Ophthalmology and Allied Sciences

(PEER-REVIEWED AND REFEREED JOURNAL)

VOLUME 10 NUMBER 1 JANUARY - APRIL 2024

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Ophthalmology and Allied Sciences

Volume 10 Number 1
January – April 2024

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Original Articles

Original Article

Ophthalmology and Allied Sciences
Volume 10 Number 1/January - April 2024
DOI: http://dx.doi.org/10.21088/oas.2454.7816.10124.1

Incidence of Rhegmatogenous Retinal Detachment and the Course of Posterior Vitreous Detachment Causing Retinal Breaks in Patients with Myopia

Aliya Sultana

How to cite this article:
Aliya Sultana. Incidence of Rhegmatogenous Retinal Detachment and the Course of Posterior Vitreous Detachment Causing Retinal Breaks in Patients with Myopia. Ophthalmol Allied Sci. 2024;10(1):07–12.

Abstract

Purpose: To study the incidence of rhegmatogenous retinal detachment in phakic and pseudophakic myopic patients and also to study the course of posterior vitreous detachment causing retinal breaks in myopia patients.

Methods: 19 Patients presented with Rhegmatogenous retinal detachment (RRD) were examined and documented. Patients of different age groups presented with various complaints were examined. Retrospective study done, cases presented from June 2022 to December 2023 were collected from electronic data of the institute. Proper history, BCVA, Slit Lamp examination, fundus examination and documentation done. All myopia patients were examined, underwent peripheral fundus examination irrespective of degree of myopia, refractive status of patients was taken into account for screening the retina, both central and peripheral retina. Phakic as well as pseudophakic patients also underwent fundus examination if the refractive error was myopia. Posterior vitreous detachment (PVD) has major role in causing retinal pathology like retinal breaks in myopia patients during its course near sites of adhesions.

Results: Myopia is definitely a risk factor for rhegmatogenous retinal detachment, some percentage of myopia patients will escape from the retinal detachment and maintain good vision. All myopia patients have risk, but the outcome is good in mild to moderate degree of myopia compared to severe degree of myopia. Presentation of breaks is also different in different degrees of myopia. In paediatric cases, retinal detachment will remain unnoticed usually due to delayed presentation, risk of Proliferative Vitreo retinopathy (PVR) is severe, all these factors will cause irreversible blindness.

RRD in myopia was commonly noted in middle age group, male gender and slightly in phakic patients more compared to pseudophakic patients.

Conclusions: Myopia is the major non traumatic cause of RRD, hence screening in myopia has important role to detect the retinal breaks as early as possible and treat to prevent the retinal detachment, which can cause severe blindness.

Keywords: Myopia; Pathological Myopia; Rhegmatogenous Retinal Detachment (RRD); Retinal BREAKS; Posterior Vitreous Detachment (PVD); Barrage Laser; Sub Retinal Fluid (SRF).

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Received on: 07.05.2024

Accepted on: 13.07.2024

INTRODUCTION

Cataract and Glaucoma incidence is high compared to RRD but risk of blindness is more with RRD. Asian population has greater prevalence compared to other other countries in the world. Refractive status will usually help in screening the patients to detect the retinal changes. Aim of our study is to see the RRD in myopia patients with severity of myopia, characteristics features of retinal detachment, different types of breaks, retinal denerative changes, Axial length of globe and associated with any systemic disorders. Many epidemiological studies conducted in Asia but characteristics of RRD was not described in detail in most of the studies.

MATERIALS AND METHODS

Study Population

Patients who reported to our hospital with refractive error having mild, moderate and severe myopia from June 2022 to December 2023 were enrolled in the study. Number of patients examined were 541. Every day the attendance of myopia patients was 2 to 3 in number. All patients were identified, examined underwent BCVA, Slit Lamp examination, indirect ophthalmoscopy, Auto refraction and documentation. RRD is defined as collection of sub retinal fluid beneath retina in sub retinal space through the retinal break, if the sub retinal fluid is not extending more than 2 Disc Diameters we call it as sub clinical retinal detachment. In patients where the details were not clear due to complicated cataract which can occur in myopia patients, B Scan Ultra Sonography done to conclude the retinal detachment.

Inclusion Criteria

All cases of myopia

Phakic and pseudophakic patients

Congenital myopia

Acquired myopia

All age group patients

Associated with systemic disorders

Exclusion Criteria

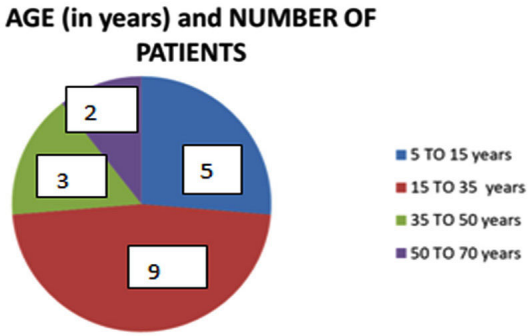
Trauma cases

Data Collection

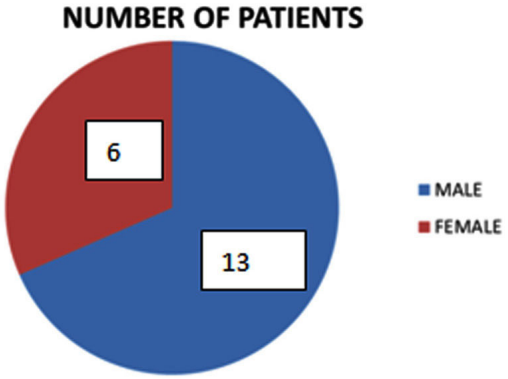
Information of age, gender, unilateral or bilateral involvement, configuration of retinal detachment, number, size, types and location of retinal breaks, refractive error of other eye, PVR changes, lattice or other chorio retinal changes in the fundus, any associated macular hole or central degenerative changes.

RESULTS

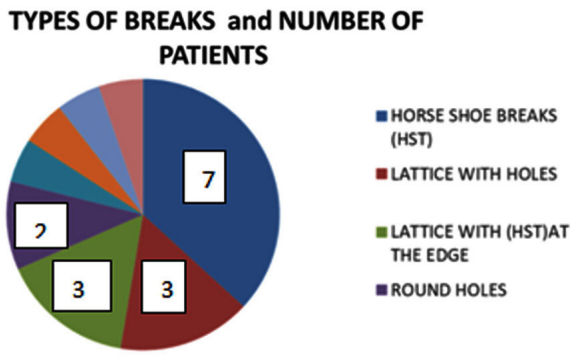
Age	Number of Patients
5 to 15	5 (26.3%)
15 to 35	9 (47.36%)
35 to 50	3 (15.78%%)
50 to 70	2 (10.52%)



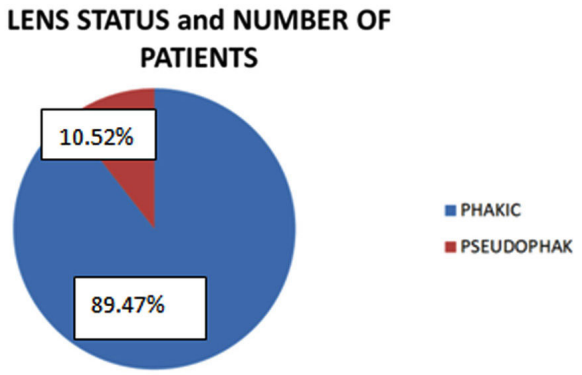
Gender	Number of Patients
Male	13 (68.42%)
Female	6 (31.57%)



Types of Breaks	Number of Patients
Horse Shoe Breaks (Hst)	7 (36.84%)
Lattice With Holes	3 (15.78%)
Lattice With (Hst) at the Edge	3 (15.78%)
Round Holes	2 (10.52%)
Retinal Dialysis	1 (5.26%)
Grt	1 (5.26%)
Breaks Not Identified	1 (5.26%)
Macular Hole Associated Rrd	1 (5.26%)

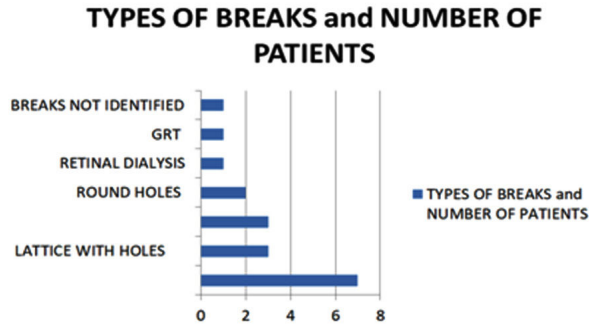


Lens Status	Number of Patients
Phakic	17 (89.47%)
Pseudophakic	2 (10.52%)



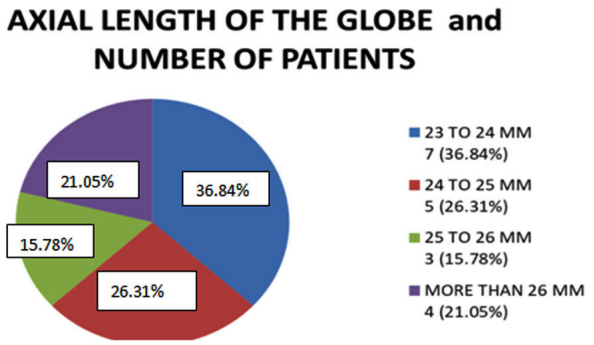
Characteristic Features of RRD	Number of Patients
Sub Total Superior Rrd	9 (47.36%)
Sub Total Inferior Rrd	5 (26.31%)
Total Rrd	5 (26.31%)

Number of Breaks	Number of Patients
Single Break	7 (36.84%)
Multiple Breaks	4 (21.05%)
Multiple Lattice With Holes	3 (15.78%)
String of Hst	2 (10.52%)
90 Degrees Grt	1 (5.26%)
Retinal Dialysis	1 (5.26%)
Breaks Not Identified	(5.26%)

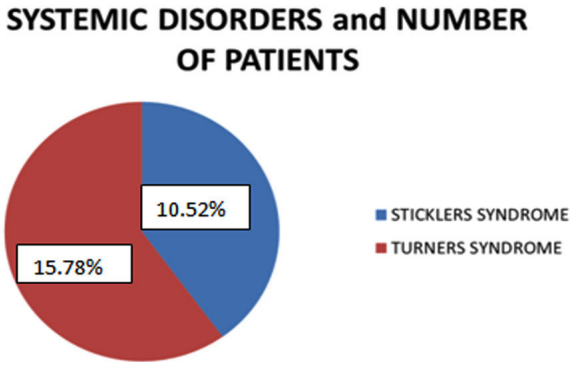


Degree of Myopia	Number of Patients
Mild to Moderate Myopia (0.5 To 4 Dioptres)	6 (31.57%)
Myopia (More Than 4 Dioptres)	9 (47.36%)
Pathological Myopia	4 (21.05%)

Axial Length of the Globe	Number of Patients
23 to 24 Mm	7 (36.84%)
24 to 25 Mm	5 (26.31%)
25 to 26 Mm	3 (15.78%)
More than 26 Mm	4 (21.05%)



Systemic Disorders	Number of Patients
Sticklers Syndrome	2 (10.52%)
Turners Syndrome	3 (15.78%)



DISCUSSION

The most striking point of this study is more number of cases are reported in middle age, there was raise in two age group individuals.[1] The mean age of patients with RRD in 2016 (61 years) was similar to the mean age of 60 years observed in 2009, study done in Netherlands, in our study mean age was 40 years, slightly younger compared to the study done in Netherlands.[2]

Incidence is more commonly noted in male patients like other studies (68.42%), though myopia

is almost equal in gender presentation but risk of RRD noted more in male population compared to female.[3] Retinal detachment can affect any age group of patients, in our study paediatric and adolescent group was also had same percentage of patients like younger and middle age group. Risk in paediatrics is usually was congenital myopia where the children were remained unnoticed and presented with chronic retinal detachment. Incidence of RRD in our study is 3.51%.

The prevalence of myopia varies considerably in different ethnic groups, where as in Asian population its percentage is 10%, slightly high compared to western countries.[4]

Every year there is 0.8% increase in prevalence in India, overall there is increase of 10.53% prevalence in all age groups for the next three decades, risk of epidemic of myopia in India after few decades. To prevent this epidemic many interventions, need to be planned.[5] Most of the studies predict risk of incidence is high after three decades probably due to lifestyle.

Existing literature on the increase incidence of myopia shows three factors responsible for the RRD, one is thinning of the retina causing small holes, second is early vitreous liquefaction and third increase in the axial length causes stretching of the retina leading to tears, piece of the retina pulled back of the eyeball.

Risk of RRD is high with high myopia, when the refractive error is more than 6 dioptres' study reported in the American Journal of Epidemiology suggests that 55% of all RDs are caused by myopia (Sharma, Grigoropoulos, & Williamson, 2004). In our study moderate degree of myopia (2 to 4 diopters) showed high incidence of RRD. Although many studies showed increase incidence of RRD in high myopia, our study revealed moderate degree of myopia with high incidence, multiple lattice degeneration with multiple holes were responsible for RRD, reason could be patients with high myopia were not reported to our institute. Incidence of RRD is related to the degree of myopia, because all the retinal changes which occur due to elongation and stretching of the globe are prone to develop retinal breaks. Moderate-to-high myopia may be a predisposing factor to more frequent development of retinal disease.[6]

The incidence is 0.015% in myopia less than 5 D, 0.07% in myopia less than 10 D, 0.075% in myopia more than 10 D, where as in myopia more than 15 to 20D risk of RRD is 15 to 110 times greater.

Is incidence is related to the severity of myopia or prevalence of myopia, very important topic to debate, because our study though not done in detailed, we had cases of RRD in moderate degree of myopia more than high myopia. Measurement of refractive error with auto refractometer and prescription of glasses were ideal or not, need to be assessed with other methods like fundus examination and axial length measurement of the globe to relate with the severe myopia which is increasing the incidence of RRD.[7]

According to literature, classic risk factors for RRD include older age, cataract surgery, and myopia[8], in our study myopia was most important risk factor noted. Older age as a risk factor could be due to liquefaction of vitreous and vitreous detachment which occurs physiologically, but trauma and myopia can cause early changes in vitreous as well as changes in normal vitreo retinal adhesions which are responsible for the RRD.

Retinal break means full thickness defect in retinal causing seepage of liquefied vitreous in to the sub retinal space there by causing detachment of neuro sensory retina from the retinal pigment epithelium. Different types of breaks are noticed, most common break causing RRD in our study was Horse shoe tear (HST). Young male patients having refractive error less than 6 D with HST had RRD in our study, where as other studies demonstrated phakic RRD from atrophic holes in lattice degeneration with the mean age of 32 years and 48% of the patients having greater than –6.00 D of myopia.[9]

Para vascular linear retinal breaks in chorio retinal atrophy patches are not visible in pathological myopia patients, usually they are along the posterior vascular arcades few disc diameters from the disc, size is also roughly two disc diameters. We could not able to locate these types of breaks in our patients, we need to do meticulous indirect ophthalmoscopy to detect the breaks, treatment of these types of breaks at the time of RRD repair will help in sealing the breaks, otherwise risk of redetachment is always therein pathological myopia cases.

RRD repair in patients with pathological myopia is usually not successful, Retinal pigment epithelium (RPE) function will be very poor due to reduced thickness of RPE compared to RPE in emmetropes. Hence repair of RRD in these patients is really challenging to attach the retina. RRD may occur in any degree of myopia but the severe myopia can cause complicated RRD.[10] RRD in severe myopia will be very difficult to manage because they

have risk of GRT, multiple small breaks, folded retina and small invisible breaks in posterior pole particularly in the are as of staphylomas.

Post cataract surgery cases show increased risk when there is vitreous loss, posterior capsular dehiscence and also post Nd Yag posterior capsulotomy. Incidence of RRD is decreased after small incision and Phacoemulsification cataract surgery. Previously the incidence was high with Intra capsular cataract extraction, in our study both the cases of pseudophakic RRD underwent small incision cataract surgery 2 years back and had intact posterior capsule. Risk of posterior hyaloid detachment after cataract surgery occurs immediately or after some time of cataract surgery due to excess mobility of vitreous and lack of support, has tendency to develop retinal tear which can lead to RRD.[11] In previous studies, the risk of RD by phacoemulsification in highly myopic ranges from 2.4 to 18%. With the current techniques, the risk of RD is close to that of the highly myopic non-operated population corresponding to near 2%.[12] Incidence of RRD is almost reduced after phacoemulsification technique, but cataract surgery in high myopia is better to postpone till the vision drops below a useful level. Status of lens is very important factor in RRD.

Existing literature shows there is no correlation between intra operative vitreous loss and retinal detachment[13], whereas Nd Yag or surgical capsulotomy has more association with incidence of retinal detachment, this association could be due to disturbance of anterior vitreous with high energy laser shots, so when ever opening is done in posterior capsule it is better to use low energy levels and avoid multiple laser shots, sometimes high energy can also cause macular damage and lead to macular holes.

Different mechanisms have been described in literature for different age group of patients, in young age myopia induced vitreous detachment where as in elderly individuals age related vitreous liquefaction and detachment are major mechanism factors for RRD.[14] Bimodal incidence of RRD has been reported in East Asian population, incidence of RRD due to myopia related vitreous changes will occur in young individuals and again there is peak in 5th or 6th decade due to senile induced vitreous changes which can lead to RRD. In our study we could see more incidence in middle age patients, there was not bimodal incidence, we need to concentrate even in elderly individuals where there is risk of RRD and also study the cases of myopia who have skipped the risk of RRD in young age or middle age are more vulnerable for RRD in 5th or 6th decade.

In our study one young adult presented with RRD after refractive surgery laser in situ keratomileusis[15], patient was examined in detail, indirect ophthalmoscopy done, peripheral retinal examination done and documented, no peripheral retinal breaks noted, patient underwent refractive surgery, one week after refractive surgery patient noticed sudden drop in vision, RRD with break noted in the superior quadrant, in refractive surgeries risk of iatrogenic retinal break is seen at the time of creating flap, intra ocular pressure is raised at the time of creating corneal flap, this increase in intra ocular pressure can induce retinal breaks at the sites of physiological vitreo retina adhesions, and can lead to retinal detachment. Proliferative vitreo retinopathy (PVR) was severe in paediatric cases and in patients with total RRD.

Our study is very much limited; we could not concentrate on Posterior vitreous detachment (PVD) induced retinal pathology in patients with myopia, like when, where and how PVD progresses with the retinal changes and cause RRD. Many studies have predicted the course of PVD causing retinal pathology which in turn lead to retinal breaks and cause RRD.[16] PVD occurrence in myopia as well as in patients who underwent ocular surgeries has major role in inducing the retinal pathology. Clinically it is very difficult to assess the PVD, some studies have shown that in some cases PVD can also cause delayed retinal breaks, I mean not immediately after the PVD[17], particularly in cases of lattice degeneration, there may be delayed retinal breaks formation, proper reasoning has not mentioned, physiological retinal thinning and stretching associated with lattice degeneration responsible for delayed retinal breaks, anyhow we need to study the progress of PVD in detail, expertisation is required to study the course of PVD and capture the delayed retinal breaks.

CONCLUSION

Round atrophic holes in lattice degeneration and Horse shoe tears were more common in young myopic patients with phakic retinal detachments. In India, changes in life style, well designed eye care services and anti-myopia strategies are required to plan and counteract myopia, decrease the incidence of RRD and prevalence of myopia. Large well-designed studies should be planned, including proper information on the refractive

status or axial eye length, lens status, traumatic injuries, and intraocular surgeries during follow-up. Ophthalmologist and Optometrist should take responsibility to educate the parents and patients about the causes of blindness associated with myopia and also treat the patients with proper therapies to reduce the risk of RRD, and risk of blindness in society. Frequent screening in all age groups of patients with myopia helps in early detection of breaks and management. Other eye examination should be done regularly to prevent the risk of RRD. Proper prescription of glasses, regular follow up and guide lines to prevent progression of myopia should be mentioned in every school for teachers and parents.

REFERENCES

1. C Chou, C-H Yang, C-H Lee, C-M Yang, T-C Ho, J-S Huang, C-P Lin, M-S Chen & Y-F Shih. Characteristics of primary rhegmatogenous retinal detachment in Taiwan. Eye 21, 1056–1061 (2007). https://doi.org/10.1038/sj.eye.6702397.
2. van Leeuwen R, Haarman AEG, van de Put MAJ, Klaver CCW, Los LI; Dutch Rhegmatogenous Retinal Detachment Study Group. Association of Rhegmatogenous Retinal Detachment Incidence With Myopia Prevalence in the Netherlands. JAMA Ophthalmol. 2021 Jan 1;139(1):85-92. doi: 10.1001/jamaophthalmol.2020.5114.
3. Gözüm N, Çakir M, Gücukoglu A, Sezen F. Relationship between Retinal Lesions and Axial Length, Age and Sex in High Myopia. European Journal of Ophthalmology. 1997;7(3):277-282. doi:10.1177/112067219700700313.
4. Priscilla Christina Natan 1, Putu Budhiastra 2, Ari Andayani 3, Komang Putra Tridiyoga 4. Rhegmatogenous Retinal Detachment in High Myopia. OSR: Journal of Social Research November 2022, 1 (12), 475-484.
5. Priscilla JJ, Verkicharla PK. Time trends on the prevalence of myopia in India - A prediction model for 2050. Ophthalmic Physiol Opt. 2021 May;41(3):466-474. doi: 10.1111/opo.12806. Epub 2021 Apr 16. PMID: 33860952.
6. José M. Ruiz-Moreno, MD, PhD; and Francisco L. Lugo Quintás, MD. Retinal Detachment and High Myopia. UP FRONT | APR 2008.
7. Elvioza Elvioza 1, Denny Agustiningsih 3, Suhardjo Prawiroranu 2, Muhammad Bayu Sasongko. Differential Distributions of Myopia Severity in Younger and Older Individuals with Rhegmatogenous Retinal Detachment. Clinical Ophthalmology 2021:15 2947–2950.
8. Ning Cheung, MD1,2; Shu Yen Lee, MD1,2; Tien Yin Wong, MD, PhD. Will the Myopia Epidemic Lead to a Retinal Detachment Epidemic in the Future? JAMA Ophthalmol. 2021;139(1):93-94. doi:10.1001/jamaophthalmol.2020.5112.
9. Elad Moisseiev, R Dr Glenn Yiu, MD. Retinal detachment in severe myopia. Clinical Picture| Volume 389, Issue 10074, P1133, March 18, 2017. November 03, 2016.IdentificationDOI: https://doi.org/10.1016/S0140-6736(16)31407-6.
10. Gonzales CR, Gupta A, Schwartz SD, *et al* The fellow eye of patients with phakic rhegmatogenous retinal detachment from atrophic holes of lattice degeneration without posterior vitreous detachment British Journal of Ophthalmology 2004; 88:1400-1402.
11. S. W. Hyams, M. Bialik, and E. Neuman. Myopia-aphakia I. Prevalence of retinal detachment. Brit. J. Ophthal. (I975) 59, 480.
12. Zerin HEKALO; Zaidi Mohamed; Louis Lhuillier; alexandre schaut; George Hayek *et al*. Retinal detachment in high myopia after cataract surgery: retrospective study about 365 cases. Investigative Ophthalmology & Visual Science July 2019, Vol.60, 493.
13. Carmen Barraquer, MD; Cristina Cavelier, MD; Luis F. Mejia, MD. Incidence of Retinal Detachment Following Clear-Lens Extraction in Myopic Patients,Retrospective Analysis. Arch Ophthalmol. 1994;112(3):336-339. doi:10.1001/archopht.1994.01090150066025.
14. Min Seok Kim, Sang Jun Park, Kyu Hyung Park, and Se Joon Woo. Research Article Different Mechanistic Association of Myopia with Rhegmatogenous Retinal Detachment between Young and Elderly Patients. Bio Med Research International Volume 2019, Article ID 5357241, 6 pages https://doi.org/10.1155/2019/5357241.
15. José D Luna, MD, María Natalia Artal, MD Claudio P Juarez, MD. Retinal detachment in myopic eyes after laser in situ keratomileusis. American Journal of Ophthalmology. Volume 130, Issue 2, P259-260, August 2000.
16. Ken Hayashi; Shin-ichi Manabe; Akira Hirata; Koichi Yoshimura. Posterior Vitreous Detachment in Highly Myopic Patients. nvestigative Ophthalmology & Visual Science April 2020, Vol.61, 33. doi:https://doi.org/10.1167/iovs.61.4.33.
17. Kantiya K. Jindachomthong, MD, 1 Howard Cabral, PhD, MPH, Manju L. Subramanian, MD,1,3 Steven Ness, MD, 1,3 Nicole H. Siegel *et al.* Incidence and Risk Factors for Delayed Retinal Tears after an Acute, Symptomatic Posterior Vitreous Detachment. Ophthalmology Retina Volume 7, Number 4, April 2023.

Original Article

Ophthalmology and Allied Sciences
Volume 10 Number 1/January - April 2024
DOI: http://dx.doi.org/10.21088/oas.2454.7816.10124.2

Ocular Muscle Balance Disorders and Associated Refractive status in School Children and Young Adults

Anupama Raju Taklikar[1], Vaibhav Kanduri[2], Aisha Nikhat[3], Meghana N.[4]

How to cite this article:
Anupama Raju Taklikar, Vaibhav Kanduri, Aisha Nikhat, *et al*. Ocular Muscle Balance Disorders and Associated Refractive status in School Children and Young Adults. Ophthalmol Allied Sci. 2024;10(1):13–19.

Abstract

Introduction: The Human race is supreme in hierarchy of animal kingdom by the acquisition of Binocular Single Vision 1 (BSV). It is important to have normal ocular muscle balance to have normal BSV. Any muscle balance disorder may lead to squint or amblyopia. Ocular muscle balance disorders shows an association with refractive error. Most of this research has focused on myopia. But hyperopia and astigmatism are also being examined in our study.

Methodology: A Prospective study conducted over period of 1 year 300 subjects were included 150 were selected from OPD and rest 150 by screening 1875 students of various schools in Raichur District who had vision less than 6\6 or with 6\6 vision and as the no pic symptoms. Visual Acuity was measured. Fund us examination, Squint evaluation and Type of squint was noted. AC/A ratio was calculated. Binocular Vision was assessed. Those who needed treatment were treated by spectacles ororthoptic exercises. Correlation was made between ocular muscle imbalance and refraction.

Results: The prevalence of refractive errors was 8% with mallet of emaleratio 1.9:1. Highest were between 17-20 yrs. Heterophori as were the most common Type of ocular muscle balance disorders (80%) followed by heterotropias (20%). Exophoria was highest (52.8%) followed by esophoria (46.6%). Strong association was noted between myopia and exophoria 43 out of 60 (p=0.042). Cases of mixed astigmatism were observed having esophoria for near and exophoria for far. Significant association was noted between hypermetropia and convergent squint (67 out of 81).

Conclusion: Myopia is mainly associated with divergent squint, Hypermetropia with convergent squint. Mixed astigmatism associated with exophoria for far, esophoria fornear.

Keywords: Refractive errors; Heterophoria; Heterotropia.

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Received on: 27.04.2024

Accepted on: 13.07.2024

INTRODUCTION

The Human race is supreme in the hierarchy of the animal kingdom by the acquisition of Binocular Single Vision.[1]

BSV is not present since birth but is acquired in early period of life. Development of BSV and fusion has been found to be developed by one to two months of age.[2] Stereops is develops between the

age three to six months and completed by five to six years of age.[3] Hindrance to the development of BSV occurs in case of presence of media opacities like cataract or corneal opacity, or in case of uncorrected refractive errors, or in case of ocular motility abnormalities.

For a child to develop into an effective adult so as to lead a normal life and to contribute his services for the family and country the presence of BSV is essential. The coordination of ocular movements and ocular refraction are interrelated.[4] Presence of refractive error cancause development of strabismus which hampers the BSV development. Early identification and correction of the refractive errors prevent the child becoming strabismic, amblyopic. It is the duty of every one in the health care industry to ensure the curbing of preventable causes of ocular morbidity by early diagnosis and treatment for better quality of life.

Hence this clinical study is intended to correlate the relationship between the type of refractive error and the ocular muscle imbalances in the individuals aged between 5-20 yrs and treatment of the same where verpossible.

The Objectives of the Study are

1. To determine the correlation between ocular muscle balance and the refractive status of eyes in children and young adults below 20 yrs.
2. To know the incidence of type of ocular muscle imbalance and their relation with refraction to treat wherever required.

MATERIAL AND METHODS

A prospective study (cross sectional) was carried out in 300 patients.

The Period of 1 year

150 students were selected from various schools in Raichur district by screening a total, of 1874 students.

Rest 150 were selected from the outpatient department of ophthalmology in Navodaya Medical College Raichur.

Clinical Examination

Visualacuity: It was measured by Snellen's chart method

1. ***Anterior Segment Examination:*** All the above selected children were examined with torchlight and slit lamp examination. Ocular movements were checked in all gazes both uniocular and binocular.
2. ***Cover test:*** Cover test is done when the child fixes object at 6 m and 40cm.
3. ***Maddox Rod Test:*** The Maddox rod test is done at both 6mt and 40 cm in a darkroom.
4. ***Synoptophore Test:*** After Maddox rod test each subject is subjected to synop to phoreto calculate the IPD and assess the 3 grades of Binocular single Vision.
5. ***Cycloplegics:*** All the children after synoptophore test were asked to putatropine eye ointment 1% in lower palpebral conjunctiva of both eyes twice daily for 3 days and were asked to comeon 4th day morning. Older childre were asked to use cyclopentolate drops every 15 mins once and were examined after 90 minutes.
6. ***Retinoscopy:*** Done by using streak retinoscope with accommodation of the subject a trest (static retinoscopy). It was done at adistance of 1mt.
7. ***Fundus Examination:*** Through the dilated pupils fundus was visualized and the subjects with normal fundus were included in the study.
8. ***Post Cycloplegic Test:*** According to the retinoscopy readings, the required strength of lens is placed in trial frame and finally what ever strength of lens required by the child to see the letters clearly on Snellens chart was considered as subjectively corrected lens.
9. ***Prism Bar cover test:*** All the children with manifest squint were tested for deviation of the eye by horizontal and vertical prism bars.
10. ***Calculation of AC/A Ratio:*** It was calculated by the following method. AC/A = IPD + (Δn - Δd/D) where IPD is the inter pupillary distance in cm, Δn is the near deviation, Δd is the distance deviation in prism dioptres, D is the fix at iondistance in dioptres.

Based on the above test results the correlation between refractive status and type of ocular muscle imbalance is established and treatment was given where verit was necessary.

Inclusion Criteria:

- Children and young adults aged between 5-20 yrs will be included.

Exclusion Criteria:

- All patients below the age of 5 years and above 20 years.
- Individuals with mental retardation.
- Individuals with optical media opacities.
- Macular/optic nerve disorders.
- One eyed individuals.

DATA ANALYSIS

Data was entered on excel spread sheet after coding and further processusing

SPSS version 19.0. (Statistical Package for Social Sciences). Chi square test was used and p value less than 0.0 5 was considered statistically significant.

RESULTS

Sex Incidence:

A total of 300 children were studied, out of which 198 were male and 102 were female. This shows that higher incidence of refractive error and squint among male children (66%) compared to females (34%). (Fig. 1)

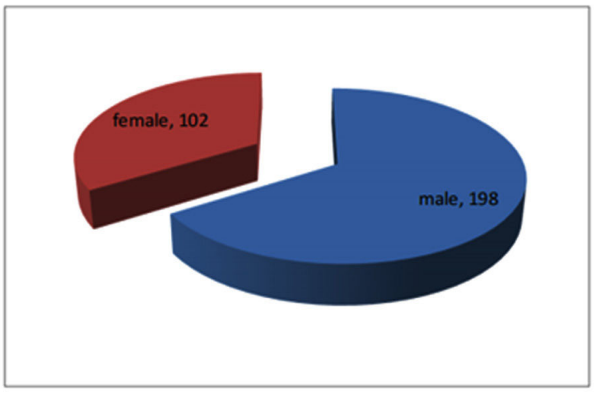

Fig. 1: Sex incidence

Age Incidence:

Out of 300 children studied the percentage of age group and sex Observation reveals maximum no. of subjects in age group 17-20 yrs constituting 22% and minimum no. of subjects in age group 5-8 yrs 8%. (Fig. 2)

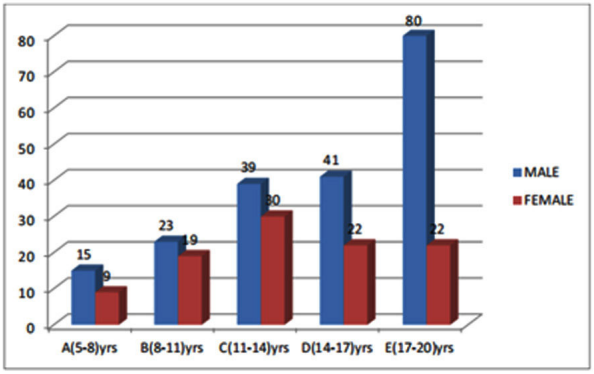

Fig. 2: Age incidence

Statistics with Respecttorefr Active Errors:

Different types of refractive errors with the inference that Anisometropia is the highest type of refractive error constituting 40% followed by hypermetropia 27%, myopia 20%, simplemyopic astigmatism and compound myopic astigmatism 5% each, mixed astigmatism, compoundhy permetropicastig matism, simplehy permetropic astigmatism 1% each. (Fig. 3)

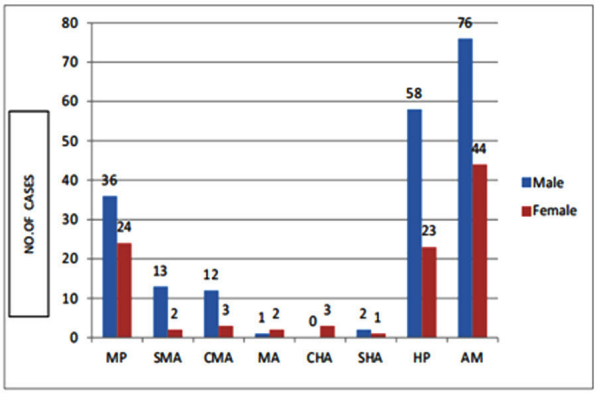

Fig. 3: Rate of incidence of different types of refract errors in males and females among 300 cases

Male children dominated with myopia, simplemy opicastigmatism, simplehy permetropic astigmatism, hypermetropia and anisometropia types of refractive errors.

Female children dominated with mixed astigmatism and compound hypermetropic astigmatism types of refractive errors.

Statistics with Respect to Srabismus:

Different types of squint present in 300 subjects studied. Observation reveals that Heterophoria (80%) dominate over Heterotropia (20%) in thes tudy. (Fig. 4)

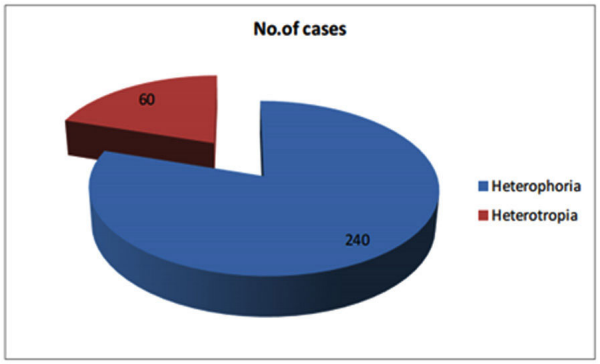

Fig. 4: Different types of squint present in 300 subjects

Number of Cases in different types of Heterophoria

Among phorias exophorias constitute the highest number of cases *i.e.* 125 (52.8%) followed by esophorias constituting 112 cases (46.66%), 3 cases (1.25%) were showing exophoria for far and esophoria fornear.

4 cases of hyperphoria were associated with esophoria and exophoria. 1 case of hypophoria was seen associated with exophoria. (Table 1)

Table 1: Number of cases in different types of heterophorias

Heterophoria	No of cases	Percentage (%)
Esophoria	112	46.66
Exophoria	125	52.80
Hyperphoria	4	Associated with Eso and Exophoria
Hypophoria	1	Associated with Exophoria
Exo for Far and Eso for near	3	1.25

Table 2: Number of cases in different types of heterotropias

Heterotrophia	No of Subjects	Percentage (%)
Esotrophia	34	56.66
Exotrophia	26	43.33
Hypertrophia	0	0
Hypotrophia	0	0

Number of cases in different types of Heterotropia

Out of 60 subjects with Heterotropias in this study Esotropia (56.6%) was leading followed by Exotropia (43.3%).

Statistics with Respect to Different Types of refractive Errors V/S Different Types of Squint. 1. Myopia V/S Squint

A strong association between myopia and divergent squint. (p=0.042). Among divergent squint there are 43 cases out of which 26 are male 17 are female subjects. Significant observation includes that there are no cases of esotropia. (Fig. 5)

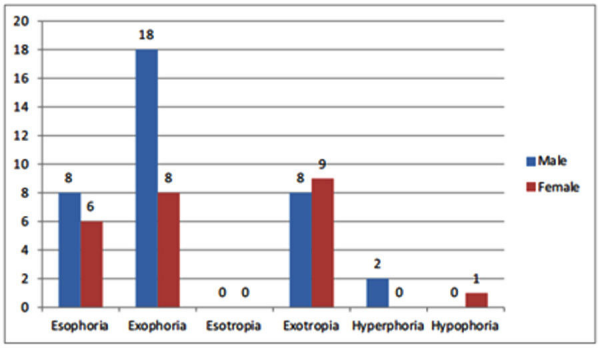

Fig. 5: Myopia V/S Squint in males & females among 60 subjects

Myopia is also associated with esophoria in 14 cases. Hyperphoria and hypophoria was also observed.

Simple Myopic Astigmatism v/s Squint

There were only 15 cases of simple myopic astigmatism of which 13 were male, 2 were female. 13 subjects were exophoric and 2 were esophoric (Fig. 6)

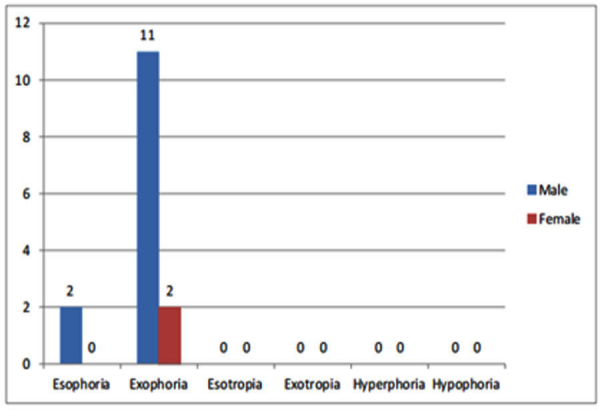

Fig. 6: Simple myopic astigmatism V/S Squint in male and female among 15 subjects.

Compoudmyopic Astigmatism v/s Squint

In compound myopic astigmatism out of 15 cases, 10 cases were exophoric, 4 were esophoric. 1 male child with exophoria was associated with hyperphoriain righteye (Fig. 7).

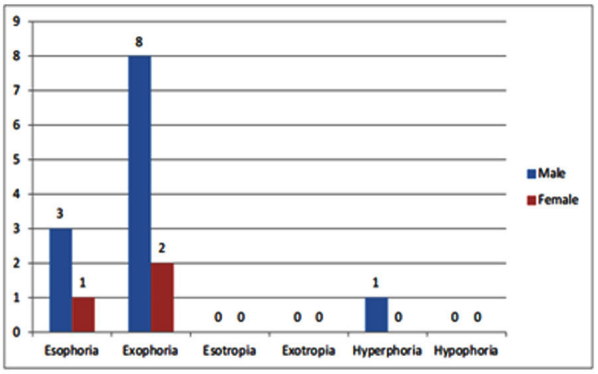

Fig. 7: Compound myopic astigmatism V/S Squint in male and female among 15 subjects

Mixed Astigmatism v/s Squint:

Out of 300 cases studied only 3 subjects had mixed astigmatism of which 1 was male, 2 were females. They had exophoria forfar and esophoria fornear.

Compound Hypermetropic Astigmatism v/s Squint:

Out of 300 subjects studied 3 females had compound hypermeteropic astigmatism. One had exotropia and other two were exophoric.

Simple Hypermetropic Astigmatism v/s Squint:

Out of 300 subjects 2 males and 1 female had this refractive error and were esophoric. No other types of squint were found.

Hypermetropia v/s squint

Out of 300 cases 81 were hypermetropic. Among the m 58 were males and 23 were females. Majority cases showed convergent squint (67). Only 1 case had hyperphoria (rt) (Fig. 8)

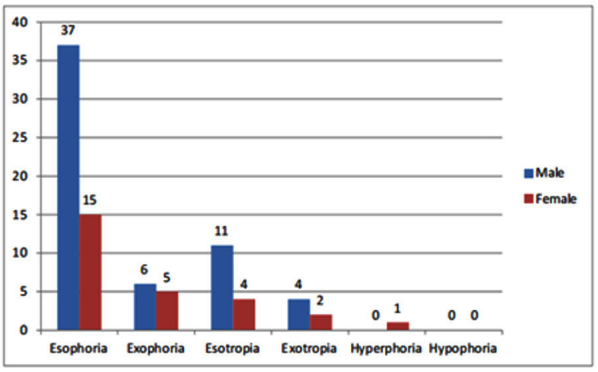

Fig. 8: Hypermetropia V/S Squint in male and females among 81 subjects.

Anisometropia v/s Squint:

Among 300 cases 120 cases had anisometropia. Of them 76 are males and 44 are females. Again males dominated over females. Out of 120 cases of anisometropia divergent squint was noted in 64 subjects (Fig. 9)

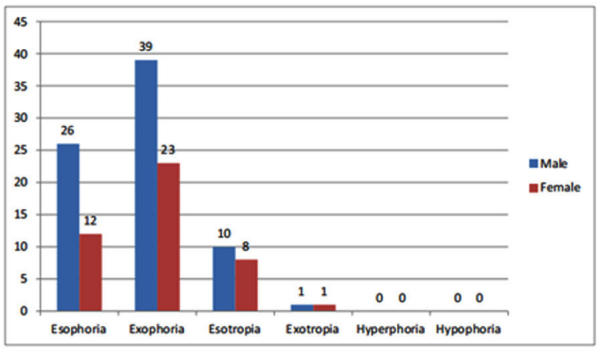

Fig. 9: Anisometropia V/S Squint in male and female among 120 subjects

Statistics with Reference Tobinocul Arsinglevision:

Out of 300 studied 240 cases had heterophoria and 60 cases had heterotropia. Among the cases of heterophoria 228 cases had normal BSV rest had poor fusion amplitude. Among heterotropias none of the cases had normal BSV

DISCUSSION

In this study a total of 300 subjects participated between age group of 5-20 years. Of those children 150 were picked up from school screening of total of 1874 children. Remaining 150 were selected from the out patient department of our hospital.

The prevalence of refractive error in our study was found to be 8% in school children. Male to femal eratio in our study was 1.94:1.

In a study done by Dr. Surinder Singh during 1974 the prevalence rate of refractive errors was found to beas high as 35%.[5]

In a similar study done by Dr. A. Panda *et al* in 1985 showed the incidence of refractive erroras 13.25%.[6]

In the present study it was found that refractive errors in males was 66%, Females 34%. Among them anisometropia was 40%, 27% hypermetropia, 20% myopia, and remaining 13% were astigmatic.

With respect to muscle imbalance, our study showed 80% heterophorias and 20% heterotropias. It is contradictory to astudy done by Dr. Lahaneet. alwhere heterophorias was 33.20% and tropias was 66.80%.[7]

In the present study Exophoria is 52.8% followed by esophoria 46.6% followed by esophoria for near and exophoria forfar in 1.25%.

Esotropia is 56.66% and exotropia is 43.33%. This shows that different types of squints are associated with different types of refractive errors.

Among 60 cases of myopia 46 cases are associated with divergent squint. 2 cases associated with hyperphoria and exophoria and 1 case associated with exophoria and hypophoria.

Esophoria in Myopia is Relatively Rare

Persons who develop progressive myopia have increasingly less need to accommodate when viewing near objects. Thus accommodation convergence reflex becomes weaker. If there refractive error remains uncorrected exophoria tends to occur, fist for near then for distance. This may eventually lead to intermittent squint and later as manifest divergent squint. Hence myopia should be corrected as early as possible to prevent development of diver gent squint.

From caese of Simple Myopic Astigmatism 13 cases had exophoria and 2 cases had esophoria. Compound myopic astigmatism was associated with 10 cass of exophoria and 4 with esophoria and 1 case had hyperphoria associated with exophoria for far and esophoria fornear.

Among 81 cases of hypermetropia 67 cases had convergent squint (p=0.04). It indicates that there is a significant association between hypermetropia and convergent squint. It is because they use more accommodation than required leading to increased convergence and tendency to develop convergent squint.

The patient with uncorrected hypermetropia can see either a single blurred image or a double image in which 1 is clear and the other is blurred. Over a period of 87 time the eye with blurred image undergoes suppression leading to amblyopia. If glasses are worn faithfully, fusional pattern is maintained.

Aniosmetropia forms the largest group of refractive errors in this study *i.e.* 120 cases. Among them phorias are 100 and 20 are tropias. Among phorias 39 are esophoric and 61 are exophoric. Among tropias 18 are esotropic and 2 are exotropic.

In anisometropia of moderate degree, in which one eye is myopic and other eye is hypermetropic, the myopiceye is used fornear fixation and hypermetropic for distant in which an alternating strabismus may develop. In unilateral myopia of moderate degree the myopic eye may diverge.

Anisometropia is more commonly associated with amblyopia than isometropia. Early identification, correction of refractive errors lead to proper maintenance of visual axesleading to decreased development of amblyopia.

CONCLUSION

The following conclusions were conferred from this study. Males have higher incidence of refractive errors than females.

Anisometropia is the most common type of refractive state followed by hypermetropia, myopia, simple myopic astigmatism, compound myopic astigmatism, simple hypermetropic astigmatism, compound hypermetropic astigmatism followed by mixed astigmatism.

Heterophoria sarecommont hanheterotropias

Myopia is associated significantly with divergent squint (exophoria and exotropia). Hypermetropia is associated significantly with convergent squint (esophoria and esotropia).

Binocular single vision is affected in heterotropias. In few cases of heter ophoria with high erfractive errors the fusional amplitude is poor indicating high chances of conversion of phoriain to tropia.

Early diagnosis of refractive errors and their correction along with orthoptic exercises in cases with poor fusional reserveprevents the progression of phorias totropias which canlead to hampered BSV, amblyopia.

Hence there is need for every school going child to undergo screening regularly for refractive errors at eleastonce in 6 months.

REFERENCES

1. Pradeep Sharma. Strabismus simplified. 2nd edition 2012: CBS Publishers and distributors.1:1
2. Braddick O, *et al*: cortical binocularity in infants. Nature 1980; 288:363-65.
3. Birch EF, GwiazdaJ, and Held R: Stereoacuity development of crossed and uncrossed disparities in human infants. Vision Res 1982; 22:507.

4. David Abrams, Duke Elder's Practice of refraction 10th Edi; (2002)1:3, 147-49, 12,45-70
5. Surendar singh Eye diseases among primary school children: Indian journal of ophthal, 1974;22;111
6. Panda a. SK Angra. Eye disease in school children. Indian journal of pediatrics 1985; 52:289-91.
7. Dr. Lahane Tatyarao Pundikarao, Dr. P.P, Dr. R.P., Eye disease in urban school children in Mumbai, India, proceedings of AIOC2004; 614-616.

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Original Article

Ophthalmology and Allied Sciences
Volume 10 Number 1/January - April 2024
DOI: http://dx.doi.org/10.21088/oas.2454.7816.10124.3

Factors Leading to Subnormal Vision after Small Incision Cataract Surgery

Anupama Raju Taklikar[1], Navya C.[2], Meghana N.[3]

How to cite this article:
Anupama Raju Taklikar, Navya C., Meghana N. Factors Leading to Subnormal Vision after Small Incision Cataract Surgery. Ophthalmol Allied Sci. 2024;10(1):21–26.

Abstract

Introduction: Avoidable blindness which could be treated or prevented by known and cost effective means is cataract. Therefore majority of blindness due to cataract can be prevented by simple techniques called conventional ECCE, SICS and phacoemulsification. Around 62.6% of blindness is due to cataract and thereby it is burdening the country with major morbidity. To reduce this burden most easy technique and cost effective method employed in developing countries like India is small incision cataract surgery (SICS).

Aim & Objective: To find out the causes of subnormal vision post operatively in patients undergoing small incision cataract surgery at a tertiary care center.

Methods: The present study was a prospective study done on 100 patients who attended OPD during the study period between 2018-2020. Patients underwent detailed examination before cataract surgery and best corrected visual acuity was recorded at day 1, 1 week, 6 weeks post-operatively. Complications were noted to determine the causes for subnormal vision at 6 weeks post-operatively.

Results: Out of the 100 patients severe visual loss (6%) was caused by iridocyclitis (65%) in majority of patients on 1st post op day. At 1st post op week residual lens matter (3%) and astigmatism (59%) contributed equally to moderate vision loss (55%). At 6 weeks astigmatism (88%) and Pigment Dispersion on IOL (16%) were the causes of moderate visual loss (55%).

Conclusion: Astigmatism was the major cause of subnormal vision at 6 weeks causing mild moderate vision loss in majority of the patients.

Keywords: Astigmatism; Complications; Cataract Surgery; Subnormal vision.

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Received on: 23.03.2024

Accepted on: 14.05.2024

INTRODUCTION

Cataract is a blinding condition resulting from an opacity of the crystalline lens of the eye. The only treatment to restore sight is by performing cataract surgery to remove the opaque lens. Therefore cataract surgery represents the most frequent surgical procedure performed by most ophthalmic surgeons.[1]

Two types of eye surgeries can be used to remove cataracts. Intracapsular cataract extraction (ICCE)

and extra capsular cataract extraction (ECCE). ICCE has the disadvantage of more surgically induced astigmatism compared to ECCE because of its longer incision length of 10-11mm, ECCE has various types like conventional SICS and phacoemulsification.[2]

Manual small incision cataract surgery is one of the most innovative and popular technique.[3]

The use of small cataract incisions is thought to reduce surgically induced astigmatism resulting in more stable refraction.[4] Surgical techniques are continuously modified and improved upon to decrease surgically induced astigmatism.

Even after all the efforts, vision might not reach up to expectations post-operatively, thereby this study aims at noting out the factors responsible for unexpected or poor results after SICS with PCIOL implantation.

Hence, this study was conducted to find out the causes of subnormal vision in patients undergoing cataract surgery with IOL implantation with no co-existing ocular morbidity.

AIMS AND OBJECTIVE

1. To find out the causes of subnormal vision post operatively in patients undergoing small incision cataract surgery.

MATERIALS AND METHODS

- A total of 100 patients between the age group of 30 to 90 years undergoing small incision cataract surgery under peribulbar block with intraocular lens implantation at a tertiary care center were selected randomly after taking complete history and informed consent.
- Pre-operative evaluation includes best corrected visual acuity, slit lamp examination, dilated fundus examination, sac syringing, measurement of intraocular pressure by applanation tonometry, routine blood investigations, A scan biometry and keratometry.
- Power of IOL was calculated using SRK II formula.
- Patients was undergoing manual small incision cataract surgery under peribulbar block with PCIOL implantation made of single piece PMMA. The post operative patients will be started on antibiotic and steroid combination eye drops which be tapered on weekly basis.
- Post-operative evaluation was done on 1st post-operative day, at the end of 1 week and 6 weeks. On each visit best corrected visual acuity, slit lamp examination, fundus examination and IOP measurement will be done. Postop B Scan USG, FFA & OCT was done in indicated cases.

Inclusion Criteria:

1. Patients undergoing small incision cataract surgery at a tertiary care center.
2. Patients within the age group of 30 to 90 years.
3. Patients with pre-senile cataract.

Exclusion Criteria:

1. Patients below 30 years of age.
2. Patients above 90 years of age.
3. Patients with ocular infections, trauma, congenital anomaly of the eye, hypertension and diabetes mellitus.
4. Patients with history of previous ocular surgeries (trabeculectomy, retinal detachment surgery etc).
5. Patients with any retinal pathologies, glaucoma, uveitis and posterior segment pathalogy.
6. Any other ocular morbidity that causes subnormal vision.
7. Patients not fit for surgery due to systemic co-morbidities.

Statistical Analysis:

Statistical analysis was done by using SSPS software to determine the causes of subnormal vision in patients undergoing cataract surgery. MS Excel 2007 was used to prepare Master chart and graphs. Variables including various percentages and proportions were statistically analysed using Chi square test. $p<0.05$ was considered statistically significant at 5% level of significance. A sample size of 100 patients was enrolled in the study.

RESULTS

A total of 100 patients were enrolled in the study 60 patients were females, 40 were males. Majority of the patients included in this study was between age group of 61-65 years that is 35%, with and in 58 patients right eye was operated and left eye was operated in 42 patients.

The visual loss was classified into Mild, Moderate and Severe visual loss (Fig. 1). On the first postoperative day (Fig. 2) 58% of the patients had mild visual loss, 37% had moderate visual loss, 1% had severe visual loss and remaining 4% of the patients had normal vision.

On post operative 1 week (Fig. 3) patients had mild vision loss of 58% in comparison with 9% on day 1, moderate vision loss of 37% in comparison

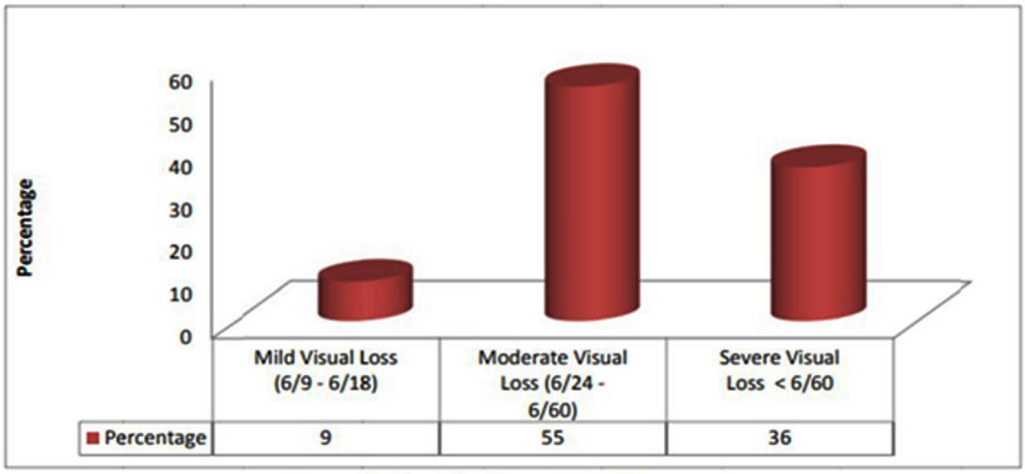

Fig. 1: Classification of Visual Loss

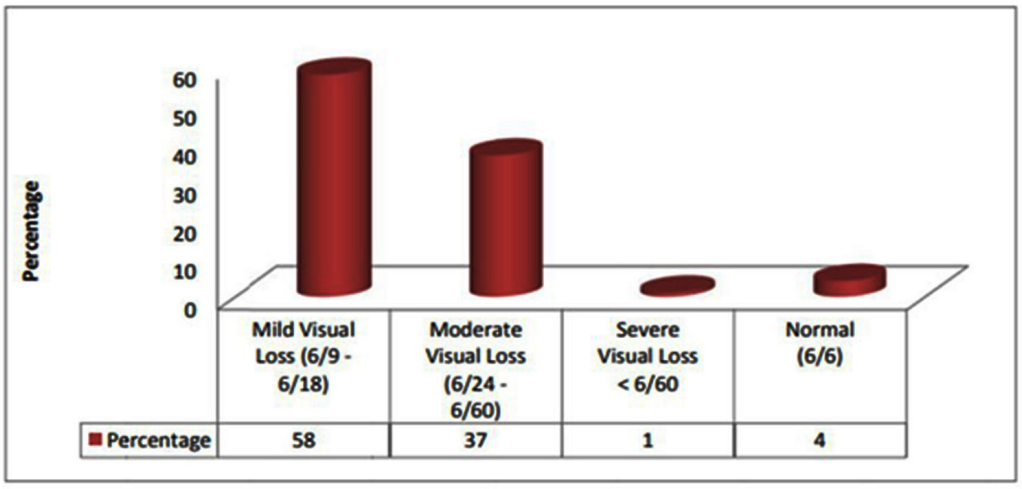

Fig. 2: Vasual outcome on the first post-operative day

with 55% on day 1 and severe vision loss of 1% in comparison with 36% on day.

Best corrected visual acuity was done at 6th week showed, 55% of the patients had mild visual loss, 11% had moderate visual loss, 1% had severe visual loss and remaining 33% of the patients had normal vision (Fig. 4)

At 1st day along with striate keratopathy (80%), iridocyclitis (65%), inflammatory membrane (6%), residual lens matter (7%) and Vitreous in AC (1%) played a major role in hampering the vision post-operatively (Fig. 5).

At 1st week along with astigmastism (59%), striate keratopathy (31%), Pigment Dispersion on IOL (13%), iridocyclitis (12%), inflammatory membrane (1%) and Vitreous in AC (1%) played a major role in hampering the vision post operatively (Fig. 6).

At 6th week along with astigmastism (88%), Pigment Dispersion on IOL (16%), inflammatory

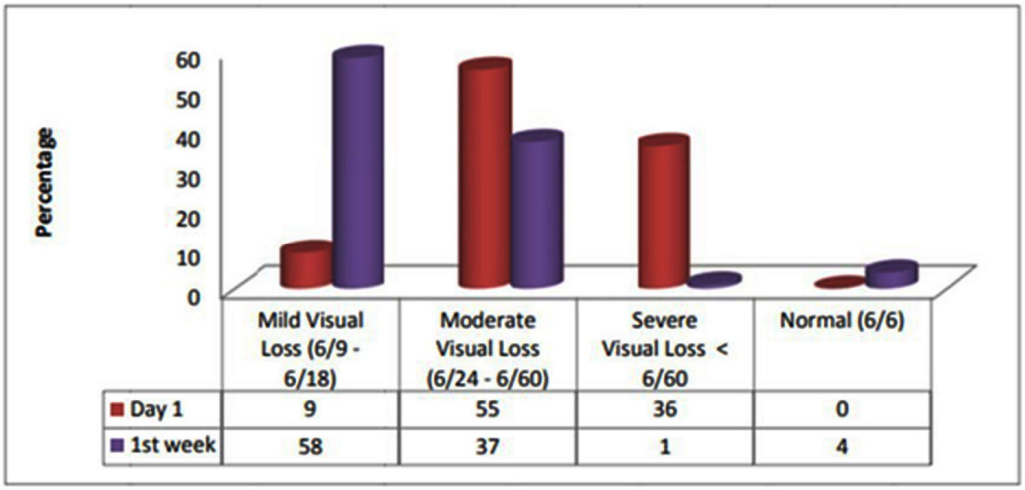

Fig. 3: Vasual outcome at 1st week

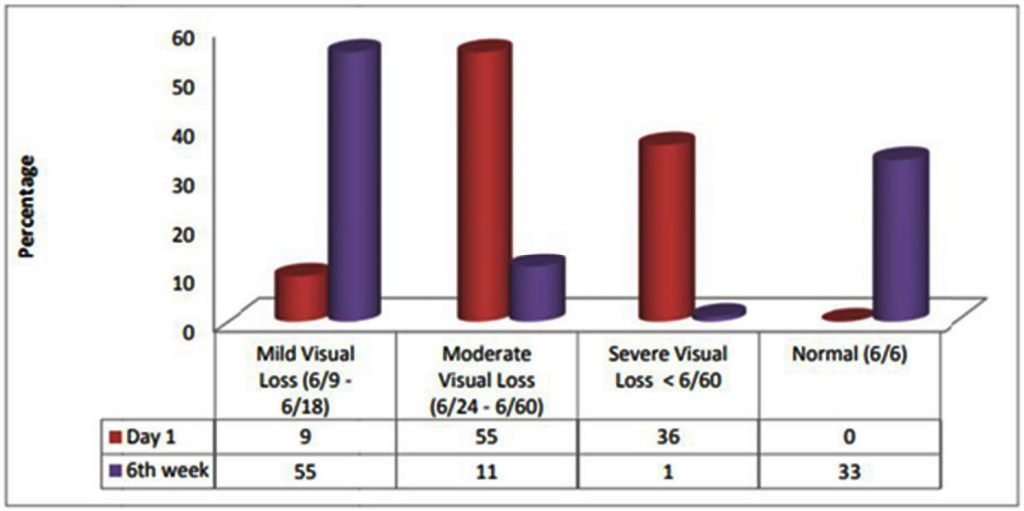

Fig. 4: Visual outcome at 6th week

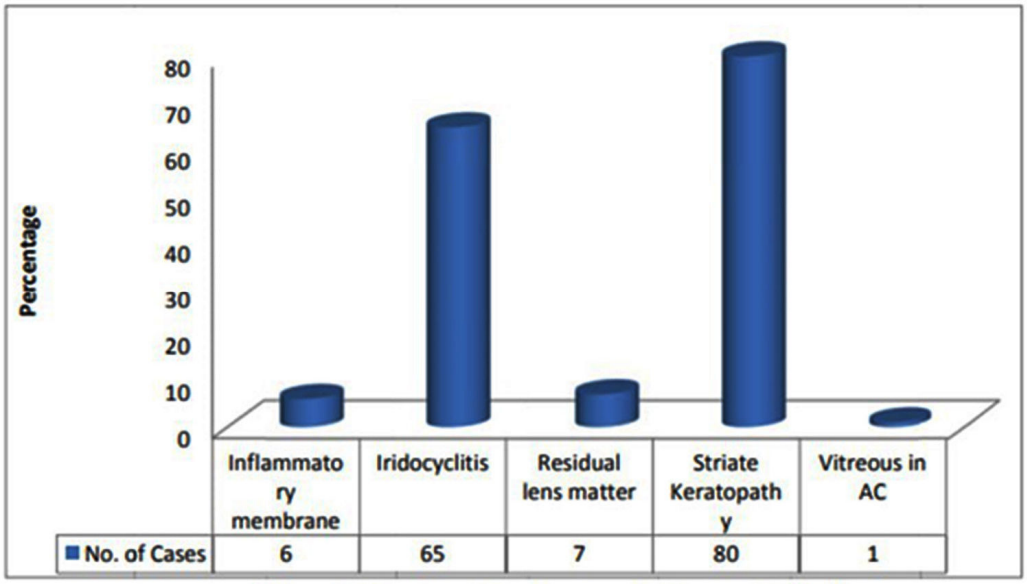

Fig. 5: Causes of sub normal vision on POD 1

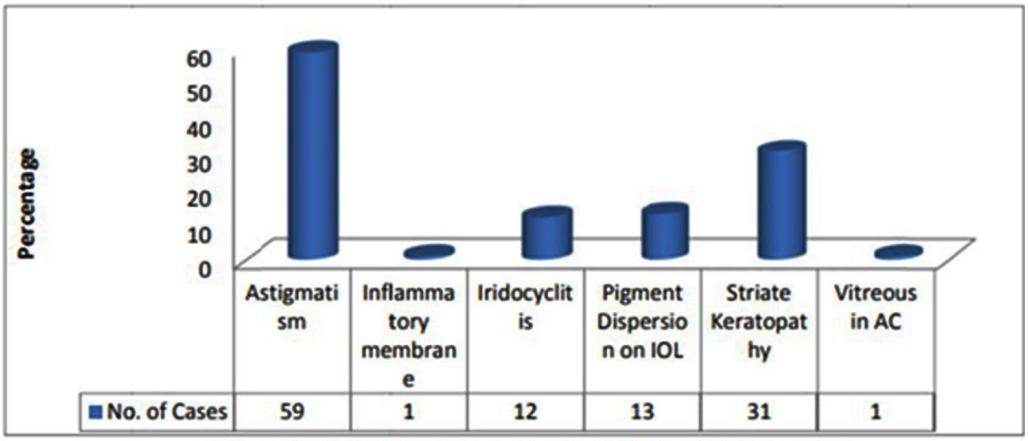

Fig. 6: Causes of subnormal vision on POD 1 week

membrane (1%) and Vitreous in AC (1%) played a major role in hampering the vision post-operatively (Fig. 7).

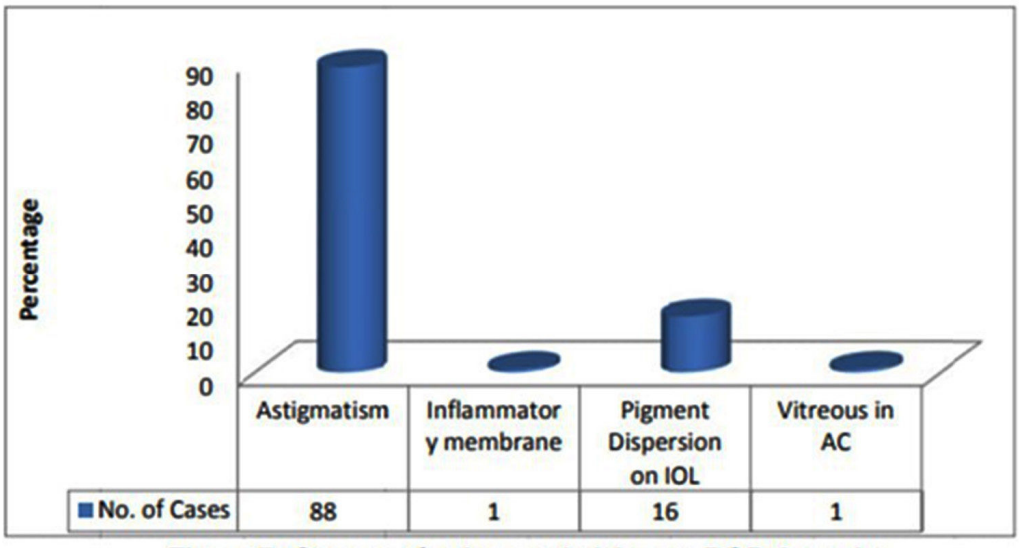

Fig. 7: Causes of subnormal vision on POD 6 weeks

DISCUSSION

In the fast progressing world most of developed countries are evolving with phacoemulsification with IOL implantation, but in developing countries like India, planned SICS with PCIOL implantation is the most commonly done surgery due to socioeconomic status. Any IOL has a capability of producing a vision of 6/6, good field of vision without chromatic aberration after an accurate IOL power estimation, smooth surgery and uneventful post-operative time.

As multiple numbers of factors determine the end visual outcome after cataract surgery few are related to surgeon like skills, few are related to operating setup, few are also related to patient's compliance.

A Total of 100 patients underwent small incision cataract surgery, 99 patients received posterior chamber intraocular lens. 1 patient was rendered Aphakic.

Intra-operative Complications Leading to Subnormal Vision:

Posterior capsule tear was seen in only 1 patient for which manual clear anterior vitrectomy was done and patient was called for secondary IOL implantation on later date, 3 patients had iridodialysis which occurred during small incision cataract surgery was seen during nuclear prolapse,

Iris prolapse occurred in 4 patients which occurred due to positive pressure during the surgery.

Post-Operative Complications Leading to Subnormal Vision:

6% of patients on day 1 and 1 patient on post-op 1 week, 1 patient on post op 6 weeks were found to have inflammatory membrane, 65% of patients on day 1 and 12% of patients on postop 1 week were found to have iridocyclitis which was attributed to excessive handling of iris tissue due to iris prolapse, synechiae, hard nucleus. These patients were started on homatropine eye drops and were followed up regularly. 7% of patients on day 1 had residual lens matter, intra operative miosis.

80% of the patients on day 1 and 31% of patients on post op 1 week had striate keratopathy for which hypertonic solution eye drops was started. Only 1 patient had vitreous in anterior chamber on post op day 1 and 1 week due to posterior capsular rent and vitreous loss. 13% of patients on 1 week and 16% of patients on 6th week showed signs of pigment dispersion on IOL. 59% of the patients and 88% of the patients developed astigmatic error on post op 1 week and 6th week respectively, All the patients had with the rule astigmatism and best corrected visual acuity arranged from 6/6 to 6/18.

At the end of 6 weeks, 1 patient had severe visual loss which was due to vitreous in anterior chamber, 11% of patients had moderate visual loss, which was due to astigmatism with associated pigment dispersion of IOL and 55% of patients had mild visual loss due to astigmatism. Moderate & Severe visual loss which was found to be higher in the 1st week, reduced by the end of 6th week with maximum number of patients falling into mild visual loss category the main reason for which was found to be astigmatism.

Numbers of complications are reduced due to the advancements in cataract surgery and also due to better way of handling tissue. Few complications like toxic anterior segment syndrome, infectious endophthalmitis, cystoid macular edema, choroidal detachment, bullous keratopathy were not seen in any of the patients. Incidences of these devastating complications are almost nearing 0% in this advancement era of surgeries.

Cataract surgery can be a doubled edged sword where it can give vision as clear as 6/6 and can also make patient to loose the vision due to its dreadful complications. In this times of phacoemulsification manual small incision cataract surgery can still be best option in developing countries as it is more economical.

CONCLUSION

Cataract surgery is one of the commonly performed surgeries. To conclude striate keratopathy and iridocyclitis were found to be the major cause for low vision on post-operative day 1. Astigmatism, striate keratopathy, pigment dispersion on IOL are major cause of reduced vision on postoperative 1st week. Astigmatism was found to be the commonest factor causing subnormal vision after cataract surgery where the best corrected visual acuity ranged from 6/6 to 6/18.

Post-operative complications though inevitable when diagnosed at right time and proper management of these complications can still reduce the ocular morbidity. To reduce all these complications proper decontamination of ocular adnexa and conjunctiva with povidine iodine, achieving soft eyeball following peribulbar anesthesia, pre operative and timely postoperative evaluation, ensuring adequate wound closure and creating awareness about the hygiene and usage of eye drops and regular follow ups are emphasized.

REFERENCES

1. Eye Care Unit, Ministry of Health, author. Annual Eye Care Report. Accra: 2010.
2. Kamal R. Dodiya, Neha S. Parmar. Study of the Incidence of Post-Operative Astigmatism in Small Incision Cataract Surgery (SICS) done by 3rd Year Residents. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 Impact Factor (2015): 6.391.
3. Ernest PH, Mc Farmland MS and Siepser SB *et al.*, (1990). Sutureless surgery to minimize astigmatism. In: Gills JP, Sanders, DR eds. Small incision cataract surgery. Thorofare, NJ Slack Inc., 1403.
4. Shepherd JR (1989). Induced astigmatism in small incision cataract surgery. Journal of Cataract and Refractive Surgery 15 85-88.

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1. Place of Publication	:	Delhi
2. Periodicity of Publication	:	Triannual
3. Printer's Name	:	**Dinesh Kumar Kashyap**
Nationality	:	Indian
Address	:	3/259, Trilokpuri, Delhi-91
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[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, *et al.* Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal Author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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