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ORIGINAL ARTICLE

# Frequency of moderate to high myopia in primary open-angle glaucoma in tertiary care hospital

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A B S T R A C T

**Introduction:** Glaucoma is one of the leading causes of irreversible blindness in the adult population worldwide with Primary Open-Angle Glaucoma being its most common type. Moderate to high myopia is one of the various risk factors associated with POAG. The prevalence of myopia is increasing worldwide, early detection and management of glaucoma in such patients can slow down its progression and prevent vision loss.

**Objective:** The Purpose of this study was to evaluate the frequency of moderate to high myopia in Primary Open Angle Glaucoma (POAG) and to find out the association between myopia and POAG.

**Methodology:** A total of 100 participants were included in this cross-sectional study through consecutive sampling techniques. Refractive error was measured through an auto refractometer. Glaucomatous Patients have been diagnosed as POAG on clinical findings (elevated IOP and optic nerve changes), visual field loss, and/or retinal nerve fiber layer (RNFL) defects. The anterior chamber angle was evaluated with the Van Herrick technique. Chi-Square for independence was used to find an association between myopia and independent variables like gender, education, and socioeconomic background.

**Results:** The mean age of all the participants was 52.36 ± 15.350, with males being 63 and females 37. The frequencies of low, moderate, and high myopia were 34%, 12.5%, and 4% respectively. Male gender had a significant association with the high prevalence of low myopia in patients with POAG (p-value <0.05). Illiteracy and low and middle-class socioeconomic background were the other significant risk factors.

**Conclusion:** Myopia is the major risk factor in POAG and other factors like illiteracy and a poor socioeconomic background attributed to it should be screened and assessed so that earlier detection in the population can prevent vision loss.

**Keywords:** *Frequency, Myopia, Open-angle glaucoma*

## Introduction

Glaucoma (derived from the Greek *glaukós,* a nonspecific term for green or light gray)[1] is one of the leading causes of irreversible blindness in adult populations worldwide and is characterized by multiple pathologic changes. The progressive degeneration of the optic nerve, loss of retinal ganglion cells, thinning of the retinal nerve fiber layer, and progressive excavation of the optic disc are some of the characteristic features of glaucoma pathogenesis.[2-4] Although the mechanisms by which all these changes take place are not yet fully understood but these lead to gradual deterioration of the visual field, which starts from the periphery and then advances until only central vision remains.[5] Primary open-

angle glaucoma is the most frequent type of glaucoma worldwide. Elevated intraocular pressure is a major risk factor for POAG while age, gender, race, refractive error, heredity, and systemic factors may also play a role in its pathogenesis. Myopia has also been associated with POAG, but it still needs convincing evidence.[6]

In open-angle glaucoma, the anterior chamber angle in the eye where the iris meets the cornea is as wide and open as it should be (grade 3 or grade 4 angle with van Herrick technique), but the eye's drainage canals used to drain the aqueous humor become obstructed over time, causing an increase in internal eye pressure and ultimately damage to the optic nerve.[7, 8] In contrast to close angle glaucoma, in which patients have symptoms in the earlier stage, patients with POAG generally report no symptoms in the initial stage and about 33% of patients don't even have any idea about the presence of the disease.[9] One of the behind the late presentation of POAG is that the visual field defects present in POAG are usually compensated by binocular vision as they do not lie in the same part of the fields of the two eyes.

The prevalence of myopia is on a rise globally and is significantly higher in Asian populations as compared to European populations, especially in the younger generations.[10] Even though many studies have suggested a link between Myopia and POAG, there is still not enough evidence to prove it.[11] This association has been linked to a variety of mechanisms. The scleral canal in myopic patients is abnormally large, unusually shaped, and tilted, and the lamina cribrosa and peripapillary sclera are also abnormally thin.[12] This could make a given level of IOP more stressful. But the clinical results aren't unquestionable.[13] In various population-based studies in the United States, it has been estimated that 50 to 75% of people in America don't know that they have glaucoma. By diagnosing and treating glaucoma early, especially in high-risk groups where it is more common and happens more often, vision loss can be prevented and the disease's progress can be slowed down.[14] Even though myopia can be caused by a curved lens or cornea or by other things, axially elongated eyes make up the majority of all myopia cases. Axial elongation can damage the optic disc or macula, which are important parts of the eye that glaucoma tends to damage. Many studies have shown that myopia is a risk factor for developing glaucoma.[15] The prevalence of glaucoma is increasing day by day and POAG being its most common type is becoming a major threat the visual loss in a large number of people. A better understanding and management of all the risk factors associated with glaucoma could prove to be useful in slowing down the progression of the damage caused by the disease.

Besides several other risk factors, myopia is associated with the majority of patients with POAG. Since there is no perfect reference standard for confirming the diagnosis of glaucoma and also the majority of screening tools for its diagnoses such as fundus photography, optical coherence tomography, and perimetry are only available in tertiary eye care hospitals, the early detection of POAG gets very difficult in less developed areas that's why most patients present late in the course of their disease when substantial visual damage has already occurred. Therefore need of the hour to refer myopic patients, old age patients, and those with a family history of the disease for glaucoma screening so that glaucoma, if any can be diagnosed and managed earlier to prevent damage.

## Methodology

A cross-sectional study was conducted from July 2021 to December 2021 at the Glaucoma Department of Al-Shifa Trust Eye Hospital, Rawalpindi. A sample of 100 subjects was taken through a consecutive sampling technique. A structured proforma based on previous research and clinical findings was used to gather the data.

Patients presenting in the glaucoma department were screened out for any ocular pathology after being examined through a 90D lens and slit lamp by an Ophthalmologist. Patients with a history of trauma or ocular pathology, any ocular fundus abnormality, without clear ocular media or central fixation were excluded. Intraocular pressure was measured with an applanation tonometer. The Anterior chamber angle was evaluated with the Van Herrick technique. Patients having open-angle glaucoma were shortlisted for the study.

The standard criteria for suspected glaucoma were as follows: (1) IOP ≥22 mmHg; (2) horizontal or vertical cup-to-disc ratio (CDR) ≥0.5; (3) violation of the ISNT rule (neuroretinal rim thickness in the following order by quadrant: inferior > superior > nasal > temporal); (4) presence of optic disc hemorrhage; or (5) presence of retinal nerve fiber layer (RNFL) defect. After that informed

consent was taken from them and subjects who were willing to participate were included in the study for further examination.

Their confidentiality was ensured by the 1975 Helsinki Declaration (as revised in Tokyo in 2004). This research was carried out after the approval of the Institutional Review Board (IRB) reference no Opto-IRB/11-02 of Al-ShifaTrust Eye Hospital, Rawalpindi. Demographic data were collected first which included age, gender, socioeconomic status, area of residence, and educational history. Visual acuity was then taken through the Snellen chart and converted into logMAR values. Autorefractometer was used to find the refractive status of the subjects. Subjective refraction was carried out by the researcher himself and the data obtained was noted in the proforma.

Chi-square for independence was used to find an association between myopia and independent variables. All the subjects were divided into three categories according to the level of spherical equivalent like emmetropic (-0.50 <SE< 0.50), myopic (SE <-0.50), and hyperopic (SE ≥ 0.50). Myopic subjects were further classified into low myopic (SE < -3.00), moderate myopic (SE= -3.00 to -6.00), and high myopic (SE> -6.00).[15]

## Results

### Demographic Characteristics

In this study, a total of 200 eyes from 100 participants were assessed. Both genders were included out of which males 63 and females were 37. The mean age of all the participants was 52.36 ± 15.350, ranging from 18 to 84 years. 42 of the total number of subjects were literate, whereas 58 were illiterate. 59 of the participants were from rural areas, whereas 41 were from urban areas. Table 1, all of the participants were from the lower and middle classes (42 and 58, respectively).

**Table 1: Frequency Distribution of Demographics**

| Demographics | Frequency |
|---|---|
| **Gender** | |
| Male | 63 |
| Female | 37 |
| **Educational Status** | |
| Literate | 42 |
| Illiterate | 58 |
| **Family Status** | |
| Lower Class | 42 |
| Middle Class | 58 |
| **Area of residence** | |
| Rural | 59 |
| Urban | 41 |

### Clinical Features

Out of 100 subjects, 89 had blurred vision in both eyes while 51 had eyestrain, 53 had a headache, 49 had redness of eyes, and 52 had difficulty in seeing after evening (Table 2).

**Table 2: Frequency Distribution of Clinical Features**

| Ocular History | Frequency |
|---|---|
| Blurred vision | 89 |
| Eyestrain | 51 |
| Headache | 53 |
| Redness of eyes | 49 |
| Reduced vision in even | 52 |

### Visual Acuity

Out of 200 eyes, 31 eyes had mild to severe media opacities and hence VA in log MAR was not possible (HM to NPL). The mean uncorrected visual acuity (UCVA) of the remaining 169 eyes was 0.74 log MAR (SD=0.413). After subjective refraction, 172 eyes had improvement in vision and the Mean Best Corrected Visual Acuity (BCVA) of these eyes was noted which was 0.48 log MAR (SD=0.413) Table 3.

**Table 3: Frequency Distribution of Visual Acuity**

| Visual Acuity | N | Valid | Missing | Mean ± SD |
|---|---|---|---|---|
| UCVA | 200 | 169 | 31 | 0.74 ± 0.413 |
| BCVA | 200 | 172 | 28 | 0.48 ± 0.413 |

### Subjective Refraction

28 eyes were not able to be corrected due to moderate to severe opacities as those patients were excluded from the study. Out of the remaining 172 eyes, 54 (27.0%) had

emmetropia, 68 (34.0%) had low myopia, 25 (12.5%) had moderate myopia, 8 (4.0%) had high myopia while 17 (8.5%) had hyperopia (Table 4).

**Table 4: Frequency Distribution of Subjective Refraction**

| Refractive Error | Frequency | Percentage (%) |
|---|---|---|
| Emmetropia | 54 | 27.0 |
| Low Myopia | 68 | 34.0 |
| Moderate Myopia | 25 | 12.5 |
| High Myopia | 8 | 4.0 |
| Hyperopia | 17 | 8.5 |
| Missing | 28 | 14.0 |
| Total | 200 | 100 |

**Inferential Statistics**

Chi-Square for independence was used to find an association between myopia and independent variables. In gender-wise distribution, the male gender had a significant association with the high prevalence of low myopia in patients with POAG (p-value <0.05). Illiteracy and low and middle-class socioeconomic background were the other major risk factors associated. Eyestrain was the only chief complaint associated with the myopic patients presenting with POAG (p-value <0.05), Table 5.

**Table 5: Demographics and Chief Complaints associated with POAG**

| Demographics | Frequency | $X^2$(df) | p-value |
|---|---|---|---|
| **Gender** | | | |
| Male | 63 | 6.230(1) | 0.046* |
| Female | 37 | | |
| **Educational Status** | | | |
| Literate | 42 | 8.179(1) | 0.016* |
| Illiterate | 58 | | |
| **Family Status** | | | |
| Lower Class | 42 | 7.068(2) | 0.027* |
| Middle Class | 58 | | |
| **Area of residence** | | | |
| Rural | 59 | 2.482(2) | 0.311 |
| Urban | 41 | | |

Statistically significant (p-value <0.05)

## Discussion

The main objectives of this study were to find the frequency of moderate to high myopia in Primary Open Angle Glaucoma (POAG) and to find the association of different factors which lead to myopia in POAG. According to the national survey on blindness and visual impairment, the estimated prevalence of blindness in Pakistan is 1.05 to 1.09% with Glaucoma contributing as a third major cause of blindness (7.1%).[16]

Results show that the mean age of all the subjects was 52.36 ± 15.350, ranging from 18 to 84 years. Out of the 100 subjects included in the study, 89 had decreased VA ranging from 0.20 logMAR to NPL. The mean uncorrected visual acuity (UCVA) was 0.74 log MAR (SD=0.413). After subjective refraction, Mean Best Corrected Visual Acuity (BCVA) was taken, which was 0.48 log MAR (SD=0.413). A spherical equivalent was noted after adding half of the cylindrical value to the spherical value of the prescription. Out of the total sample, 54 eyes (27%) had emmetropia (-0.50 <SE <0.50), 101 eyes (50.5%) had myopia (SE ≤ -0.50) while 17 eyes (8.5%) had hyperopia (SE ≥ 0.50). Data were missing for 28 eyes (14.0%) due to media opacities as in those subjects one eye was included but the other eye doesn't follow inclusion criteria. Out of the 101 myopic eyes, 68 eyes (67.3%) had low myopia (SE < -3.00), 25 eyes (24.7%) had moderate myopia (SE= -3.00 to -6.00) while 8 eyes (8.0%) had high myopia (SE> -6.00).

The factors responsible for the increased number of myopic patients reporting POAG were male gender (p-value=0.046), low socioeconomic background (p=0.027), and low education level (p=0.016). Area of residence had a statistically insignificant relationship with the increased number of myopic cases having POAG (p=0.311). The only chief complaint that has a significant relationship was eyestrain (p=0.021). Headache (p=0.126), redness of eyes (p=0.948), and difficulty seeing at dusk (p=0.165) had no statistically significant relationship with myopia in patients with POAG. The increased risk of glaucoma with increasing age is noticed in almost all population studies. According to Chauhan, patients older than 60 years manifested seven times higher incidence of glaucomatous visual field defects than those under 40 years. Some studies have reported that the prevalence increase becomes significant after the age of 60.[17] Our study also confirms the same finding as

evident from the mean age of all the subjects in this study which was 52.36 ± 15.350.

Gender has no statistically significant impact on the prevalence of POAG as some studies report male while some report female gender to be the major risk factor for POAG.[18] In our study, the male gender (63%) has been reported to be the major risk factor as compared to the female gender (37%). A study in Canada indicates that low socioeconomic status is associated with greater severity of glaucoma, specifically for those ≥65 years old.[19] It could be interpreted as low socioeconomics leading to more blindness that eventually causes more disability and hence starting a vicious cycle of increasing poverty. It came out as no surprise when our data showed that low socioeconomic status (p-value=0.027) was the major risk factor for the prevalence of myopia and ultimately POAG. Importance should be given to glaucoma education and screening, especially in poor areas.

Most studies indicated a low level of education as a contributing factor of blindness and the same is the case with glaucoma as its prevalence is decreased with increasing levels of education and income.[15] Our study has also confirmed the same finding as illiteracy (58%) was the major risk factor associated with myopia and POAG (p=0.016). Whether a person is illiterate or literate, they have no prior knowledge about glaucoma and they only visit hospitals when there is severe visual loss. Studies have shown that people coming from rural areas were more prone to advanced glaucoma due to a lack of proper medical facilities and tools for diagnostics and management of glaucoma patients in rural areas. But in this study, the area of residence was not found to be significant (p=0.311).

Primary open-angle glaucoma remains symptoms less in the earlier stage due to the silent nature of its pathogenesis till the advanced stage is reached when people start to experience visual disturbances. Patients become only aware when they notice vision loss or blind spots, which usually occurs in the late or severe stage of glaucoma and a substantial degree of irreversible optic nerve damage may have already occurred.[19] Our study has found no significant relationship between the various symptoms associated with POAG and myopia except eyestrain which has a statistically significant relationship (p=0.021).

## Conclusion

In conclusion, our results show that, as myopia and glaucoma are both among the most prevalent and rapidly increasing eye diseases causing vision impairment and blindness globally, emphasis on knowledge about glaucoma, proper eye consultation, behavior toward the irreversible nature of the disease, and its proper management should be made especially in myopic patients.

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