Journal of Clinical and Biomedical Sciences

Original Article

Association of Primary Open Angle Glaucoma with Axial myopia

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Abstract

Background: Primary open angle glaucoma (POAG) is observed to be associated with axial myopia, if diagnosed at an early stage and early age can help in a great extent to avoid irreversible blindness and reduce the blind years of the patient.

Aims: We intend to take up the study to correlate Axial Myopia with POAG and POAG Suspects and also to document the correlation between the severity of Axial Myopia and POAG and with POAG Suspects.

Settings and Design: This was an observational study, where axial myopes (axial length more than 24.50 mm and spherical equivalence equal to or more than -0.5D) were included.

Methods and Material: Intraocular pressure (IOP) measurement, gonioscopy, fundus evaluation and visual field analysis was done. Patients were examined and diagnosed as POAG, IOP suspects and Disc suspects. Each of the groups were again correlated as per severity in axial length.

Results: Out of 162 eyes, males were 55.56% (n= 90) and females were 44.44 % (n=72) of the study population. 62.9 % of the patients (n=102) belonged to the age group 41-50 years and 37.8 % (n=60) belonged to 30-40 years. The average age noted was 43 +5.97 years. 22.22 % (n=26) were diagnosed POAG and had an association with axial length (p=0.046), while no association with age (0= 0.361) and gender (p=0.933). IOP suspects formed 8.64 % (n=14) of the population, showed association with gender (p=0.008) but there was no association with age (p=0.637) and axial length (p=0.361). Disc suspects formed 27.16 % (n=44) of the population, showed no association with age (p=0.797), gender (p=0.316) and axial length (p=0.070).

Conclusions: Our study showed association of axial myopia (aged 41-50 years) with POAG (22.2 %). IOP suspects had predilection to male population (p=0.046). No such association was found in disc suspects.

Keywords: Primary Open Angle Glaucoma (POAG), axial length, axial myopia, intraocular pressure (IOP), disc suspects, intraocular pressure suspects.

Introduction

Myopia is a form of refractive error wherein parallel rays of light come to a focus in front of the sentient layer of the retina when the eye is at rest. In the great majority of cases, myopia is due to an increase in the axial length of the eye.[1] High myopia is associated with an increased risk of ocular complications and may lead to disorders such as primary open angle glaucoma,[2] myopic tractional maculopathy (MTM),[3] chorioidal neovascularization (CNV)[3] which cause blindness.

Primary open-angle glaucoma (POAG) is described as a multifactorial optic neuropathy that is chronic, progressive and irreversible with a characteristic acquired loss of optic nerve fibers.[4] Such loss develops in the presence of open anterior chamber angles, characteristic visual field abnormalities and increase intraocular pressure that can be deleterious to the vision.

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Conflict of Interest: None
Financial Aid: Nil

Primary open angle glaucoma is seen as a co-morbid condition with axial myopia.

However, direct and convincing evidences are still lacking. If primary open angle glaucoma can be diagnosed in patients with axial myopia at an early stage and early age, treating glaucoma may help the patient to a great extent to avoid irreversible blindness and reduce the blind years of the patient.

This observational study was done to evaluate cases of axial myopia for a possible correlation between of cases POAG and POAG suspects.

Material and Methods

This observational study was carried out in Ophthalmology OPD at R.L. Jalappa hospital, Kolar from December 2018- June 2020. The study was approved by the ethics committee of the Institute and adhered to the tenets of the declaration of Helsinki.

All patients were assessed by detailed history and clinical examination of both the eyes. Documentation of visual acuity by snellens chart for distant vision, slit lamp biomicroscopy (for ruling out pseudo-exfoliation, pigment dispersion and other causes of secondary glaucoma), retinoscopy and automated keratometry readings (to exclude corneal curvatural myopes) were done.

Estimation of axial length using A-scan ultrasound biometry was done. Patients with axial myopia (axial length more than 24.50 mm and spherical equivalence equal to or more than -0.5D) aged between 30 and 50 years were included in this study; excluding diabetics, long term topical/ systemic steroid users and patients with any past ocular surgery. Further they were segregated and classified according to the severity of axial myopia as per study done by Lee MW et al[5] into:

- Subgroup 1 (24.5–26.0 mm),
- Subgroup 2 (26.0– 27.5 mm),
- Subgroup 3 (≥27.5 mm)

Fundus examination by direct and indirect ophthalmoscopy, and 90D slit lamp examination including optic disc and retinal nerve fible layer evaluation, visual field analysis (using Humphery Field Analyser, 30-2 SITA standard program, Zeiss HFA model 720i), assessment of intraocular Pressure (using Goldmann Applanation Tonometer) and gonioscopy (Shaffer's grading system used by Goldmann three-mirror goniolens) was done.

A POAG suspect[6] defined as an individual who had either:

1. A suspicious optic nerve or nerve fiber layer appearance (enlarged cup- disc ratio, asymmetric cup-disc ratio- difference between both eyes cup disc ratio is more than 0.2, notching or narrowing of the neuroretinal rim, a disc hemorrhage, or suspicious alterations in the nerve fibre layer),
2. A visual field abnormality consistent with glaucoma .
3. An elevated IOP: above an arbitrary cutoff value, typically 21 mm Hg. Usually, if 2 or more of these findings are present, the diagnosis of POAG is supported.

The data were analyzed to find out the frequency of POAG and POAG suspects (disc suspects and IOP suspects) in axial myopia patients, also if any possible correlation between the severity of axial myopia (according to axial length) was attempted.

Sample Size Estimation

Sample size calculated based on variance of axial length with 99% confidence interval, and 1% absolute precision is 69. Sample size (n)= Z21-α/2 σ2 d2

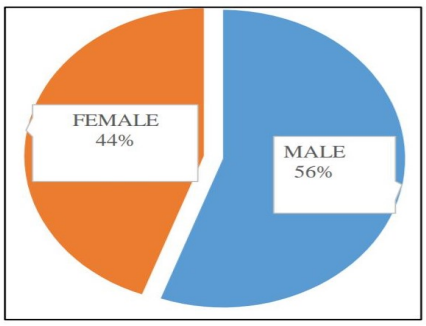
Where, σ: Standard Deviation d: Precision α/2 : desired confidence level.

Statistical Methods Used For This Study

Data will be coded and entered into excel sheet. All quantitative measures will be presented by mean and SD. Qualitative or categorical data by frequency and percentage. Difference in proportions will be compared by Chi Square (Bar- Fischer Exact Test). Mean comparison between grades of myopia will be done by using t-test or Mann Whitney U test. p -value =/< 0.05 will be considered as statistically significant.

Observations

- 81 patients of axial myopia (162 eyes) were observed to identify any association between POAG and suspects.
- Out of 81 patients, 45 (55.56%) were males and 36 (44.44%) were females.



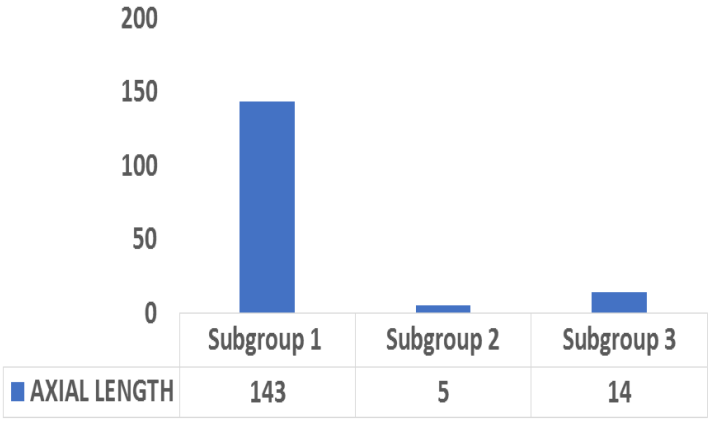
Graph 1: Gender wise distribution of patients:

- The mean age was 43 years with a standard deviation of 5.97.

Table 1: Age wise distribution of total sample size.

Age (in years)	Number of cases	Percentage (%)
30-40	30	37%
41-50	51	63%

Graph 2: Axial length wise distribution.



Most of the axial length was between 24 -26.0 mm (Subgroup 1- 143 patients, 88%).

- Out of 162, 36 eyes (22.22 %) showed POAG changes.

Table 2: POAG versus age.

		Age (in years)		Total	P value
		30-40	41 – 50		
POAG	Absent	49	77	126	0.316
	Present	11	25	36	
Total		**60**	**102**	**162**	

Table 3: POAG versus gender.

		Gender		Total	P value
		Female	Male		
POAG	Absent	57	69	126	0.933
	Present	16	20	36	
Total		**73**	**89**	**162**	

Table 4: POAG versus Axial length.

		Axial length (in subgroup)			Total	P value
		1	2	3		
POAG	Absent	107	5	14	126	0.046
	Present	36	0	0	36	
Total		143	5	14	162	

- IOP suspects formed 8.64 % (n=14) of the population.

Table 5: IOP suspects against age.

		Age (in years)		Total	P value
		30-40	41-50		
IOP SUSPECTS	Absent	54	94	148	0.637
	Present	6	8	14	
Total		60	102	162	

Table 6: IOP suspects versus gender.

		Gender		Total	P value
		Female	Male		
IOP SUSPECTS	Absent	62	86	148	0.008
	Present	11	3	14	
Total		73	89	162	

Table 7: IOP suspects versus axial length.

		Axial length (Subgroup)			Total	P value
		1	2	3		
IOP SUSPECTS	Absent	129	5	14	148	0.316
	Present	14	0	0	14	
Total		143	5	14	162	

- Disc suspects group formed 27.16 percent (44 patients) of the population.

Table 8: Disc suspects versus age.

		Age (in years)		Total	p value
		30-40	41-50		
DISC SUSPECTS	Absent	43	75	118	0.797
	Present	17	27	44	
Total		60	102	162	

Table 9: Disc suspects versus gender.

		Gender		Total	p value
		Male	Female		
DISC SUSPECTS	Absent	56	62	118	0.316
	Present	17	27	44	
Total		73	89	162	

Table 10: Disc suspects versus axial length.

		Axial length (Subgroup)			Total	p value
		1	2	3		
DISC SUSPECTS	Absent	100	5	13	118	0.070
	Present	43	0	1	44	
Total		143	5	14	162	

Results

Males consisted of 55.56% (n= 90) and females consisted 44.44 % (n=72) of the study population. 62.9 % of the patients (n=102) belonged to the age group 41-50 years and 37.8 % (n=60) belonged to 30-40 years. The average age noted was 43 years + 5.97. POAG was seen in 22.22% (n=36). POAG formed 22.22 % (n=36), showed an association with axial length (p=0.046), while no association with age (0= 0.361) and gender (p=0.933). IOP suspects formed 8.64 % (n=14) of the population, showed association with gender (p=0.008) but there was no association with age (p=0.637) and axial length (p=0.361). Disc suspects formed 27.16 % (n=44) of the population, showed no association with demographics (age; p=0.797), gender (p=0.316) and axial length (p=0.070).

Discussion

Glaucoma being a multifactorial disease group is associated with other co morbid conditions like systemic hypertension,[7,8,9] diabetes[10,11] and myopia. The relationship between refractive errors and glaucoma has been investigated in several past clinical trials and population based studies, but still maintains to have a inconclusive results and thus remains subject of keen interest. Few of the large population based studies carried out in past like the Blue mountain study[7] done on Australian population, The Beaver Dam Eye Study[8] and Barbados Eye Study[10] done on black population, found a strong relationship between POAG and myopia.

In Asian Populations, much similarity was observed in Beijing Eye Study[12], done in China. Followed by Singapore Malays Eye Study[13] showing that patients with moderate or high myopia (>4D) having 3 times risk of developing POAG when compared with Emmetropia. A systematic review and metaanalysis of observational studies[14] which included data from 11 population cross sectional studies which was published in 2011 also showed high myopia (more than -3D) as risk factor for the development and the progression of Primary Open Angle Glaucoma with odds ratio of 1.92.

However on the contrary few studies like Ocular hypertension Treatment Study[15] which has a larger population cohort has found no association between POAG and myopia and concluded myopia not to be a predictive development of POAG. Same was observed in study done by Chao[16] et al in Chinese origin population and South Indian study[17] done in 2008.

Majority of the mentioned studies have defined severity of myopia based on the refractive error (in diopters), being unclear about major contributing factors like axial length and others (cornea curvature or lenticular changes). The objective of the study was to define the severity of myopia based on axial length and then finding its association with POAG and suspects.

The average adult axial length of the eye ball is 22-24mm. Literature study showed the prevalence of glaucoma is 3% in eyes with axial length less than 26.5mm 11% in eyes with axial length between 26.5 and 33.5 mm, and 28% in eyes with axial length >33.5 mm18. All patients above 24.5 mm were included in our study to find association with POAG/ suspects.

In our study, majority of axial myopes belonged to subgroup 1 which included eyes with axial length between 24.5 and 26.0 mm statistically significant association of POAG was seen with axial length, but not with disc and IOP suspects groups. In Asian Population, the Kandy eye study showed axial length as common and known risk factor of glaucoma (P=0.003). Same was concluded by Singapore Malays Eye Study. However in contrary a study done in Chinese origin population, Choa et al a study done did not find axial length to be a risk factor for visual field loss and thus not linked to Glaucomatous optic nerve damage.[13,16,19]

POAG is an adult onset disease having chronic course and gradual progression. Our study showed tendency towards patients above age of 41 years. In Blue mountain study[7], Kandy eye disease[19] and Chennai Glaucoma Study[17] showed the prevalence increased exponentially with age above 40 years. Myopia is generally detected during adolescence, the study population included age groups of 30-50 with the objective of with objective of early detection of POAG in myopes. Even though, the raw data showed more patients patients in age group 41-50 years, there was no statistical significance associated between age and POAG/ suspects.

In our study males were more than females which confirms to other studies. However statistical significance was only seen in cases of IOP suspects. The significance of gender is less accurate than that of age and race, although several studies suggest a higher prevalence in men.[8, 12, 13]

Our study showed no association of axial myopia with IOP suspects. Recent studies showed that, for a given IOP in eyes with POAG, optic nerve damage appears to be more pronounced in highly myopic eyes than in non–highly myopic eyes.

The main difficulty is that myopic eyes have abnormal disc similar to glaucomatous disc causing a problem in the diagnosing and further managing glaucoma. Axial myopization leads to marked changes of the optic nerve head and enlargement of all three layers of the optic disc (i.e., optic disc Bruch's membrane opening, optic disc choroidal opening, optic disc scleral opening) with the development of a secondary macrodisc making it more difficult to differentiate between myopic changes and glaucoma-associated changes. There is higher susceptibility for glaucomatous optic nerve fiber loss in highly axial myopic eyes compared with non–highly myopic eyes.[20]

Our study there was no association between severity of axial myopia and disc suspects. Jonas JB et al found that optic nerve damage appears to be more pronounced in high myopic eyes. Routine slit lamp bio microscopy may not be accurate in detecting glaucomatous disc changes in axial myopic eyes. Neuroretinal rim parameters, assessment of retinal nerve fiber layer and ganglion cell-inner plexiform layer thickness measurements and texture and, the examination of the microcirculation of the optic nerve head using optical coherence tomography and observing PPA with and without Bruch's membrane are some of the recent diagnostic parameters that are being used.[21, 22, 23]

In this study we used axial length of the eyes with POAG to grade the severity of myopia instead of only the refractive power of the eye. This is also a novel attempt to understand Optic disc suspects and IOP suspects for the association with axial myopia.

Limitations of our study being smaller sample size and short duration of follow-up. Longer time is required to observe the onset of POAG in axial myopes as POAG is an adult onset disease with chronic course. A bigger sample size with more eyes of higher degree of myopia is required to understand true association and/ or development of POAG.

Conclusion

Myopia and glaucoma have similar or overlapping optic nerve head changes and visual fields defects. The dilemma of accurate diagnosis, management and monitoring of such patients requires through understanding of pathophysiology and disease progression. The current study showed association of axial myopia (aged 41-50 years) with POAG (22.2 %), with male predilection. No such association was found in POAG suspects (36 %). Further research is required to strengthen this observation & translate the information for therapeutic advantage.

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