

EFFECT OF MYOPIA ON PRIMARY OPEN ANGLE GLAUCOMA

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ABSTRACT

Objective: It is a retrospective study to evaluate the effect of myopia on primary open-angle glaucoma by classifying the eyes into NMG (non-myopic glaucoma), HMG (highly myopic glaucoma) And MMG (mild to moderate myopic glaucoma).

Methods: The study was performed on 120 patients with primary open-angle glaucoma who were medically treated. Any participant who had surgery done was excluded from the study. The relation between glaucoma and different myopia and progression were assessed on the basis of age, gender, risk factors.

Results: Out of the 120 cases assessed, 46 [38 percent] were female and 74 [62 percent] were males. On the basis of age there were 9 cases between 31-40 y, 30 cases between the ages 41-50, 40 cases between 51-60, 32 cases between 61-70 and 9 cases between 71-80, on the basis of myopia 59 [49 percent] were NMG 47 [39 percent] were MMG and 14 [12 percent] were HMG. On the basis of risk factors, 12 of them had Diabetes Mellitus, 7 had Hypertension, 7 had a history of steroid use, 3 had a history of migraines and 6 of them had a family history of glaucoma. In the observed one year period 73 percent if the cases were not progressive while 27 percent were progressive. In this study, it has been observed that the males are more commonly affected and the age group with the most cases was the 51 to 60 age group. The majority of the cases showed no risk factors though Diabetes Mellitus is the most common. The progression of the disease is seen more frequently in cases associated with Diabetes Mellitus and Hypertension. In MMG 12 out of the 47 cases were progressive and in NMG 15 out of the 59 cases were progressive.

Conclusion: Though high myopia is important in the pathogenesis of glaucoma there was no evidence that high myopia increases the progression of the disease of the 14 cases, only 5 were progressive.

Keywords: Myopia, Primary open-angle glaucoma, NMG, HMG, MMG, Diabetes Mellitus, Hypertension

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INTRODUCTION

Myopia is a refractive error of the eye that makes it difficult to see objects that are far away without optical correction. Although myopia can be caused by lens or corneal curvature or by other factors, axially elongated eyes is the cause for a majority of all myopic cases. Axial elongation can affect the eye's intraocular structure (optic disc or macula), where glaucomatous damage can occur.

An association between myopia and primary open-angle glaucoma has been recognized for decades and has been studied in numerous case studies. Glaucoma, one of the leading causes of irreversible blindness in the adult population worldwide, as a progressive optic neuropathy [1]. Primary open-angle glaucoma (POAG) is the most commonly reported type of glaucoma in population studies conducted worldwide. Elevated intraocular pressure is a well-known major risk factor for POAG. Myopia has also been found to have an influence on intraocular pressure (IOP). Reduced IOP slows the development or slows the progression of glaucoma.

In a case-control study, myopic refractive error was found to be significantly correlated with ocular hypertension (OH) [2]. An Israeli study of 2403 subjects found a significant relationship between myopia and increasing IOP, particularly in persons of North African or Asian descent [3]. Other studies have documented higher applanation (abnormal flattening of the cornea) pressures in myopic patients [4], which included children [5], or in participants with increased axial length [6], but a UK study found no significant relationship with IOP [7] or in myopic anisometropia [8]. There was also found to be an affiliation with myopia and low-tension glaucoma [9]. However, a study on young Chinese myopic eyes with a glaucomatous optic disc tracked for about 7 y did not record any progression in their optic discs, irrespective of the glaucoma treatment [10]. Furthermore, two Japanese studies have stated that myopia is a preventive factor for the progression of glaucoma [11, 12].

High myopia is considered to have a fairly different pathology than mild to moderate myopia on the basis of the progression of glaucoma. Highly myopic eyes are associated with a more aggressive pathological changes in the posterior pole of the eye (which includes the optic disc and macula) which leads to further deterioration, whereas myopic changes in mild to moderate myopia usually tend to remain the same after adolescence [13, 14]. Some studies have compared highly myopic glaucomatous eyes compared to non highly myopic glaucomatous eyes and have noted that different retinal nerve fiber layer (RNFL) involvement patterns are seen, suggesting that the pattern of progression may differ in myopic cases of varying severity [15]. Hence based on the degree of refractive error myopia was divided into 3 sub-groups: non-myopic, mildly to moderately myopic, and highly myopic.

Myopia is a common condition and its incidence in young people is increasing; hence, to explore the effect of myopia on glaucoma longitudinal cohort data of medically treated primary open-angle glaucoma patients was analyzed.

METHODS AND MATERIALS

A retrospective review of the medical records of all subjects who were evaluated by the Ophthalmology Department of Saveetha Medical College and Hospital from March 2019 to February 2020. At the initial test, each participant received a comprehensive ophthalmological examination, including a review of the medical history, measurement of visual acuity, provovative test, slit-lamp biomicroscopy, Goldmann applanation tonometry, gonioscopy, central corneal thickness (CCT) measurement and Postmydriatic test.

The inclusion criteria was a subject with a visual acuity of 20/40 or better, the presence of a normal anterior chamber, an open angle on slit-lamp and gonioscopic examinations, glaucomatous optic nerve damage (the presence of focal thinning of the neuroretinal rim or

notching) and glaucomatous Visual Field defects. All of the subjects with glaucoma in our study were monitored at 3-month intervals. All tests were conducted during the same visit or within a 2-week span. All participants received medical therapy during the follow-up period. If the subject underwent intraocular surgery or laser therapy during the follow-up period, only data collected before these surgeries were included and analyzed.

In terms of risk factors, the presence of Diabetes was confirmed from history or a fasting blood glucose of 140 mg % or higher [16]. Patients were considered Hypertensive when systolic blood pressure was ≥ 160 mmHg or diastolic blood pressure was ≥ 95 mmHg and were under anti-hypertensive therapy. A family history of glaucoma, a typical history of migraine, [17] and a history of steroid use [18] are also considered risk factors. On the basis the

level of spherical equivalent the eyes of the participants were divided into the following three: a non-myopic group (>0 D, NMG), a mild to moderate myopic group (0 to -6 D, MMG), and a highly myopic group (≤ -6 D, HMG). Glaucomatous progression was determined based on two criteria, optic disc and VF progression.

RESULTS AND DISCUSSION

Out of the 120 cases assessed 46 [38 percent] were female and 74 [62 percent] were males [table 1 and fig. 1]. Out of the 46 females 22 were non myopic 17 were mild or moderate myopic and 7 had high myopia and out of the 74 males 37 were non-myopic 30 were mild or moderate myopic and 7 had high myopia [table 4 and fig. 4]. On the basis of age there were 9 cases between 31-40 y, 30 cases between the ages 41-50, 40 cases between 51-60, 32 cases between 61-70 and 9 cases between 71-80 [table 2 and fig. 2].

Table 1: Gender distribution of myopia

Gender	Count
Female	38%
Male	62%
Grand total	100.00%

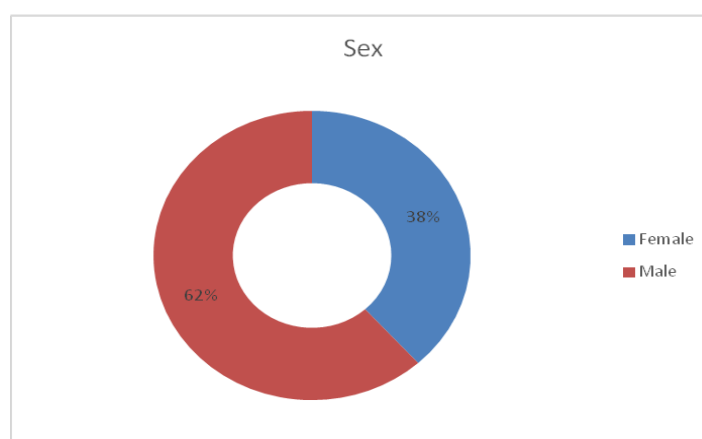


Fig. 1: Gender distribution of myopia

Out of the 120 glaucoma cases 59 [49 percent] were NMG 47 [39 percent] were MMG and 14 [12 percent] were HMG [table 3 and fig. 3]. The risk factors taken into consideration in this study are Diabetes Mellitus, Hypertension, Steroid use, Migraine, Family

history. Of the total 12 of them had Diabetes Mellitus, 7 had Hypertension, 7 had a history of steroid use, 3 had a history of migraine and 6 of them had a family history of glaucoma [table 5 and fig. 5] [table 6 and fig. 6].

Table 2: Classification of myopia on the basis of age

Age	Classification as per age
31-40	9
HMG	5
MMG	3
NMG	1
41-50	30
HMG	9
MMG	8
NMG	13
51-60	40
MMG	24
NMG	16
61-70	32
MMG	9
NMG	23
71-80	9
MMG	3
NMG	6
Grand total	120

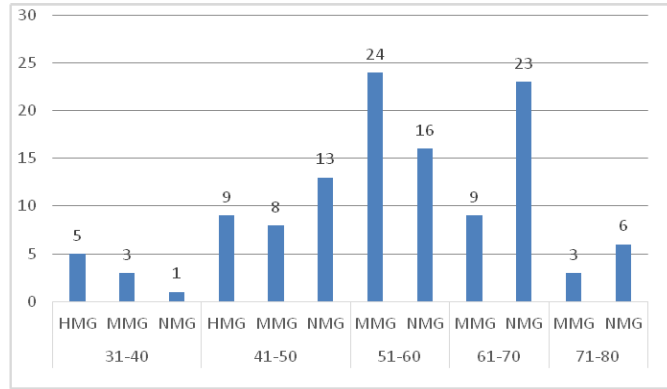


Fig. 2: Classification of myopia on the basis of age

Table 3: Classification of glaucoma on the basis of NMG, HMG and MMG

Myopic types	Percentage
HMG	12%
MMG	39%
NMG	49%
Grand total	100%

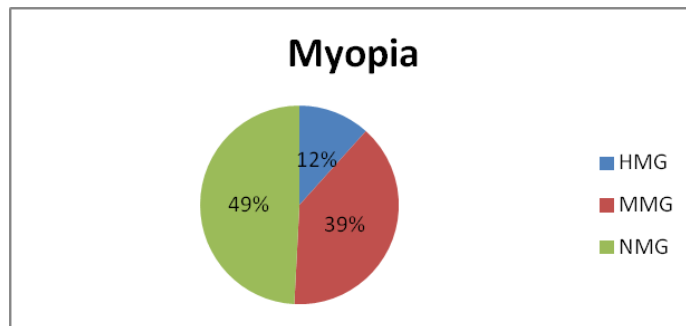


Fig. 3: Classification of glaucoma on the basis of NMG, HMG and MMG

Table 4: Classification on the basis of sex and myopia

Gender and myopic type	Number
Female	46
HMG	7
MMG	17
NMG	22
Male	74
HMG	7
MMG	30
NMG	37
Grand total	120

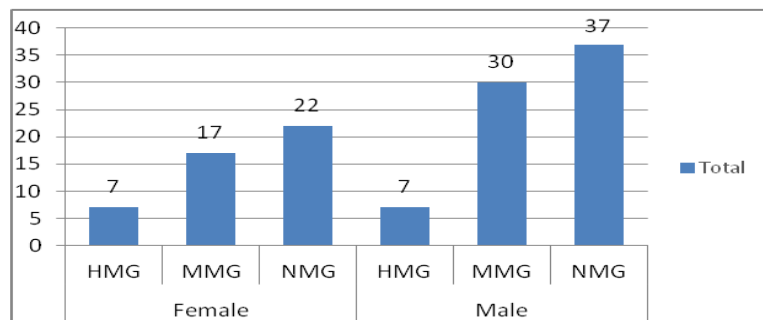


Fig. 4: Classification on the basis of sex and myopia

Table 5: Risk factors observed

Risk factors	Number of people
Diabetes Mellitus	12
Family History of Glaucoma	6
Hypertension	7
Migraine	3
No Known Risk Factors	85
Steroid Use	7
Grand total	120

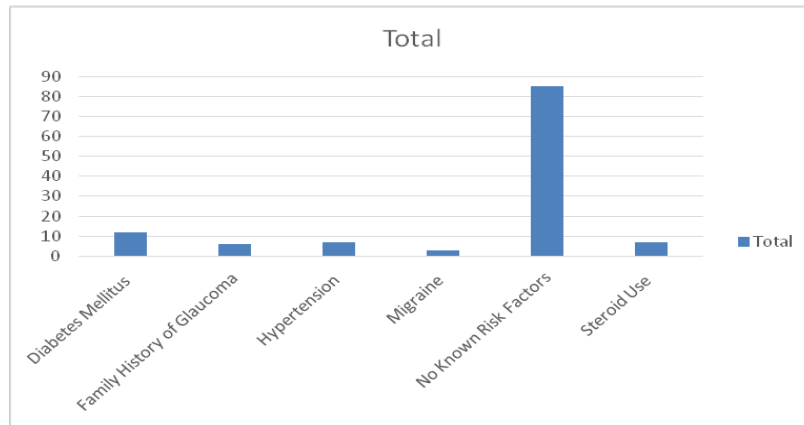


Fig. 5: Risk factors observed

Table 6: Classification on the basis of myopia and risk factors

Myopic type with associated risk factor	Number of people
HMG	14
Diabetes Mellitus	3
Migraine	1
No Known Risk Factors	9
Steroid Use	1
MMG	47
Diabetes Mellitus	4
Family History of Glaucoma	3
Hypertension	4
No Known Risk Factors	34
Steroid Use	2
NMG	59
Diabetes Mellitus	5
Family History of Glaucoma	3
Hypertension	3
Migraine	2
No Known Risk Factors	42
Steroid Use	4
Grand total	120

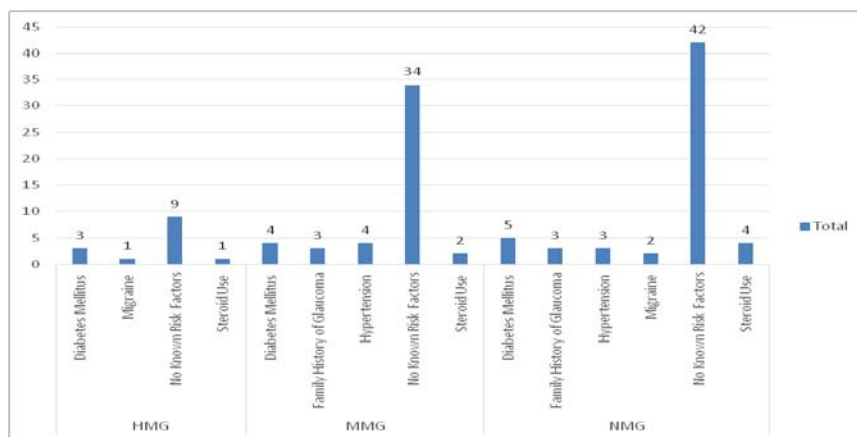


Fig. 6: Classification on the basis of myopia and risk factors

In the observed one-year period 73 percent if the cases were not progressive while 27 percent were progressive. Out of the 14 HMG

cases 9 were non-progressive and 5 were progressive, in MMG 12 out of 47 were progressive and in NMG 15 out of the 59 were progressive.

Table 7: On the basis of progression

Progression	Percentage of people
Non-Progressive	73%
Progressive	27%
Grand total	100.00%

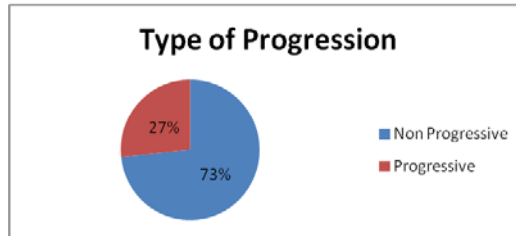


Fig. 7: On the basis of progression

Table 8: Progression of glaucoma depending on myopia

Myopic type with associated progression	Number of people
HMG	14
Non Progressive	9
Progressive	5
MMG	47
Non Progressive	35
Progressive	12
NMG	59
Non Progressive	44
Progressive	15
Grand total	120

Table 9: Association of glaucoma with risk factors and progression

Glaucoma types	Count of MYOPIA
HMG	14
Non-Progressive	9
Diabetes Mellitus	1
Migraine	1
No Known Risk Factors	6
Steroid Use	1
Progressive	5
Diabetes Mellitus	2
No Known Risk Factors	3
MMG	47
Non-Progressive	35
Family History of Glaucoma	2
No Known Risk Factors	32
Steroid Use	1
Progressive	12
Diabetes Mellitus	4
Family History of Glaucoma	1
Hypertension	4
No Known Risk Factors	2
Steroid Use	1
NMG	59
Non-Progressive	44
Family History of Glaucoma	2
Hypertension	1
Migraine	1
No Known Risk Factors	38
Steroid Use	2
Progressive	15
Diabetes Mellitus	5
Family History of Glaucoma	1
Hypertension	2
Migraine	1
No Known Risk Factors	4
Steroid Use	2
Grand total	120

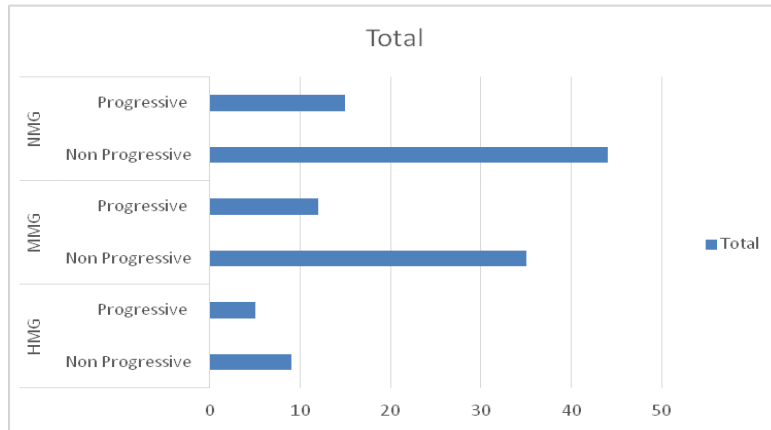


Fig. 8: Progression of glaucoma depending on myopia

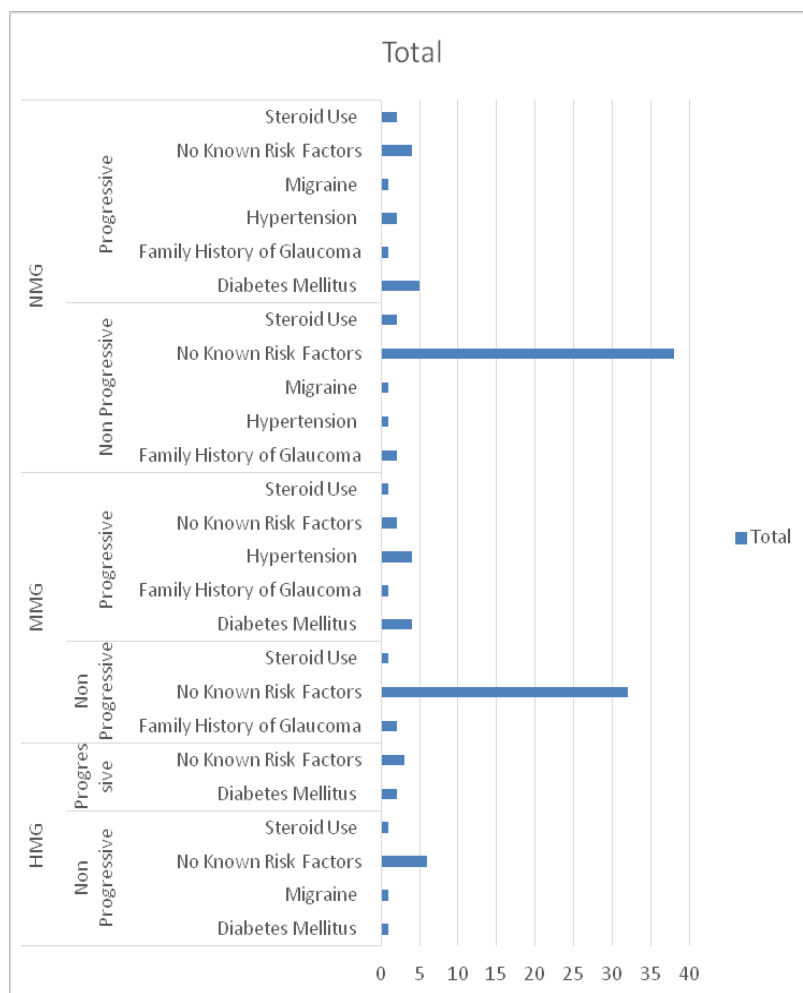


Fig. 9: Association of glaucoma with risk factors and progression

Myopia as a risk factor for glaucoma is backed by population studies, but what remains controversial is the link between myopia and increased susceptibility to or progression of glaucoma [19]. Population-attributable risk assessment is very important to focus the medical and public health interventions based on the risk factors causing the most damage in the community [20].

In this study, it has been observed that the males are more commonly affected and the most common age group was between 51 to 60. Though Diabetes is the commonest risk factor the majority

of the cases have no known risk factors. Also the progression of the disease is seen more frequently in cases associated with Diabetes Mellitus and Hypertension. In MMG 12 out of the 47 cases were progressive and in NMG 15 out of the 59 cases were progressive. Though high myopia is important in the pathogenesis of glaucoma there was no evidence that high myopia increases the progression of the disease [Out of the 14 cases, only 5 were progressive]. Because glaucomatous damage is assessed based on structural changes in the optic disc or functional changes in the VF, and as these structural and functional changes may not occur. Out of the 14 HMG cases 9

showed no progression, while only 5 were progressive. This correlation may be explained by the increased difficulty in detecting progression by optic disc photographs in highly myopic glaucomatous eyes. Highly myopic eyes may show a tilted optic disc with large peripapillary atrophy, which makes the evaluation of glaucomatous neuroretinal rim changes difficult [21].

Our current study has several limitations, our participants were included and categorized on the basis of refractive error. Axial length measurement is a more direct assessment of the degree of myopia, as myopia can also be caused by lens changes or other factors. However, axial length is strongly associated with refractive error, and eyes with visually significant lens changes were not included in our analysis. Since this study was a retrospective one, there is a possibility that the participants were treated with the medication of varying aggressiveness as required by their target pressures. Thus, this should be considered in the interpretation of our results. However, most of our study participants had well-controlled IOP during the follow-up period (the relatively shorter follow-up period should be acknowledged as another limitation).

CONCLUSION

In conclusion, myopia is a major risk factor for primary open-angle glaucoma, other systemic diseases, age and gender also can be considered as risk factor with raised IOP is seen as a modifiable risk factor. Also no level of myopia was associated with glaucoma progression; high myopia in our study had a preventive effect on glaucoma progression. This is due to lower progression detection rate due to the use of structural criteria that occurs because of difficulty in detecting the optic disc changes in highly myopic eyes.

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Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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