

A STUDY OF AMBLYOPIA IN 18-19 YEAR OLD MALES

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ABSTRACT

During a vision screening of 6,556 National Service pre-enlistees aged 18-19 years at the Medical Classification Centre of Central Manpower Base, 48 subjects were found to have visual acuity of 6/12 or less in one or both eyes in the absence of ocular pathology. The prevalence of amblyopia in this population is 0.73%. Amblyopia was due to anisometropia in 24 cases (50%), strabismus in 9 cases (18.7%), high astigmatism (meridional) in 7 cases (14.5%) and other causes or a combination of factors in 8 cases (16.7%). Strabismic amblyopia is most commonly associated with esotropia. There is a positive association between the severity of amblyopia and the degree of strabismus in strabismic amblyopes. Meridional amblyopia tends to be less severe than most other types of amblyopia. The amblyopes were detected late (average 7-10 years of age) and orthoptic treatment of a small minority of them upon diagnosis was unsuccessful.

Keywords : Anisotropic amblyopia, strabismic amblyopia, meridional amblyopia, esotropia, hypermetropia

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INTRODUCTION

Amblyopia is the commonest visual disability of childhood. The condition is potentially reversible if it is detected and treated early, during the sensitive period of development of the visual system which extends from birth to about the seventh year.

This study involves all National Service pre-enlistees aged 18-19 years who were seen at the Medical Classification Centre of Central Manpower Base over a period of 4 1/2 months from 1989 to 1990. The main objectives of the study were:

1. To determine the prevalence and frequency of various types of amblyopia.
2. To find out the age of detection of amblyopia.
3. To investigate the relation between the degree of amblyopia and the severity of the amblyopiogenic factor.

MATERIALS AND METHODS

Amblyopia is defined as reduced visual acuity despite refractive correction in the absence of detectable anatomic defect in the

eye. Nystagmus and other ocular diseases such as cataract or corneal opacity are excluded from the definition.

In this study, reduced visual acuity is taken as 6/12 or poorer vision, the reason being that 6/12 Snellen acuity of the master eye is considered a significant visual impairment that can affect a soldier's combat performance, especially in shooting.

The various types of amblyopia are categorised as follows:

1. Anisometric amblyopia - the refractive error of the 2 eyes differed by more than 2.5 D.S. and no other amblyopiogenic factor is present.
2. Strabismic amblyopia - that associated with strabismus and no other amblyopiogenic factor.
3. Meridional amblyopia - that associated with high astigmatism in the absence of any other amblyopiogenic factor. High astigmatism is defined in the Singapore Armed Forces as a cylindrical error of -2.25 D.C. or more.
4. Combination - this category includes all cases of amblyopia where more than one amblyopiogenic factor was found and none appears to be the main factor e.g. anisometropia with strabismus, high astigmatism with strabismus etc.
5. Others - this comprise one case of bilateral ametropic amblyopia and one case of right strabismic/left ametropic amblyopia.

All pre-enlistees (total 6,556) who were seen at the Medical Classification Centre of Central Manpower Base over a period of 4 1/2 months from 1989 to 1990 were screened. This eliminated bias or errors in sampling as can occur in studies either relying on voluntary registration or based on a select group of individuals. All male pre-enlistees with visual acuity of 6/12 or less had the following history taken followed by a full ophthalmic examination.

Points in History:

1. Age of diagnosis of poor vision or 'lazy eye'
2. Type of treatment, if any, received
3. History of eye injury, squint or ptosis operation
4. Family history of poor vision or 'lazy eye'

Ocular Examination:

1. Unaided Snellen acuity
2. Refraction and best corrected Snellen acuity
3. Examination for relative afferent pupillary defect

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4. Fundoscopy and slit-lamp examination
5. Examination for amblyopiagenic factors e.g. ptosis, cover/uncover test for squint
6. Measurement of angle of squint, if present, using prism cover test
7. Placodisc test for keratoconus if astigmatism exceeds 2.25 D.C.

RESULTS AND OBSERVATIONS

Out of a population of 6,556 National Service pre-enlistees, 48 subjects were found to have visual acuity of 6/12 or less in one or both eyes in the absence of ocular pathology. The prevalence of amblyopia in the study population is 0.73%.

The frequency distribution of the various types of amblyopia seen in this population is shown in Table I. Anisometropic amblyopia is the commonest, accounting for half the cases of amblyopia. An analysis of all 17-19 years old National Service pre-enlistees with amblyopia over the past 12 years from computerised data revealed a comparable figure of 46.25% for the percentage of anisometropic amblyopes. 75% of anisometropic amblyopia were found in myopic eyes and 25% in hypermetropic eyes.

Table I - Frequency Distribution of Amblyopia

Amblyopia	No.	Percentage
Anisometropic	24	50.0
Strabismic	9	18.7
Meridional	7	14.6
Combination +	6	12.5
Others *	2	4.2
Total	48	100

+ Combination - This comprises:

- 4 cases of anisometropic/meridional amblyopia
- 1 case of strabismic/meridional amblyopia
- 1 case of anisometropic/strabismic amblyopia

* Others - This comprises:

- 1 case of bilateral ametropic amblyopia
- 1 case of right strabismic/left ametropic amblyopia

In subjects with anisometropic amblyopia, the affected eye may either be myopic or hypermetropic. For the same degree of impairment in Snellen visual acuity, a comparison was made between the average amount of anisometropia in those subjects whose amblyopic eye was myopic and those whose affected eye was hypermetropic. This is shown in Table II. The results

Table II - Anisometropic Amblyopia. A Comparison (between Myopic and Hypermetropic Individuals) of the Average Amount of Anisometropia Associated with the Same Degree of Visual Acuity Impairment

Best Corrected Visual Acuity	Average Difference in Spherical Refractive Error (Anisometropia) Between Amblyopic & Non-Amblyopic Eye in the Same Individual - D.S.	
	Myopia	Hypermetropia
6/18	6	4.75
6/60	10.5	5.50

N.B. There were no cases of hypermetropia with corrected visual acuity of 6/12, 6/24 or 6/36 in the amblyopic eye.

agree with the known fact that the amount of anisometropia associated with a given degree of amblyopia is less for hypermetropic eyes compared to myopic ones.

The racial composition of the study population and the prevalence of amblyopia in each race is shown in Table III. Table IV shows the percentage distribution of the various types of amblyopia in each race. The most common type of amblyopia in Chinese and Malays is anisometropic amblyopia. There was no case of meridional amblyopia in the Malays in our study population.

Table III - Racial Composition of Study Population and Prevalence of Amblyopia in Each Race

Race	% of Study Population	Prevalence of Amblyopia (% of Each Race)
Chinese	79.6	0.67
Malay	9.2	1.42
Indian	5.2	0.56
Other Races	6.0	-
All Races	100	0.73

Table IV - Classification of Amblyopia and its Racial Distribution (Results Expressed as a Percentage of the Total Number of Amblyopia in the Race)

Amblyopia	Race					
	Chinese		Malay		Indian	
	No.	%	No.	%	No.	%
Anisometropic	18	48.6	6	67	-	-
Meridional	6	16.2	-	-	1	50
Strabismic	5	13.5	3	33	1	50
Others	8	21.6	-	-	-	-
Total	37	100	9	100	2	100

Strabismic and meridional amblyopia was the predominant type of amblyopia in Indians compared to Chinese or Malays. However the number of Indian amblyopes in the study population is too small to support this observation. Further study is needed.

In strabismic amblyopes, larger squints were associated with poorer vision (see Table V). 67% of strabismic amblyopes had esotropia.

Table V - Comparison of the Best Corrected Visual Acuity with the Angle of Squint in Strabismic Amblyopes

Visual Acuity	6/12	6/18	6/24	6/36	6/60
Angle of Squint (Prism Dioptres)	10	15	12	20	50

Table VI shows the percentages of the various degrees of amblyopia measured by Snellen acuity for each of the 3 main types of amblyopia. Severe amblyopia (6/24 or less) is associated with 67% of anisometropic amblyopes, 67% of strabismic amblyopes and only 14.2% of meridional amblyopes.

The age of detection of amblyopia in these pre-enlistees is presented in Table VII. The various types of amblyopia were most commonly diagnosed during lower primary school age i.e. 7-10 years and the vast majority of these amblyopes were

Table VI - Snellen Visual Acuity of 48 Amblyopic Subjects According to Type of Amblyopia. Results Expressed as a Percentage of the Total Number of Subjects in Each Type of Amblyopia

Best Corrected Visual Acuity	Amblyopia		
	Anisometropic	Strabismic	Meridional
6/12	4	22.2	71.4
6/18	29	11.1	14.2
6/24	21	11.1	-
6/36	12.5	11.1	14.2
6/60	21	44.4	-
< 6/60	12.5	-	-
Total	100%	100%	100%

Table VII - Age of Detection of Amblyopia Vs Type of Amblyopia

Age of Detection (year)	Amblyopia (% of each type)				
	All Type	Anisometropic	Meridional	Strabismic	Ametropic
5 - 6	4	4	-	10	
7 - 8	35	40	33.3	10	100 (1 case)
9 - 10	34	28	33.3	50	
11 - 12	17	16	16.6	30	
13 - 14	6	8	16.6	-	
Not Detected Before	4	4	-	-	
Total	100%	100%	100%	100%	

detected during routine vision screening provided by the School Health Service. Only 2 cases (4%) were detected during the pre-school age i.e. before 7 years.

Only 4 subjects (8% of amblyopes) had treatment for amblyopia. 2 subjects with strabismic amblyopia and 1 subject with anisometropic amblyopia had occlusion therapy for 1-2 years up to the age of 8 years. The fourth subject who has strabismic/meridional amblyopia was followed up by a private ophthalmologist and had monthly CAM vision stimulation for 2 years till the age of 8 years. Amblyopia was diagnosed late in all the 4 subjects, at the age of 6-7 years, and treatment over a period of 1-2 years was unsuccessful in restoring normal visual acuity to the amblyopic eye.

DISCUSSION

Amblyopia is a relatively common disorder. Its prevalence in various studies ranges from 2-5%, depending on the diagnostic criterion: the poorer the visual acuity criteria selected, the lower the prevalence of amblyopia.

Refractive amblyopia is more common than other forms of amblyopia in Singapore. This is in contrast to the findings of Shaw et al in their study of amblyopia seen in the ophthalmic clinics of Leicestershire⁽¹⁾ in 1981. In that study, amblyopia was judged to be due to: strabismus alone in 45% cases, strabismus and anisometropia combined in 35% cases, anisometropia alone in 17% cases, and form deprivation (the consequence of defective light or form input as in cataract or corneal scarring) in the remaining 3%. The main reason for our higher frequency of refractive amblyopia is that there are more cases of high myopia in our Oriental race compared to the Caucasians. Although hypermetropia is more common in Caucasians and is more amblyopiagenic than myopia, a point

that will be discussed later, the exceedingly high prevalence of myopia in our Oriental race, which far exceeds that of hypermetropia and myopia in Caucasians, would account for the higher incidence of refractive amblyopia locally. The higher frequency of refractive amblyopia in our population may also be due to the differences in detection of poor vision in a nonselective screening process such as our study versus a referral or selected study i.e. the squint brings the amblyope for treatment while the normal appearing but visually defective patient goes unnoticed until he is detected in routine screening such as in this study. Furthermore convergent strabismus is less common among Asians than among Caucasians. This may account for our finding of a lower prevalence of strabismic amblyopia among Asians compared to the study by Shaw et al, since convergent strabismus is more prone to cause amblyopia than is the divergent type which is more common in Asians.

The predominance of myopia over hypermetropia in eyes with anisometropic amblyopia is related to the fact that our population has a much higher prevalence of myopia than hypermetropia. In actual fact anisometropic amblyopia is more common in hypermetropes with anisometropia than in anisometropic myopes⁽²⁾. This is because myopic eyes can perceive objects sharply when it is placed at some finite distance, unlike an eye which is more hypermetropic than its fellow eye. A greater amount of accommodation is necessary to obtain a sharp retinal image in the more hypermetropic eye. This does not occur in children who instead accommodate appropriately only for the less hypermetropic eye. The fellow eye does not see clearly at all object distances and thus develops amblyopia. A corollary of this which our observations support is that the amount of anisometropia that causes a given degree of amblyopia may be smaller in a hypermetropic eye than in a myopic one. It must however be noted that in anisometropic amblyopia, the magnitude of anisometropia may not be static but may change as the child grows, due to a difference in the growth rates of the two eyes. Thus the range of anisometropia observed in the study may not reflect the actual situation during the susceptible period of visual system development in these subjects i.e. the observed anisometropia may be more or less than that which triggered off the onset of amblyopia.

Meridional amblyopia was found to be less in severity compared to anisometropic or strabismic amblyopia. However its existence is a strong argument for prescribing glasses early in life to children with high degrees of astigmatism.

In the child with strabismus, the two foveae receive dissimilar images. The young patient pathologically suppresses the image in the deviating eye to avoid diplopia (seeing the object in two different locations) and visual confusion (seeing two different objects in the same location). As diplopia should be more severe the larger the squint, one would expect more visual suppression in eyes with larger squints. This may account for the positive correlation between the degree of amblyopia and the angle of squint.

Only 33% of strabismic amblyopia in this study population are due to exotropia despite the fact that exotropia is more common than esotropia in Asians. This supports the view that divergent strabismus is less prone to cause amblyopia than is the convergent type.

In amblyopia with both anisometropia and strabismus, anisometropia could have been the primary event that caused amblyopia as a poorly seeing eye often deviates because it is only the fusion mechanism (impaired in anisometropia) that keeps the eyes aligned. Thus uncorrected anisometropia may lead to secondary strabismus. Long-standing strabismus also may lead to anisometropia. This observation was made by Lepard in a study⁽³⁾ which found that eyes with normal visual acuity become progressively more myopic with growth and

development until 25 years of age whereas contralateral eyes with impaired acuity due to strabismic amblyopia show no significant change in the average refractive error during the same period.

The vast majority of the amblyopes in the study were diagnosed late, at the age of 7 years or later. Treatment started at the age of 6-7 years was unsuccessful. Although there is no well-established age beyond which amblyopic treatment is ineffective, up to the age of 7 years chances of rapid and complete restoration of vision are good. As a child grows older, reversal of amblyopia becomes increasingly difficult⁽⁴⁾.

Moreover compliance to occlusion therapy is more easily enforced on infants than on toddlers and older children. Hence the younger the patient, the better would be the response to treatment. This underscores the importance in any primary health care service of a good and comprehensive eye screening programme for early detection and treatment of amblyopia.

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