



Original Article

Association between Myopia and Glaucoma; A Cross-sectional Study

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ABSTRACT

Myopia is a major cause of worldwide avoidable blindness and its prevalence increasing rapidly.

Objective: To investigate the prevalence of glaucomatous optic nerve damage with various myopia levels as well as the relationship between myopia and glaucoma. **Methods:** A multi-centered cross-sectional study was conducted from January 2022 to July 2022. 250 individuals between the ages of 40 and 65 were recruited using non-probability purposive sampling technique. Mild, moderate and severe degree of myopia who had never had any surgery were included. All subjects underwent refraction and the optic disc ratio was assessed by slit lamp biomicroscopy, perimetry was performed to evaluate the visual field defects and IOP was determined using air puff tonometer. Frequency of glaucoma indicated by presence of visual field defects, glaucomatous optic disc. SPSS software was used for data analysis. **Results:** 145 (58%) of the 250 total subjects were female and 105(42%) were male. 67 (26.8%) people had refractive errors of mild myopia up to 3D. While 85 (34%) had a severe degree of myopia (refractive error greater than 6D) and 98 (39.2%) had a moderate degree. No intragroup's intraocular pressure showed a significantly distinct configuration. Age-related VF anomalies (a larger blind region, a vertical cup to disc ratio, and an unjustified defect) were associated with both glaucoma and high myopia. Findings from the study indicated that glaucoma risk increased for those with high myopia ($p=0.001$). **Conclusion:** High myopia is strongly associated with glaucomatous changes and a high prevalence of optic disc damage.

INTRODUCTION

Glaucoma is the most common cause of permanent blindness in the world [1]. Even if individuals with visual field anomalies are not aware of their diagnosis, it can have a negative influence on their quality of life [2,3]. The most prevalent type of the disease is POAG in various populations [4]. The main therapy objective of therapy is to lower the IOP which cause no further glaucomatous changes [5, 6]. Although the pathophysiology of glaucoma is currently unknown, genetic and environmental factors are likely to have an impact on it [7, 8]. Therefore, the

discovery of new risk factors might enable earlier and more thorough screening of populations at risk. Additionally, it might shed light on the pathophysiology of the disease [9]. Myopia is the most typical type of vision impairment that affects people globally [10-12], and in recent decades, its incidence has gone up dramatically, especially in Asian countries [13-15]. There are several explanations for the rising prevalence of myopia, including more study and near-work time, decreased outdoor time, greater education levels, and genetic factors [16-19]. Iris colour and

myopia development are also correlated [20]. Numerous ocular pathologies, such as cataracts [21] and retinal detachment [22] have been linked to high myopia (6 D). Myopia may or may not be a risk factor or a predictor for the initial onset and progression of glaucomatous optic nerve injury, according to the results of earlier investigations [23-25]. The optic nerve head (ONH), a structure in the posterior ocular fundus, mediates the entry and exit of the retinal blood vessels as well as the ejection of the retinal ganglion cell axons. It is located 4-5 mm nasally and somewhat superiorly from the fovea in emmetropic eyes (mean disc-fovea angle) [26, 27]. Bruch's membrane (BM), the choroid, and the peripapillary scleral flange, respectively, constitute the inner, middle, and external layers of the ONH canal anatomically [28]. The phrase "optic disc" describes the entire area, including the lamina cribrosa at its base, and can be used to describe the size and shape of the structure. The average inter-individual variability in optic disc size among Caucasians is 1:7 [29]. The optic disc in extremely myopic eyes enlarges with longer axial length or greater myopic refractive error, starting at a cut-off value of roughly eight diopters or an axial length of about 26.5 mm [30]. The size of the disc is likely not a determinant in the development of glaucoma in eyes that are not severely myopic, as there are typically no noticeable disc size differences between primary and secondary open-angle glaucoma groups [31]. A greater incidence of glaucomatous optic neuropathy is associated with the size and existence of a secondary macrodisc in eyes with severe myopia [32]. This cross-sectional study's objectives were to assess the relationship between myopia and glaucoma as well as the prevalence of glaucomatous optic nerve injury among myopic individuals. The findings of this study may help determine whether or not myopia indicates a significant risk for glaucoma, which is the primary cause of permanent blindness worldwide. Even if patients are ignorant of their visual impairment, myopia has a severe impact on their quality of life.

METHODS

A multi-centered cross sectional study was conducted from January 2022 to July 2022. 250 subjects between the ages of 40 and 65 were recruited using a non-probability purposive sampling technique. With the support of the Raosoft sample size calculator, the sample for this study has been estimated. Mild (up to 3D) moderate (3D to 6D) and severe degree (more than 6D) of myopia who had never had a cataract or refractive surgery were included. This study omitted pathological myopia, secondary myopia, ocular illnesses (amblyopia, strabismus, congenital ocular disease), and history of ocular interventions (LASIK, cataract surgery). Patients whose IOP was greater than 40

mm Hg were excluded from this study. All subjects underwent visual acuity assessment, refraction evaluation and slit lamp biomicroscopy examination. In addition tonometry and perimetry was also performed. The visual acuity of each individual was tested using a logMar chart which is a standardized chart used to test visual acuity. Then perform a refraction analysis (objective and subjective). To achieve the best corrected visual acuity, objective refraction was performed using an auto refractometer in conjunction with subjective refraction. auto-refractometer, which is a computerized instrument that measures the refractive error of the eye without any input from the patient. Subjective refraction was performed by asking the patient to choose between different lenses to obtain the best possible visual acuity. A slit lamp biomicroscopy to examine the anterior and posterior segments of the eye in details. Its was also used to evaluate the optic disc ratio and identify glaucomatous optic discs. Visual field abnormalities were assessed using perimetry. Intraocular pressure (IOP) was measured using an air puff tonometer. The data were compiled using a self-structured proforma, and SPSS software was used for descriptive statistics and chi square analysis. A p-value of 0.05 or less was regarded as significant.

RESULTS

A multi-centered cross sectional study was conducted from January 2022 to July 2022. 250 people between the ages of 40 and 65 were recruited using a non-probability purposive sampling technique. Age distribution was among 5 groups (Figure 1) as follow 41-45 years, 46-50 years, 51-55 years, 56-60 years and 61-65 years.

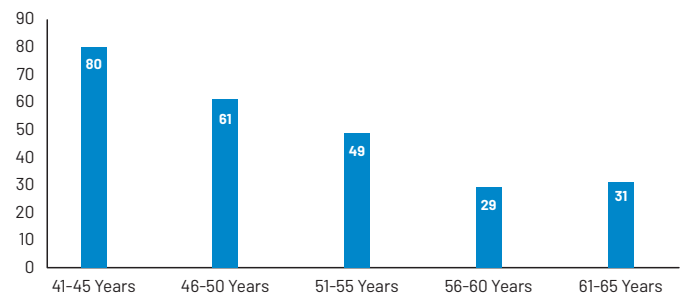


Figure 1: Age Distribution

In this study, 145(58%) of the 250 total subjects were female and 105(42%) were male (Figure 2).

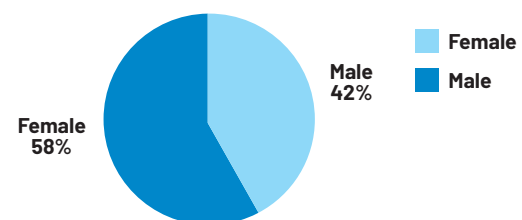


Figure 2: Gender Distribution

In current study, 67 (26.8%) people had refractive errors of mild myopia up to 3 D. While 85 (34%) had a severe degree of myopia (refractive error greater than 6 D) and 98 (39.2%) had a moderate degree (Figure 3).

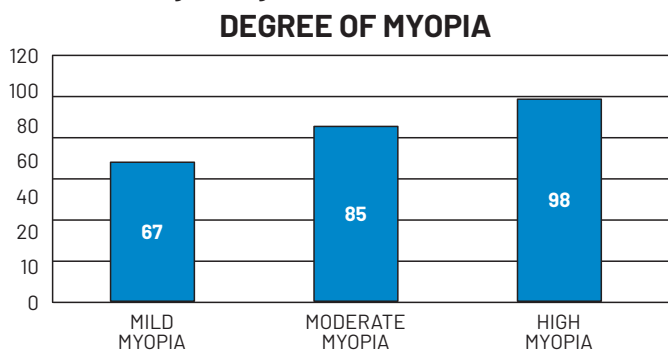


Figure 3: Degree of Myopia

According to the present study, frequency of glaucoma, as indicated by presence of visual field abnormalities, glaucomatous optic disc and may or may not raise IOP. Chi-square statistics were used to examine degree of myopia and glaucomatous changes. There was a significant relationship at 5% significant level between high myopia and glaucomatous changes of respondents (Table 1).

Table 1: Degree of Myopia and Glaucoma Association (Optic Disc Enlargement, visual field defects and raised IOP)

Degrees of myopia	Optic Disc Enlargement	Visual Field Defects	Raised IOP	p-value
Mild Myopia	5	2	6	0.13
Moderate Myopia	53	29	48	0.06
High Myopia	91	51	85	0.001

Older age was linked to both glaucoma and high myopia-related VF abnormalities (a larger blind area, a vertical disc ratio and an unidentified defect). According to study findings, people with high myopia were more likely to get glaucoma (p 0.001).

DISCUSSION

The latest findings are consistent with significant population-based research on myopia and glaucoma from decades previously. According to the BMES [33], glaucoma has been connected to the development of matched optic disc cupping with rim thinning (cup-to-disc ratio 0.7, or cup-to-disc asymmetry 0.3), as well as detectable visual field loss on automated perimetry. The most recent findings concur with significant population-based research on glaucoma and myopia that were done decades ago. The development of matched optic disc cupping with rim thinning (cup-to-disc ratio 0.7, or cup-to-disc asymmetry 0.3) and detectable visual field loss on automated perimetry have both been associated with glaucoma, according to the BMES [33]. According to the Tajimi Study in Japan and the Aravind Comprehensive Eye Survey in India, there is a link between POAG as evaluated by

a thorough ophthalmologic exam and myopia greater than one degree [34, 35]. According to the BES in China [33], extremely high myopia (higher than 6 D), the onset of glaucomatous optic nerve, anomalies of the visual field, and increased IOP have all been connected. The Rotterdam Eye Study in the Netherlands found a connection between adverse myopia greater than 4 D and glaucomatous visual field loss [36, 37]. The findings of the present study suggest that defined to high myopia may be an indicator of risk for glaucoma, while low to moderate myopia may not have a significant impact on glaucoma. If myopia has been categorised as low to moderate myopia and marked or high myopia after just a myopic refractive error of 6 diopters. The results of the current study are consistent with a 30 000-person eye survey undertaken in Malmö before the Early Manifest Glaucoma Experiment. According to the Malmö Eye Survey [38], as myopia increased, so did the prevalence of glaucoma. At initial intraocular pressure levels, the relationship between myopia and glaucoma was strong, but it gradually weakened as intraocular pressure climbed. People with high myopia may need more frequent eye health management because they may be more susceptible to glaucoma and optic nerve damage. Individuals with high myopia should undergo thorough eye exams frequently to check for any warning signs of optic nerve damage or glaucomatous changes.

CONCLUSIONS

High myopia is strongly associated with glaucomatous changes and a higher prevalence of optic disc damage compared to low or moderate myopia.

Authors Contribution

Conceptualization: MJ

Methodology: NF, FQ

Formal analysis: MS

Writing-review and editing: FR, AMB

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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