**Original Article**

# Prevalence of amblyopia and strabismus in anisometropic patients

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**Abstract**

**Objective:** To find out the prevalence of amblyopia and strabismus in anisometropic patients.
**Study design:** It is a descriptive cross sectional hospital based study.
**Place and duration of study:** An Eight-month study was carried out in Ophthalmology department of Holy Family Hospital, Rawalpindi . (from Aprill 2022 to December 2022)
**Material and Methods:** Sixty patients were studied during the research duration and consecutive sampling technique is followed to collect the sample. Detailed history and examination of patients was done starting from Slit lamp examination followed by assessment of visual acuity, refraction and Fundus examination. Orthoptics assessment was done to the patients who were presented with complaint of deviation.
**Results:** Out of all the anisometropic patients more than two third were amblyopic. As per data 60 were total patients 46 were amblyopic. Total 09 patients were presented with the Strabismus out of which 07 had esotropia and 02 had Exotropia.12 patients were presented with just the asthenopic symptoms that were corrected with the correction as their visual status reached to the 6/6.
**Conclusion:** Most commonly anisometropia is associated with the amblyopia and then strabismus. It is more common in females and most commonly affected age groups is 16-25 and then 06-15. There is less prevalence of strabismus because mostly patients are orthophoric.
**Keywords:** Anisometropia, Refractive Error, Amblyopia, Strabismus.

## 1. Introduction

Anisometropia is characterized as an asymmetry in the refractive status of individual's both eyes.[1] It can appear in any manner; one eye might be emmetropic and other is ametropic or the both eyes might be ametropic of different values. At the point when difference between refractive status of two eyes is 1D, then retinal size will be vary by the 2% and individuals can tolerate around 5% difference in the refractive status of both eyes that is 2.5D, and above from this relies on patients ability.[2]

Causes of anisometropia include uneven growth of both eyes because axial length of eye balls differ in magnitude. There is positive correlation between the degree of anisometropia and the asymmetry between axial length of two eyes.[3] It has been seen that larger anisometropic refractive errors occur when the vision disruption occurs within the period of most rapid eye growth (up to 3 years of age). Other causes include miscalculation of intraocular lens power during cataract Surgery,[4] trauma to the eye, and retinopathy of prematurity. Retinopathy of prematurity (ROP) is associated with a higher prevalence of anisometropia and more severe anisometropia.[5]

Anisometropia can results in the diplopia. Patient with anisometropia will see blurred image with one eye as compared to the other. Patient may also notice smaller image with one eye and larger image with the other. Other symptoms that the patient will see may include eyestrain, poor depth perception, headache, nausea, light sensitivity, tiredness and dizziness.

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Anisometropia has two basic types one is axial anisometropia and other one is refractive anisometropia. Axial anisometropia is due to difference in axial length between two eyes and Refractive anisometropia is the difference between dioptric power of two eyes. On the basis of types of refractive error, Anisometropia is further classified as simple anisometropa, compound anisometropia and mixed anisometropia. Simple anisometropia is the condition in which one eye is emmetropic and other is ammetropic. On the basis of ametropic eye simple anisometropia divided into Simple Myopic Anisometropia or Simple Hypermetropic Anisometropia. Compound Anisometropia in which both eyes are myopic or hypermetropic but of different values, and this is further subdivided into Compound Myopic or Compound Hyperopic Anisometropia. Mixed Anisometropia which is also called antimetropia, is the condition in which one eye is myopic and other is hypermetropic. And when classification made on the presence of astigmatism, anisometropia is further divided into simple astigmaic anisometropia, compound astigmatic anisometropia and mixed astigmatic anisometropia.

Anisometropia can leads to the disruption in Binocular single vision ( BSV) if it remains untreated in the lon run. Binocular Single Vision is the ability of both eyes to contributes to the simultaneous perception, so that single image formed on retina. Grades of Binocular Single vision are; Simultaneous perception: in this grade object is perceived at the same time by the both eyes, Fusion: when two retinal images gather to form a single image and Stereopsis: is the peak stage where fused images with slight horizontal disparity gives three dimensional image. Normally BSV is present in patients with low anisometropia but if it remains untreated and increase to higher level, it can affect fusion, produce amblyopia and strabismus.[6] Anisometropia is the leading causative agent in the development of amblyopia and strabismus in childhood.[7] Amblyopia is defined as a unilateral or sometime bilateral decrease in visual acuity after best possible correction even when there is no deformity in eye structure and visual pathway is present. Anisometropia causes amblyopia in a way that, when visual power of eyes varies, size and form of image falling on retina also changes. And when significant error continuously occurs, it causes the blur image on retina, that results into the amblyopia. Prevalence of amblyopia shows that, anisometropic amblyopia is 24-37% of all the amblyopias.[8] Severe anisometropias (3 or more D) are more prone to persist in preschool age.[9] Different studies shows that prevalence of amblyopia is higher in the anisohyperopes as compared anisomyopes.[10] Hyperopic anisometropia of only 1-2 degree can cause amblyopia whereas myopic anisometropia of 3D usually does not cause amblyopia. This might be due to the earlier development of unilateral blur in the presence of hyperopic anisometropia, with a higher impact on the visual cortex maturation than in myopic anisometropia.[11]

Examination of Amblyopic eye shows that it cannot be improved to the 6/6. Pinhole test shows no improvement. There is difference of 2 or more Snellen lines between vision of two eyes. Amblyopia is not a simple phenomenon, with the loss of Snellen acuity there is also loss of contrast sensitivity of stimulus,[12] stimulus shape distortion, uncertainity in position of stimulus and also increase in magnitude of crowding phenomenon.[13]

Strabismus is the misalignment of visual axes of two eyes. Image of one eye projected on retina whereas other form on extra foveal region which results in diplopia. And children that have strabismus avoid this phenomenon by suppressing the image of deviating eye, this results in defective binocular single vision. One of the prior reasons of concomitant strabismus is the high refractive error. Hyperopia and Astigmatism usually associated with the convergent squint, whereas myopia have association with the divergent squint. Both of the conditions amblyopia and strabismus occurs with the anisometropia, but this does not mean every anisometropic patient will present with these conditions. In high anisometropia, One eye that have high refractive error, see blur image than the other eye, as a result this eye starts to suppress its image. This abnormal visual experience disrupts the interocular alignment resulting in strabismus by interfering with the sensory development.

Anisometropia mostly associated with amblyopia. And different studies shows that this anisometropic amblyopia is commonly associated with strabismus.[14] Out of all human population 1-3% have amblyopia and about one half to two thirds of amlyopic persons have anisometropia alone or with the combination of strabismus.[15] From all types of anisometropias,

hyperopic anisometropia have significant risk for the amblyopia and increasing the severity of strabismus.[16] Different studies shows that hyperopia of 1-2D, if not corrected early in life will cause amblyopia and convergent squint (accomodative esotropia ).[17] Due to the high prevalence of hyperopia as compared to the myopia, this is demonstrated that, when strabismus will associated with anisometropia, it will usually convergent and found in anisohyperopes rather than in anisomyopes.[18] Different studies shows that anisometropia have direct relationship with the amblyopia and strabismus, so as anisometropia increases, amblyopia and degree of concomitant strabismus increases as well.[19] When we compare the association of the amblyopia and strabismus with the anisometropic patients, amblyopia and anisometropia are most frequently associated. Various studies show that Anisometropic amblyopia is almost twice as frequent as the strabismic amblyopia.

Treatment of Ansometropia and its association, involves correcting the refractive error by wearing glasses, treating the lazy eye (amblyopia) and squint surgery to correct the appearance of squinted eye and vision problem by restoring the binocular vision. First step should always be the correction of refractive error. Because if refractive error would be the cause of amblyopia and strabismus, then full refractive correction will give beneficial results to the patients. For example in most of cases if hypermetropia causing squint, glasses usually correct it. In case of high anisometropia, if patient wear spectacles, these can cause aniseikonia and BSV will be disturbed. Also patients will experience asthenopic symptoms such as strain and headache. However we can make aniseikonic spectacle to compensate this situation. Contact lenses are also the option for such patients, because these lenses not minify or magnify images too much, that's why these are the better options.

Then treat amblyopia by patching good eye. The main objective of patching is to restrict the use of good eye, in order to force the lazy eye to work. If this is done in early childhood, the vision will improve, often to the normal level. The length of treatment with an eye patch varies with the age of the child and the severity of the amblyopia.[21] The patch may be worn for a few hours a week or for most of the day. Treatment is continued until either the vision is normal or until no further improvement is found. Child should be followed up to make sure that treated eye is still being improved or become amblyopic again. One of the problems with patching vision for amblyopia is that children either don't want to wear the patch, or don't wear it enough for it to be effective. For this purpose, vision therapy included playing games with the child is encouraged so that affected eye work more. To help this condition various special spectacles are also made that encourage children to use the lazy eye. For example, LCD shutter glasses which give a blurred image to the strong eye and clear image to the weak eye and then children are asked to watch a 3D movie wearing the glasses for one hour per day. It helps the patient to enhance brain-eye coordination and increases muscles control to improve focus. By using this type of methodologies children can be tackled and their vision can be improved. Surgical options advised to the patients to improve the appearance of eyes by straighten them. It can also restore binocularity. It involves tightening, loosening or moving one or more of the eye muscles. This is the procedure that requires expertise, time and knowledge.

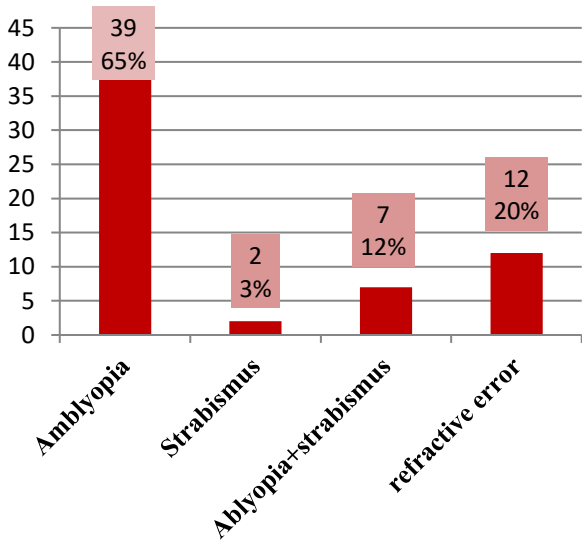
## 2. Materials & Methods

Descriptive cross-sectional hospital based study of 09 months duration was conducted from 01st of Aprill 2022 to the 20th of December 2022. Out of 24,618 patients from eye OPD of Holy Family Hospital Rawalpindi 9269 were referred to refraction room. Considering time availability sample size was 60 patients of anisometropia who were symptomatic and consecutive sampling technique is followed to collect the sample.The data of anisometropic patients who were exposed to diagnostic criteria was obtained on specially designed proformas. Detailed history and examination of patients was done starting from Slit lamp examination followed by assessment of visual acuity, refraction and Fundus examination. Orthoptics assessment was done to the patients who were presented with complaint of deviation. Patients of both gender which include chidren, teenagers and adults were included, especially the patients who presented with the decreased vision in one eye, deviation in eyes and asthenopic symptoms were studied. And the patients who excluded from the study were those who were non cooperative and did not willing to be part of research study. And also those who presented with the significant pathology such as DR, keratitis, cataract, corneal dystrophy etc.

## 3. Results

Result of my study in fig:I gave the comparative association of all the consequences in anisometropic patients. I found that most commonly, anisometropia results in the Amblyopia as 39 out of 60 anisometropic patients were amblyopic that is 65% of total symptomatic anisometropia cases. There were 2 (3%) out of 60 with strabismus, 7 (12%) out of 60 had both amblyopia and strabismus and 12 (20%) out of 60 had only decreased vision complaint that reached to normal visual acuity status (6/6) by appropriate optical correction.

**Fig I:** Prevalence of amblyopia and strabismus in anisometropic patients




Age based distribution showed that anisometropia was most common in age group of 16-25 out of 4 groups and then in age group between 5-15. 16-25 age group contain 25 patients whereas 5-15 age group had 22 patients. This showed that anisometropia was usually common in young people and children. Frequency and percentage of anisometropic patients in different age groups was 5-15 (22, 37%) ,16-25 (25, 42%), 26-35 (8, 13%) , 36-45 (5, 8%). Gender based distribution showed that Anisometropia was more prevalent in the females as compare to males. Percentage of females was 53% and of males was 47%. Results of my research study in table:I showed that 7 (12%) out of 60 had Esotropia, 2 (3%) out of 60 patients had exotropia and 51 (85%) out of 60 patients were orthophoric. Prevalence of amblyopia in anisometropic patients was also described which showed that 46 (77%) out of 60 patients were amblyopic and 14 (23%) out of 60 were without amblyopia.

**Table I:** Prevalence of amblyopia in Anisometropic patients

| Amblyopia | Frequency | Percent |
|---|---|---|
| **Present** | 46 | 77% |
| **Absent** | 14 | 23% |
| **Total** | 60 | 100% |

## 4. Discussion

Anisometropia is a binocular condition with different refractive power in both eyes. It is a serious condition because if neglected, it may lead to amblyopia or deviation in the eye. Amblyopia is defined as a Unilateral or in some cases, bilateral decrease in visual acuity after best possible correction. It is not related to any deformity in eye structure or visual pathway. One of the principle reason of amblyopia is anisometropia. Because when visual power of both eyes varies from each other, size and form of image falling on the retina also varies. If a significant refractive error constantly causes the blurr image on the retina of the eye, it can result into the amblyopia. Anisometropia can also results into the strabismus that is simply the misalignment of eyes. Asthenopic symptoms associated with the anisometropia includes deviation of eyes, double vision and eye strain. Different researches show that asthenopic symptoms associated with the untreated refractive errors. So the patients who have untreated anisometropia develops asthenopic symptoms. The purpose of this study is to prove with discussion and results that which one of these consequences is commonest.

The study was started on 01st of April 2022 till 20th of December 2022. Out of 24,618 patients from Holy Family Hospital, Rawalpindi, 9269 were referred to refraction room. Considering time availability sample size was 60 patients of anisometroopia who were symptomatic. Result of this study showed the comparative association of all the consequences in anisometropic patients. It showed that most commonly anisometropia result in the Amblyopia as 39 out of 60

anisometropic patients were amblyopic that is 65% of total symptomatic anisometropia cases. There were 2 (3%) out of 60 with strabismus, 7 (12%) out of 60 had both amblyopia and strabismus and 12 (20%) out of 60 had only decreased vision complaint that reached to normal visual acuity status (6/6) by appropriate optical correction. These results support the study of YH Aldebasi which also showed that anisometropic amblyopia is more prevalent as compared to the strabismus. My research study showed that anisometropia was most common in age group of 16-25 out of 4 groups and then in age group between 5-15. 16-25 age group contained 25 patients whereas 5-15 age group had 22 patients. This showed that anisometropia was usually common in young people and children. Frequency and percentage of anisometropic patients in different age groups was 5-15 (22, 37%), 16-25 (25, 42%), 26-35 (8, 13%), 36-45 (5, 8%). Gender based distribution of anisometropia showed that it was more prevalent in the females as compare to males. Percentage of females was 53% and males was 47%. And when patients were distributed on the criteria of presence of strabismus, I came out with the results that 7 (12%) out of 60 had Esotropia, 2 (3%) out of 60 patients had exotropia and 51 (85%) out of 60 patients were orthophoric. Further category was made to check prevalence of amblyopia in anisometropic patients, results described that 46 (77%) out of 60 patients were amblyopic and 14 (23%) out of 60 were without amblyopia. This condition showed that more than two third patients had amblyopia which support the results of J South,T Gao,A Collin, J Turuwhenua. According to their study out of all the Anisometropic patient that they took during their research about 2/3$^{rd}$ patients had amblyopia. In the end from the whole research I found that amblyopia was more prevalent than the strabismus, because I found that only 9 patients out of 60 were presented with the strabismus whereas 39 patients were of amblyopia.

Limitations of my study was the small sample size and just one hospital for research study. Larger sample size with more than one hospital could give the better results.

**Conclusion:**

Most commonly anisometropia is associated with the amblyopia and then strabismus. It is more common in females and most commonly affected age groups is 16-25 and then 06-15. There is less prevalence of strabismus because mostly patients are orthophoric.

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