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Key Words

Types of refractive error, amblyopia, children

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Received: 20 July 2024

Accepted: 10 September 2024

Published: 12 September 2024

Citation: Rajshekar and Aratis, 2024.
Types of Refractive Error Causing
Amblyopia in Children Aged 6-16
Years. Res. J. Med. Sci., 18: 620-623,
doi: 10.36478/makrjms.2024.8.
620.623

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Types of Refractive Error Causing Amblyopia in Children Aged 6-16 Years

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ABSTRACT

In children amblyopia is the most common cause of visual impairment, it often persists in adulthood. The prevalence in childhood is estimated to be 1-4%. In Adults prevalence of amblyopia was found to be 2.9% in one study, indicating need for early detection and treatment. A prospective observational study was conducted between 6-16 years visiting to our outpatient department with defective vision. Detailed history about present and past ocular problems, history of any medical or surgical treatment and family history were taken. A standard examination procedure was used for each study subject. Among them Refractive amblyopia was the most common type of amblyopia out of which anisometropic amblyopia accounted for 44%, ametropic 24%, Strabismic 12%, Meridional 10%, Visual deprivation 8% and Combined 2%. Unilateral amblyopia was observed in 63% of the amblyopic children and the right eye was more commonly affected than the left eye. All the types of amblyopia were more common within the age group of 11-16 years in our study. Amblyopia is a major preventable and treatable cause of low vision in children and being the major cause of monocular or bilateral low vision in adulthood.

INTRODUCTION

At birth, the visual system is not mature and visual acuity is around 20/400. Visual acuity gradually improves and at first month of life stereopsis develops. During the first two years of life optic nerves Myelination, visual cortex development and lateral geniculate body growth noted^[1].

At 4 years of age fovea matures as it is the most visually sensitive part of the retina. For the development of normal vision visual stimuli are very necessary. When brain receives a clear, focused image from both eyes it leads to proper development of visual pathways in central nervous system. During development of visual pathway in the brain anything that interferes or inhibit its process may leads to amblyopia^[2].

The critical period is the period during the maturation of visual system because at this time visual system is affected by external affairs. During the 1st 3 years of life most of the visual system maturation occurs, although some plasticity will be there between 3 and 8 years of life, or even longer to some degree.

There are three critical phases in the development of visual acuity and amblyopia, The phase of development of visual acuity (from birth to 3 or 5 years of age)-The phase during which interference may cause amblyopia (from birth to 7 or 8 years of age)-The phase during which recovery is predictable from amblyopia (from the time of deprivation to adolescence or possibly young adulthood)^[3].

Our two eyes receive largely overlapping images on their retinal surfaces because our eyes view the world simultaneously from slightly different angles.

By the process of fusion dissimilar images arising in each eye is appreciated as a single image and this depends on clear visual axes with good visual acuity in both eye, the ability of visual cortex to appropriately combine the slightly dissimilar monocular inputs (sensory fusion), and the requirement of coordination of two eyes for all directions of gazes, so that corresponding points on the two retinas are aligned (motor fusion)^[4].

Our visual cortex in addition to binocular single vision has the ability to disambiguate the minute dissimilarities from the pair of two dimensional retinal images and reconstruct the third dimension (stereopsis)^[5].

When two eyes has significantly different inputs in-terms of focus (anisometropia) or visual direction (strabismus) then there is no possibility of sensory fusion and the visual cortex relies on interocular suppression to block the discordant input from one eye. Amblyopia is a manifestation of this binocular barrier to normal growth of the central visual pathways^[6].

Research conducted for both anisometropic and strabismic amblyopia have shown a linear relationship

between severity of amblyopia and percentage of binocularly suppressive neurons in the visual cortical areas V1 and v2.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Subjects: Children aged between 6-16 year visiting to hospital with complaint of defective vision.

Inclusion Criteria:

- Children aged between 6-16 years.S

Exclusion Criteria:

- Children who were allergic to any composition in 1% cyclopentolate or 1% homatropine solution.
- Children aged <6 years and >16 years.

(Retrospectively per month on average 8-10 patients with defective vision having amblyopia visit tertiary care hospital. After exclusion and inclusion criteria we take a sample size of 100).

Study Analysis: Data were entered in MS Excel and analysed in SPSS v20. Continuous variables were summarised as mean or median with standard deviation (SD) or interquartile range (IQR). Categorical variables were expressed as percentages with 95% confidence interval (95% CI). T test was used to test the statistical significance of difference between the groups in continuous variables. Chi square test was used test the statistical significance of deference in distribution of categorical variables.

Amblyopia was Defined as: A difference in the best corrected visual acuity (BCVA) between the two eyes of two or more Snellen lines. A best corrected visual acuity of less than or equal to 6/12 bilaterally on the Snellen's chart.

Standard definitions of different subtypes of amblyopia were used for diagnosis.

Written informed consent will be taken from the study subjects or from their parents or guardians for further investigations and procedures. After explaining to them the plan and intention of the study in their best language known to them.

In our outpatient department, a standard examination procedure was used for each study subject. Detailed history about present and past ocular problems and treatment, history of any medical or surgical treatment, and family history were taken.

Collection of data is by visual tests for both near and distant vision, clinical examination of both anterior and posterior segments of the eye by slit lamp examination, fundoscopy, keratometry and A-scan biometry will be conducted. Children are then taken up to assess the refractive error under the cycloplegic effect of 1% homatropine bromide for 6-8 years and

1% cyclopentolate for 8-16 years of age, by streak retinoscopy. The appropriate glasses are prescribed after 3 days of post mydriatic test. The data thus collected is analyzed. Uncorrected refractive errors are also recorded.

RESULTS AND DISCUSSIONS

Table 1: Affected Eye in Amblyopic Children

Effected Eye	Male	Female	No. (%)
RE			33
LE			30
BE			37
Total	45	55	100

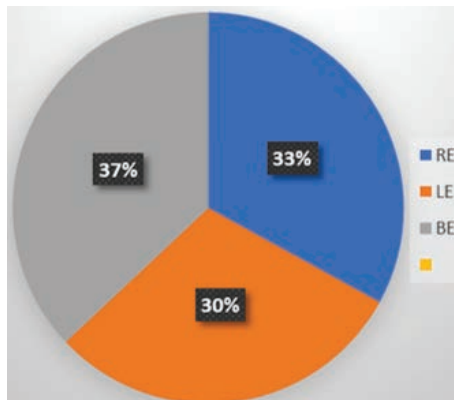


Chart 1: Affected eye in amblyopic children

Table2: Age Wise Distribution of Amblyopia

Age (In years)	No. of children (%)
6	3 (3.0)
7	3 (3%)
8	7 (7%)
9	7 (7%)
10	13 (13%)
11	10 (10%)
12	13 (13%)
13	7 (7%)
14	8 (8%)
15	10 (10%)
16	19 (19%)
Total	100 (100%)

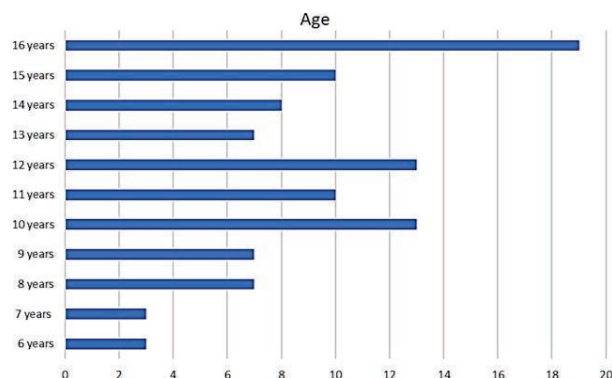


Chart 2: Age wise distribution of amblyopia

Table3: Types of Refractive Error Causing Amblyopia

Refractive Error Type	Number of children affected (%)
Myopia	25
Hypermetropia	46
Myopic astigmatism	24
Hypermetropic astigmatism	5
Total	100

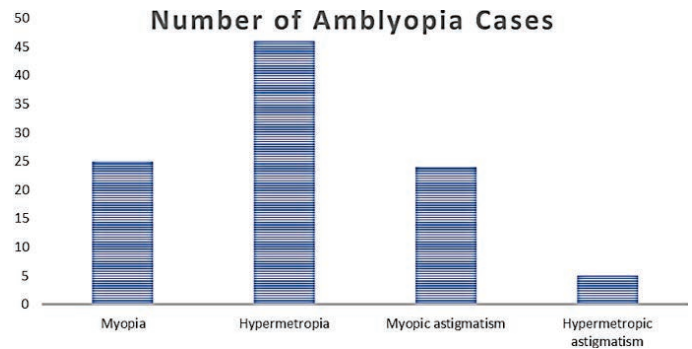


Chart 3: Type of Refractive error causing amblyopia

In the present study, the mean age was 12.11 ± 2.93 years with age ranging from 6-16 years and was found that 67% of children were between 11-16 years age group and 33% were 6-10 years. In contrast to another study conducted by Alarepe A T *et al.*, reported that mean age of presentation was 9.2 ± 2.8 years with age ranging from 4-16 years^[7], Magdalene D *et al.*, reported that maximum number of patients were found in the age group of 11-16 (63.58%)^[8] and Aldebasi Y H the prevalence of amblyopia was statistically higher in the older age group (10-13 year) compared to younger age group (6-9 years)^[9].

In our study we found that there is gender discrepancy with male (59%) predominance similar findings were reported by Ikuomenisan S J *et al.*, Magdalene D *et al.*, and Marthala H *et al.*, But in other studies like Alarepe A T *et al.*, reported that there were more female children and Aldebasi Y H reported that there was no statistical difference in gender for amblyopes ($P > 0.05$)^[9].

In our study we noticed that right eye (33%) was commonly affected when compared to left eye (30%) and unilateral amblyopia (63%) found to be more common than bilateral amblyopia (37%), which was similar to studies conducted by Ikuomenisan S J *et al.*, Marthala *et al* and Aldebasi^[9-10].

In our study 79% of children were orthophoric followed by 15% with esotropia, 2% of exotropia and alternate esotropia and 1% each alternate exotropia and hypertropia. Marthala H *et al.*, reported that Esotropia of 33.12%, Exotropia 21.87% and orthotropia in 45% of cases^[10].

In our study maximum number of children presented to the hospital with defective vision ranging from 6/18 to 6/60 and after correction maximum number were found to be better than 6/18 which was similar to another study conducted by Marthala^[10].

In our study hypermetropia (46%) was found to be the most common refractive error followed by myopia (25%), myopic astigmatism (24%) and hypermetropic astigmatism (5%). In contrast to another study conducted by Marthala H *et al.*, the most common

refractive error was found to be hyperopic accounting about 37.50%, Hyperopic astigmatism 25%, Myopia 1.87% and Myopic astigmatism 35.62%^[10].

CONCLUSION

In our study hypermetropia (46%) was found to be the most common refractive error followed by myopia (25%), myopic astigmatism (24%) and hypermetropic astigmatism (5%).

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