

# Evaluation of Myopia as a Risk Factor for Glaucoma

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**Abstract:** *Background:* Several factors including myopia has been attributed as a risk factor for the development of glaucoma. However the exact relationship between myopia and glaucoma still remains unanswered. *Methods:* Subjects with any myopia ( $\geq 1.0$  diopter [D]) were identified by a standardized subjective refraction and categorized into low myopia ( $< 2D$ ) or moderate ( $> 2D - 6D$ ) and high myopia ( $> 6D$ ) over a period of 6 months. IOP was estimated using Goldman applanation tonometry. Anterior chamber angle assessment was done using Van herick technique in all patients and Gonioscopy in selected patients. Glaucoma was diagnosed from characteristic visual field loss, combined with optic disc cupping and rim thinning. *Result:* Of the 200 eyes of 100 patients enrolled on this study 18% (36 eyes) had established glaucoma. While a large proportion of study group (84%) had suspicious disc changes in the form of increased Cup Disc Ratio (CDR), notching and thinning of neuroretinal rim, 18% had corresponding Visual field changes. 10% patients had IOP outside normal limits. *Conclusions:* This study has confirmed myopia as a risk factor for glaucoma. Hence it is beneficial to screen patients with myopia at regular intervals for progression into glaucoma.

**Keywords:** Glaucoma, Myopia, Cup Disk Ratio, visual field.

## 1. Introduction

Glaucoma is one of the leading causes of irreversible blindness in the adult population worldwide. In addition to elevated intraocular pressure, there is growing evidence of other risk factors like age, gender, race, refractive error, heredity and systemic factors.[1]

Numerous studies have shown that refractive errors, especially medium-to-high myopia, are independent risk factors for POAG. One of the hypothesis laid down for such a relationship includes scleral thinning that occurs in high myopia, which reduces the tolerance of the sclera and optic nerve to elevating intraocular pressure (IOP), thereby leading to further elongation of the ocular axis and injuries to optic nerve functions, consequently leading to primary open-angle glaucoma (POAG).[2] The pathogenesis of glaucoma in myopes is also likely to be influenced by both genetic and environmental factors.[3-5]

The prevalence of myopia has been increasing in the recent years.[6] In view of the evidences depicting myopia as a risk factor for Glaucoma, the prevalence of this blinding disease is therefore, also expected to rise in the coming years. Although many studies found that myopia is associated with glaucoma, direct and convincing evidences are still lacking. The purpose of this study is to evaluate the evidences implicating myopia as a risk factor of glaucoma.

## 2. Aim and Objects

To evaluate myopia as a risk factor for glaucoma

## 3. Methods

Subjects with any myopia ( $>$  or  $= -1.0$  diopter [D]) were identified by a standardized subjective refraction and categorized into low myopia ( $< 2D$ ) or moderate ( $> 2D - 6D$ ) and high myopia ( $> 6D$ ) over a period of 6 months. A total of 100 subjects (52 males and 48 females) were enrolled in this

study within the age group of 5 – 50 years. A detailed ocular examination including slit lamp examination was done. Visual acuity assessment was done using Snellens Visual Acuity chart. Intra ocular pressure (IOP) was estimated using Goldman applanation tonometry. Anterior chamber angle assessment was done using Van herick technique in all patients and Gonioscopy in selected patients. Optic disc assessment was done by direct and indirect ophthalmoscopy, Slit lamp biomicroscopy and documented using stereoscopic fundus photography. Cup disc ratio (CDR) and Disc damage likelihood score (DDLS) was documented in all patients. Humphrey field analyzer was used to assess the visual field changes. Glaucoma was diagnosed from characteristic visual field loss, combined with optic disc cupping and neuroretinal rim thinning.

## 4. Result

200 eyes of 100 patients were studied. 52 males and 48 females were enrolled in this study. 104 eyes had mild degree of myopia, 76 eyes were moderately myopic and 20 had high myopia. Of the total 44% (88) eyes had IOP less than 15 mmHg, a majority i.e 46% (92) had IOP in higher teens ( $< 16$  mmHg) and a significant minority i.e 10% (20) of the eyes presented with IOP of greater than 21 mmHg (Fig 1). On analyzing the distribution of Intraocular pressures within the three categories of myopia, it is seen that majority of mild (42.30%) and moderate (47.39%) myopes had IOP  $< 15$  mmHg, whereas majority of High myopes (60%) had IOP above 21 mmHg. Moreover, all of the high myopic eyes had IOP above 16 mmHg (Table 1)

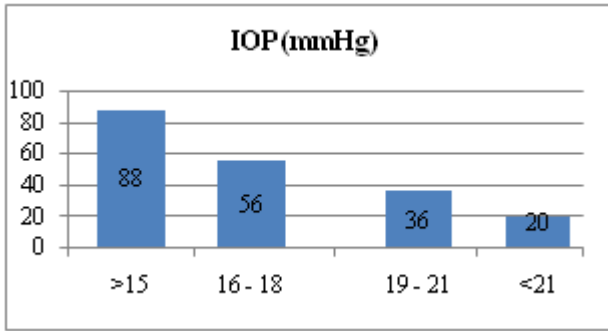


Figure 1: Distribution of IOP in the study population

Table 1: IOP distribution within mild, moderate and high myopic eyes

IOP range	Mild myopia	Moderate myopia	High myopia
<15 mmHg	44 (42.30%)	36 (47.39%)	0 (0%)
16- 18 mmHg	27 (25.96%)	24 (31.58%)	4 (20%)
19-21 mmHg	24 (23.07%)	8 (10.53%)	4 (20%)
>21mmHg	9 (8.65%)	8 (10.53%)	12 (60%)
	104 (100%)	76 (100%)	20 (100%)

Assessment of Glaucoma: A Significant majority, 168 (84%) eyes showed CDR of more than 0.4, while 32(16%) eyes had CDR of  $\leq 0.4$  (Fig 2, 3). 86% of the discs were documented to be disc at risk (DDLs score of  $\leq 4$ ), 8% of discs showed Glaucoma Damage (DDLs score of 5-7) and 6% had Glaucoma disability (DDLs score of 8-10)(Fig 4). Although a large number of eyes had suspicious disc changes only 18% (36) of the eyes had associated glaucomatous visual field defects in addition to disc changes and hence were diagnosed as glaucomatous eyes. While in remaining 82% (164) visual field was normal (Fig 5).

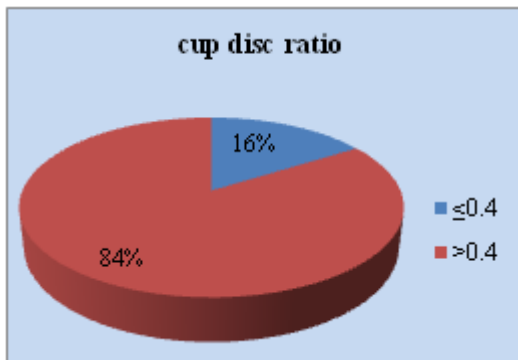
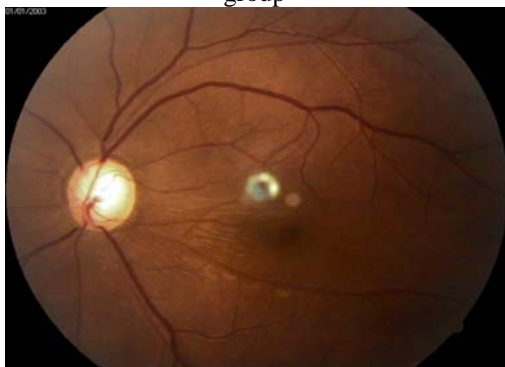
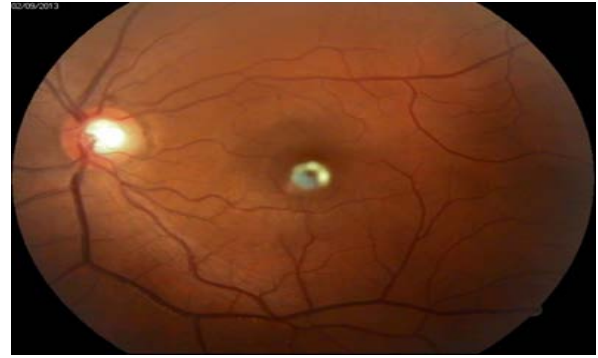


Figure 2: Pie chart showing CDR assessment in the study group



(a)



(b)

Figure 3: (a) Glaucomatous optic disc in a myopic eye (b) Suspicious disc changes in a non-glaucomatous myopic eye.

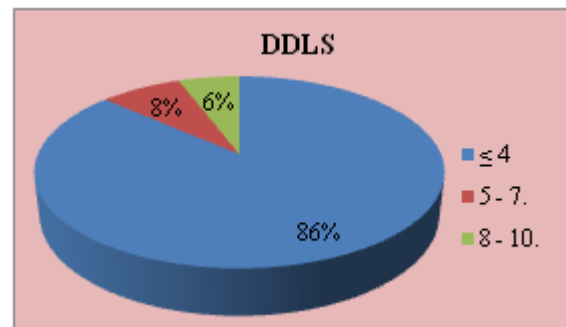


Figure 4: Disc Damage likelihood Score in the study group

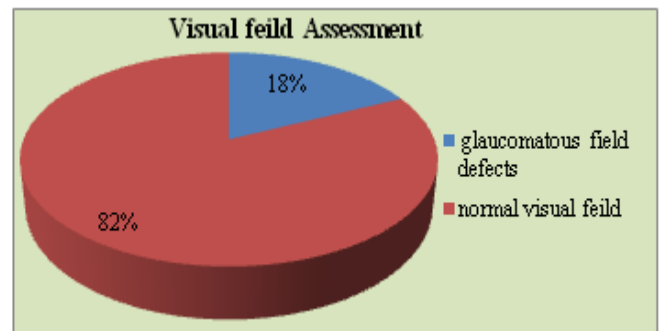
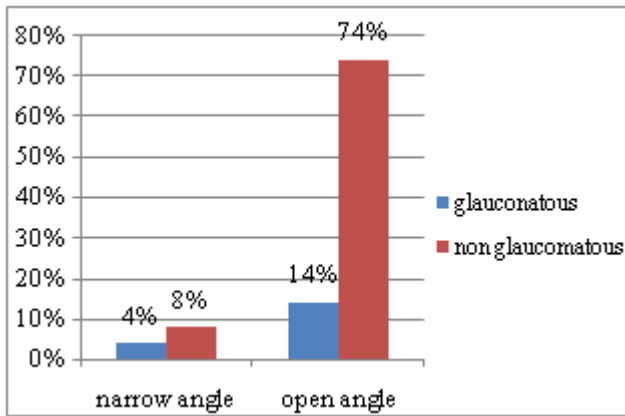


Figure 5: Assessment of Visual Field

Anterior chamber depth assessment using Van herick grading and Gonioscopy revealed open anterior chamber angles in majority (88%) of eyes of the study population, while 12% had narrow angles (Fig 6). Of the 36 eyes (18% of study group) with Glaucoma, 28 (14%) had open angle glaucoma while 8 (4%) had narrow angle glaucoma. Among those with open angle glaucoma, 20 (10%) had Primary open angle glaucoma and 8 (4%) had Normotensive glaucoma. In this study a higher prevalence of glaucoma was seen in myopic females (25%) than in myopic males (11.54%) (Table 2). No relationship could be established with incidence of Glaucoma to the degree of myopia.



**Figure 6:** Assessment of angle of anterior chamber

**Table 2:** Sex preponderance for Myopia with Glaucoma

	Females	Males
glaucomatous	12(25%)	6(11.54%)
non glaucomatous	36(75%)	46(88.46%)
	48(100%)	52(100%)

## 5. Discussion

Most studies have suggested that moderate to high myopia is associated with increased risk of POAG. The Blue Mountains Eye Study, after adjusting for age, sex, and other risk factors, found a strong relationship between POAG and myopia, with an odds ratio of 2.3 in eyes with low myopia (between -1.0 and -3.0D) and 3.3 in eyes with moderate-to-high myopia (>-3.0D). [7] Although no particular pattern was observed regarding incidence of glaucoma to the degree of myopia in this study, however a strong relationship was observed with intra ocular pressure, an independent risk factor for glaucoma and the degree of myopia with high myopes having IOP above 16mm Hg of which 60% were outside normal limits. Perkins and Phelps found that compared with the normal population, myopic patients were more prone to POAG, ocular hypertension and low-tension glaucoma. [8] Wang et al. observed that POAG was significantly more prevalent in high myopic patients than in normal individuals (1.20% vs. 0.21%). [9] This study revealed 84% of eyes having suspicious disc changes and 18% having established glaucoma indicating a strong relationship between myopia and glaucoma. Also, the most common type of glaucoma seen in our study is POAG which in agreement with most other studies.

## 6. Conclusion

Glaucomatous changes in optic disc and visual fields are seen in a significant proportion of myopic individuals. Large number myopic eyes are also found to have intraocular pressure on the higher side of normal value and a significant number of high myopic eyes are found to have IOP outside normal limits. Most common type of glaucoma seen in myopic individuals is Primary Open Angle Glaucoma (POAG). Myopic females are more likely to have glaucoma than myopic males. This study has confirmed a strong relationship between myopia and glaucoma indicating myopia as a risk factor for glaucoma and hence it is

beneficial to screen patients with myopia at regular intervals for progression into glaucoma.

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