amblyopia is 1.6–3.6%[9], the available data concerning the prevalence of amblyopia in different geographical areas is still inadequate. There have, however, been limited studies where amblyopia has been the primary focus of attention with the establishment of the patient profile, age of presentation, and other demographic details. Therefore the present study was constructed to screen and evaluate the cases of amblyopia.

In our study 2589 patients were screened in the study period out of which 63 cases were diagnosed with amblyopia. Therefore the prevalence of amblyopia was 2.43% in our study. The prevalence of amblyopia in our study is consistent with global results of 1.6–3.6%. Damaris Magdalene et al[10] in their study revealed that the prevalence of amblyopia was 1.75% which is also consistent with our study.

Ambylopia was unilateral in 96.82% and bilateral in 3.18% of the subjects in our study. Vimla Menon et al[11] in their study found similar distribution of unilateral and bilateral amblyopia.

In our study maximum cases of amblyopia i.e., 29 (46.03%) were diagnosed in 4-10 years of age group. Vimla Menon et al[11] in their study revealed similar results too i.e. majority of patients presented between the ages of 4 and 10 years. Probable reason for such an occurrence can be due to the fact that most of the cases falling in this age group are school going and have more chances of being diagnosed with amblyopia due to reading difficulties.

Out of the 63 amblyopic subjects in our study maximum cases i.e., 29 (46.03%) were diagnosed as refractive amblyopia followed by strabismic amblyopia in 25 (39.68%) subjects and deprivation amblyopia in 9 (14.29%) subjects. In a study by Damaris Magdalene et al[10], 45.29% had refractive amblyopia, 40.36% had deprivation amblyopia and 14.35% had strabismic amblyopia with incidence of refractive amblyopia consistent to our study while deprivation amblyopia was found to be more than strabismic amblyopia which is inconsistent to our study. Also in contrast to our study, Menon V et al[11] found strabismus to be the most prevalent cause of amblyopia (62.22%). This could be because their study was conducted at squint and amblyopia clinic of the hospital where children with strabismus, that is, exotropia, esotropia, etc., tend to come more frequently than simple refractive errors whereas our study population comprised of all cases attending Ophthalmology OPD upto 40 years of age irrespective of their underlying pathology.

Overall, in different types of amblyopia, hypermetropia was found to be the most common refractive error in 27 subjects (42.86%) followed by anisometropia in 23 subjects (36.50%). Myopia was found in 8 subjects (12.70%) and 5 subjects (7.94%) had no underlying refractive error. There was no significant co-relation present between the refractive status of the eye and the type of amblyopia in our study. According to a study by Vimla Menon et al[11], there was no significant co-relation present between the refractive status of the eye and the type of amblyopia, which is similar to our study. These results are in accordance with study

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done by Valeria Mocanu et al[12] who reported that while analyzing the values of the refractive errors, a statistically significant difference for hypemetropia and astigmatism was found. These refractive errors were also identified as risk factors for amblyopia in the general population. In the Australian preschool children study, hyperopia was identified in 66.7% of the amblyopic preschool children and myopia was present in 7.4% of the children which is similar to results in our study, however incidence of anisometropia and astigmatism was inconsistent to our study[13].

Congenital cataract was the most common cause of deprivation amblyopia followed by ptosis as well as corneal opacity in our study. Binocular vision was absent in 19 (30.15%) subjects while 44 (69.85%) subjects had some grade of binocular vision in our study. in their study revealed that most of the cases of deprivation amblyopia were due to congenital cataract and had undergone cataract surgery in the past which is consistent to our study. Similar results were found by Damaris Magdalene et al[10] and Vimla Menon et al respectively in their study[11].

In our study, we enrolled cases with no selection bias, thus our study included both children and adult population unlike many studies which either were done on children or on adult population. This served as an advantage to our study. However limitations to our study were small sample size and a relatively shorter duration of study period (1 year). Population-based studies at a future date with no selection bias, larger sample size and longer duration period would thus be useful to further validate the mass education measures that can be taken up to prevent and treat this condition.

Conclusion

Early detection of amblyopia and institution of appropriate therapy is of immense value towards preventing the prevalence of life long visual morbidity. Therefore, the most important benefit from screening is the reduction of preventable visual loss. Based on our results, we do recommend obligatory regular screening of school children and young adults using simple distance VA chart by well-trained health care providers. Referral for consultation is mandatory if patients are having VA of 6/18 or worse in one or both eyes which cannot be adequately corrected by use of glasses. We hope this would help over the lack of awareness among parents and community and promote better quality of life.

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