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Occurrence of occludable angles in patients attending a tertiary care centre in rural Karnataka

Sanjana Bharath^{1*}, Sujatha Vijayalekshmi¹, Pallavi B A¹, Vijay Kumar Srivastava¹¹Dept. of Ophthalmology, MVJ Medical College and Research Institute, Bengaluru, Karnataka, India

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ABSTRACT

Background: Glaucoma is responsible for blindness in 1.2 million people and accounts for 5.5% of total blindness, putting it as leading causes of irreversible blindness in India. With early detection and appropriate management, vision loss from glaucoma can often be prevented or significantly delayed.

Aim: To describe the occurrence of occludable angles in hypermetropes, emmetropes and myopes and to emphasize the significance of screening for angle closure suspects in high-risk groups.

Materials and Methods: This a prospective comparative study which includes 120 patients above 40 years. Eye examinations included measurement of visual acuity, refraction, Anterior chamber depth, IOP, Fundus examination, Gonioscopy. The subjects were divided into group of 40 each who were hyperopic with shallow anterior chamber, emmetropic and myopic on refraction.

Results: Out of 120 participants 11 had occludable angles (9.16%). Out of 11 cases 9 were hyperopic, 2 were myopic. Mean IOP of hypermetropes, emmetropes and myopes were 14.575 ± 2.34 , 13.15 ± 2.105 and 13.85 ± 2.377 respectively.

Conclusion: Occurrence of occludable angle is higher in hypermetropes compared to myopes and emmetropes. This study emphasizes the significance of including gonioscopy in routine comprehensive eye examination.

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1. Introduction

Glaucoma affects 2–3% of people over the age of 40 years, but up to 50% may be undiagnosed. It is the second leading cause of blindness in the world.¹ The burden of glaucoma worldwide has been a significant concern, with over 60.5 million people affected in the year 2010 and this number has been projected to rise to 80 million by the year 2020.² Out of a total of 39.36 million blind individuals globally, more than 3 million suffer from blindness as a result of glaucoma.³ The impact of glaucoma is particularly significant in Asia, where an estimated 27.8 million more people are expected to be affected by 2040 and in countries like India and China, the burden of glaucoma is particularly high.⁴ In

India alone, the burden of glaucoma is estimated to be 11.9 million, with a prevalence of blindness affecting 8.9 million individuals and this makes India one of the countries with the highest regional burden of global blindness, accounting for 23.5% of cases.⁵ It is worth noting that glaucoma is the third leading cause of blindness in India, following closely behind cataracts and refractive errors.⁶ This highlights the importance of raising awareness about the condition and ensuring to prevent and manage this potentially debilitating disease.

Primary angle-closure glaucoma (PACG) is more likely to lead to blindness than primary open-angle glaucoma. Detecting Primary angle closure suspects (PAC) at an early stage, before it advances to PACG, can prevent vision loss. Undetected hence untreated glaucoma leads to faster

* Corresponding author.

E-mail address: sanjanasbharath06@gmail.com (S. Bharath).

progression, early visual impairment, and blindness. An occludable angle has the posterior trabecular meshwork visible for less than 90 degrees of the angle circumference with gaze in primary position. Angle closure glaucoma is correlated with many risk factors, such as hyperopia, shallow anterior chamber depth (ACD), increased lens thickness and female gender^{7,8} and that narrow angles occur more frequently in hypermetropic eyes than emmetropic and myopic eye. The main aim of this study is to describe the occurrence of occludable angles in hypermetropes, emmetropes and myopes and to emphasize the significance of screening for angle closure suspects and also comparing the Intra ocular pressure (IOP) of the respective groups. The cause of blindness due to glaucoma is multifactorial. Most cases of blindness are either undetected or diagnosed at a very advanced stage. Key challenges in the management of blindness in India include lack of awareness, cases of blindness that are not detected, lack of access to diagnostic and therapeutic care, and problems related to adherence to treatment.

2. Material and Methods

This prospective comparative study, which was approved by the Institutional ethical committee, was conducted in the Department of Ophthalmology at MVJ Medical College and Research Hospital in rural Bengaluru from June 2023 to August 2023. The study included a total of 120 patients who were over 40 years. The inclusion criteria for the study were individuals aged over 40 years, hypermetropes with shallow anterior chamber depth, myopes, and emmetropes. Patients with clinical evidence of glaucoma, intraocular pressure higher than 21 mm Hg, previous intraocular surgery, refractive surgery, or neurological diseases were excluded from the study.

Informed consent was taken to ensure that all patients participating in the study were fully aware of the procedures and potential risks involved. The eye examinations conducted were comprehensive, including measurements of visual acuity, refraction, and anterior chamber depth (ACD) using Van Herick's technique with a slit-lamp biomicroscope. Additionally, intraocular pressure (IOP) was evaluated using a Perkins applanation tonometer and Dilatation and fundus examination was conducted. Gonioscopy examination was performed to assess the angles of the eye. The grading of gonioscopy findings was based on Shaffer's method. The angles were classified as open and occludable. The subjects were categorized into three groups based on their refractive error: hyperopic individuals with shallow anterior chamber, emmetropic individuals, and myopic individuals. Each group consisted of 40 participants.

2.1. Statistics

The data collected was entered in excel spread sheet and statistical analysis was carried out using SPSS (Statistical Package for Social Sciences) version 20. For both quantitative and qualitative variables, the mean, standard deviation, frequency, and proportions were used to compute descriptive statistics for the explanatory and outcome variables. To examine the statistical relationship between the qualitative variables, chi square was used. The statistical significance of IOP in relation to eye condition was tested using the ANOVA test. The level of significance was set at 5%.

3. Results

In this prospective comparative study of 120 patients, the age distribution was as follows: 51 (42.5%) subjects fell within the age group of 40-49 years, with a significant portion of 41 (34.2%) patients falling in the range of 50-59 years. Additionally, 24 (20%) patients were aged between 60-69 years, while a small minority of 4 (3.3%) subjects were in the age group of 70-79 years. Gender distribution among the patients was fairly balanced, with 58 (48.3%) being male and 62 (51.7%) females. Among the patients, 11 (9.16%) were found to have occludable angles, while the majority 109 (90.83%) had open angles. Among those with occludable angles, 9 (22.5%) had hypermetropia and 2 (5%) had myopia. The mean Intraocular pressure (IOP) was found to be 14.58 \pm 2.343 mmHg in hypermetropes, 13.15 \pm 2.105 mmHg in emmetropes, and 13.85 \pm 2.377 mmHg in myopes. This data is summarized in multiple tables in the study, such as Table 1 for age distribution, Table 2 for gender distribution, Table 3 for angle classification, and Table 4 for IOP correlation with refractive error.

Table 1: Age group distribution

Age group	No. of patients	Percent
40-49	51	42.5
50-59	41	34.2
60-69	24	20.0
70-79	4	3.3
Total	120	100.0

Table 2: Sex distribution

Sex	No. of patients	Percent
Female	58	48.3
Male	62	51.7
Total	120	100.0

4. Discussion

Our study aims to describe the occurrence of occludable angles in individuals with hypermetropia, emmetropia, and

Table 3: Co-relation between IOP and refractive error

Refractive error group	IOP		p value
	Mean	Std. Dev	
Hypermetropia	14.58	2.343	0.02
Emmetropia	13.15	2.105	
Myopia	13.85	2.377	
Total	13.86	2.342	

Table 4: Co-relation between age and IOP

Age in Years	IOP		p value
	Mean	Std.Dev	
40-49	13.098	2.44	0.021
50-59	14.341	2.347	
>60	14.357	2.354	

Table 5: Co-relation between IOP and gender

Gender	IOP		p value
	Mean	Std. Dev	
Male	13.629	2.592	0.389
Female	14.017	2.3068	

myopia. It is important to note that angle closure glaucoma is more commonly observed in India⁹ compared to Western countries. Various studies conducted in southern India have compared the prevalence rates of angle closure, with the Vellore eye study¹⁰ reporting occludable angles in 10.35% of the population. Additionally, the Andhra Pradesh eye disease survey¹¹ found that occludable angles at risk for angle closure were present in 1.4% of adults over 30 and 2.2% of adults over 40. The Chennai Glaucoma Study¹² revealed that 6.27% of the population were considered primary angle closure suspects, with 40% of primary angle closure glaucoma cases being misdiagnosed as primary open-angle glaucoma. In our study, we observed an occurrence rate of 9.16% for occludable angles, highlighting the importance of further research on this topic.

In a study conducted by Tanvi Choudary et al.,¹³ it was found that 23.24% of hypermetropes, 6.72% of myopes, and 2.50% of emmetropes had occludable angles. The mean intraocular pressure (IOP) was measured to be 15.47 +/- 0.463 mmHg in hypermetropic individuals, 13.29 +/- 0.118 mmHg in myopic individuals, and 12.76 +/- 0.58 mmHg in emmetropic individuals. Interestingly, the mean IOP of hypermetropic patients was comparable to the normal IOP of their respective groups. Upon further analysis in our study, it was observed that hypermetropes had higher intraocular pressure compared to emmetropic and myopic individuals, with a statistically significant difference (P value of 0.02). Similarly, in the study by Subba Rao et al.,¹⁴ 18% of patients with a high risk of angle closure were found to have occludable angles, while the remaining 72 had open angles. Furthermore, in a Chinese study by Jiangning,¹⁵ participants with hypermetropia, emmetropia, and myopia

exhibited crude prevalences of 7.43%, 6.4%, and 1.25% respectively, in terms of iris trabecular meshwork contact. These findings shed light on the varying prevalence rates of occludable angles in different refractive error groups.

The variability in results across various studies could be attributed to the disparity in sample sizes as well as differences in the demographic characteristics of the participants. Additionally, the varying definitions of occludable angles utilized by different studies may also contribute to the fluctuations in findings.

4.1. Refractive error and IOP

The association of IOP with refractive error has been inconsistent. Myopia was associated with an increased prevalence of all forms of open-angle glaucoma and Ocular hypertension (OHTN), whereas hyperopia was associated strongly with an increased prevalence of angle-closure glaucoma across all racial or ethnic groups in a study by Shen et al.¹⁶ Shallow ACD and short axial length have been associated with hyperopic individuals, and ACD decreases as lens thickness increases. In addition to having long axial lengths, myopia patients are more likely to have deep ACDs and open angles. Some studies have suggested that myopia may be associated with risk of primary open-angle glaucoma,¹⁷ and hyperopia with possible risk of ocular hypertension.¹⁸ Considering the substantial variability in IOP across populations and the inconclusive findings regarding its associations with age, gender and refractive error, conducting research on its distribution and influencing factors in diverse groups is crucial. This will not only enhance our understanding of this important measure in ophthalmology but also pave the way for more comprehensive approaches towards promoting better eye health worldwide.

4.2. Ageing and IOP

The correlation between intraocular pressure (IOP) and age has been a subject of interest in various studies, with differing results across different populations. In the current study, a significant correlation was observed between IOP and advancing age, as shown in Table 4. It is well-established that as individuals age, they tend to experience pronounced ocular changes, including a decline in aqueous humor secretion and outflow facility, as well as alterations in corneal characteristics.¹⁹ One of the key factors contributing to elevated IOP in older individuals is the onset of structural changes in the trabecular meshwork, which leads to a reduction in trabecular outflow facility and uveoscleral outflow^{20,21} resulting in elevated IOP. While some studies have reported a positive correlation between advancing age and elevated IOP,^{22,23} other studies have yielded conflicting results with no definitive association.²⁴ In fact, some studies have even suggested a negative

relationship between age and IOP.^{25–27} These varying findings emphasize the complexity of understanding the relationship between age and intraocular pressure. Overall, age plays a significant role in the regulation of IOP and can have a profound impact on the risk of developing glaucoma.

4.3. Gender and IOP

There was no statistical difference in IOP in relation to gender (Table 5). The findings were consistent with those of other studies that did not support a correlation between IOP and sex.^{28–30}

The study has a few limitations that should be taken into consideration. Firstly, it is important to note that the findings are based on a hospital setting rather than being derived from a population-based sample. Secondly, the sample size used in the study was relatively small. While gonioscopy is widely acknowledged as the most dependable technique for identifying occludable angles, it does have an inherent subjectivity which should be taken into consideration when interpreting the results.

5. Conclusion

The occurrence of occludable angles is observed to be higher in individuals with hypermetropia compared to those with myopia and emmetropia. Not all individuals with occludable angles will develop angle closure. However, individuals with occludable angles are known to be at a greater risk for this complication. In addition to measuring intraocular pressure (IOP), it is recommended to regularly screen for gonioscopy, especially in those who are at a heightened risk for developing glaucoma. This proactive approach can help in the early detection and appropriate management of the condition, potentially preventing any vision loss or damage to the optic nerve. Having a thorough understanding of the risk factors, diagnostic methods, and treatment options for occludable angles and angle-closure glaucoma is crucial for detecting the condition early, intervening promptly, and safeguarding against vision loss that may result from it. Continued research efforts are necessary to further enhance our knowledge of angle closure and optimize the approaches used in its treatment, with the ultimate goal of alleviating the global impact of angle-closure glaucoma on individuals worldwide.

6. Ethical Approval

The study was approved by the Institutional Ethics Committee.

7. Source of Funding

None.

8. Conflict of Interest

None declared.

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Author's biography

Sanjana Bharath, Post Graduate  <https://orcid.org/0009-0000-7133-4946>

Sujatha Vijayalekshmi, Professor

Pallavi B A, Associate Professor

Vijay Kumar Srivastava, Professor and HOD

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