

## A study on primary open angle glaucoma in systemic hypertensives in patients in a tertiary care centre

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### Abstract

Glaucoma is the second leading cause of world blindness. There are many risk factors influence development of POAG. Systemic hypertension is one of the risk factors and is one of cause for gradual progressive loss of vision in old age. A hospital based study of prevalence of POAG was carried out as hospital bases study on systemic hypertensive patients attending DM WIMS hospital from 01/07/2017 to 30/06/2018. A total of 400 patients with systemic hypertension between 50-80 years of age attending department of Ophthalmology, DM WIMS hospital are evaluated for POAG and complete ocular and clinical examination were performed.

The significance of study parameters between two or more groups was determined by Chi square test and correlation coefficient analysis done to find out relation between intraocular pressure (IOP) and blood pressure level. In this study -3.75% of POAG cases were presenting the systemic hypertensive population (as compared to 2.56% in normal population) and IOP was found to be significantly correlated with blood pressure levels. Among the cases diagnosed as POAG, 4.05% were males and 3.27% were females. Hence, patients of systemic hypertension should be screened for POAG and monitoring of IOP and blood pressure levels to be done at regular intervals.

**Keywords:** Systemic hypertension, Intraocular pressure, Primary open angle glaucoma, Tonometry, Blood pressure.

### Introduction

Glaucoma is not a single disease but a group of disorders characterized by a progressive optic neuropathy resulting in a characteristic optic disc changes and irreversible visual field defects that are associated frequently but not invariably with raised intraocular pressure (IOP). Thus, IOP is the most common risk factor and the only modifiable risk factor for development of glaucoma. Consequently the term 'ocular hypertension' is used for cases with constantly raised IOP without any associated glaucomatous damage. Conversely, the term normal or low tension glaucoma (NTG/LTG) is suggested for the typical cupping of the disc and visual field defects associated with a normal or low IOP. Glaucoma causes gradual visual loss often without any warning symptoms. Open angle glaucoma causes a slow progressive degeneration of retinal ganglion cells and axons characterized by a specific pattern of optic nerve head and visual field damage. India accounts for 12.9% of primary open angle glaucoma related blindness in the world. Despite the extensive world wide research the causes of open-angle glaucoma (OAG) are not very well understood. Although raised intraocular pressure (IOP) plays a major role in the development and progression of glaucoma, other risk factors, particularly those affecting the blood supply to the optic nerve head have to be evaluated as they may play a significant role in the progression and development of glaucoma. Several studies have been conducted to find the association if any between OAG and systemic vascular factors such as systemic hypertension, hypotension, atherosclerosis, and vasospasm. According to the vascular theory of OAG development and pathogenesis, low blood pressure (BP), particularly in the presence of raised IOP, can reduce perfusion pressure (PP) of the optic nerve head, causing ischemic damage to the retina, optic

nerve and the retinal ganglion cells. In systemic hypertensive patients persistently raised BP may result in arteriosclerosis, changes in the size of the precapillary arterioles, and capillary dropout leading to increased resistance to blood flow and thus reduced perfusion at the optic nerve and retinal ganglion cells. Disruption of the autoregulatory mechanisms of blood flow in the optic nerve head vascular beds at high BP levels may increasingly contribute to reduced perfusion. However these conflicting differences regarding the possibility of the effect of high or low blood pressure levels on OAG and optic nerve damage have not been studied.

The present study was carried out with following aims and objectives in mind:

1. To study the association of primary open angle glaucoma in systemic hypertensive patients.
2. To study the relationship between intraocular pressure and various ranges of blood pressure.

### Materials and Methods

The study was carried out in the department of Ophthalmology, in a tertiary centre from 01/07/2017 to 30/06/2018 for a period of 1 year. Patients aged between 50 to 80 years of age with systemic hypertension attending the ophthalmology opd were screened for detection of primary open angle glaucoma. Hypertension is defined as patients with a history of hypertension on antihypertensive therapy, or a systolic blood pressure  $\geq 140$  mmHg and a diastolic blood pressure  $\geq 9+2.00$  BE N60mm Hg as per the Joint National Committee (JNCC) Guideline at the time of examination.

**Inclusion Criteria**

1. IOP > 21 mmHg (by goldmans applanation tonometry) with visual field defects.
2. IOP > 21 mmHg (by goldmans applanation tonometry) with optic nerve head changes.
3. Optic nerve head changes with visual field defects.

**Exclusion Criteria**

1. Gonioscopy showing closed angles.
2. Any Corneal scarring or media opacities.
3. Secondary glaucomas due to any other cause.
4. Recent history of ocular surgeries.
5. Patients with secondary hypertension.

**Results and Observations**

The results were as follows. The total number of patient’s studies was 400. Of which 247(61.75%) were males and 153(38.25%) were females. Of the 400, 122(30.5%) were in the age group of 50-59 years. 183(45.5%) were in the age group of 60-69 years, and 95(23.75%) were aged between 70-79 years.

Of the 247 males studied 10(4.05%) had POAG, 3 (1.21%) had normal tension glaucoma and 6(2.45%) were diagnosed to have ocular hypertension.

Of the 153 females 5(3.25%) had POAG, 4(2.61%) had NTG and 3(1.41%) had ocular hypertension.

**Table 1: Sex-wise distribution of POAG in hypertensive patients**

Sex	Total Number of Patients (n)	Primary Open Angle Glaucoma (POAG)	%	Normal Tension Glaucoma (NTG)	%	Ocular Hypertension (OT)	%	Normal	%
Male	247	10	4.05	03	1.21	06	2.45	228	92.30
Female	153	05	3.25	04	2.61	03	1.41	148	92.16
Total	400	15	3.75	07	1.75	09	2.25	369	92.25

**Table 2: Age-wise distribution of POAG in hypertensive patients**

Age Group (in years)	Total Number of Patients (n)	Diagnosed			
		Primary Open Angle Glaucoma	Normal Tension Glaucoma	Ocular Hypertension	Normal
50-59	1				
60-69	6				
70-79	3				
Total	10				

Among the diagnosed cases the right eye was affected in a mean of 24 cases,NTG mean was 15. The left eye was affected in 22.5 with POAG, for NTGthe mean was 14,23.5 for ocular hypertension and in 14 the left eye was normal.

**Table 3: Comparison of mean intraocular pressure among normal patients and those diagnosed**

Eye		Diagnosed			Normal (mmHg)
		Primary Open Angle Glaucoma+2.00D BE N6 (mmHg)	Normal Tension Glaucoma (mmHg)	Ocular Hypertension (mmHg)	
Right eye	Mean ± S.D	24	15		14.5
	Range	22-27	14-16	23-25	10-25
Left eye	Mean ± S.D	22.5	14	23.5	14
	Range	22-26	12-15	23.27	10-24

**Table 4: Change in IOP over various range of Systolic blood pressure and diastolic pressure**

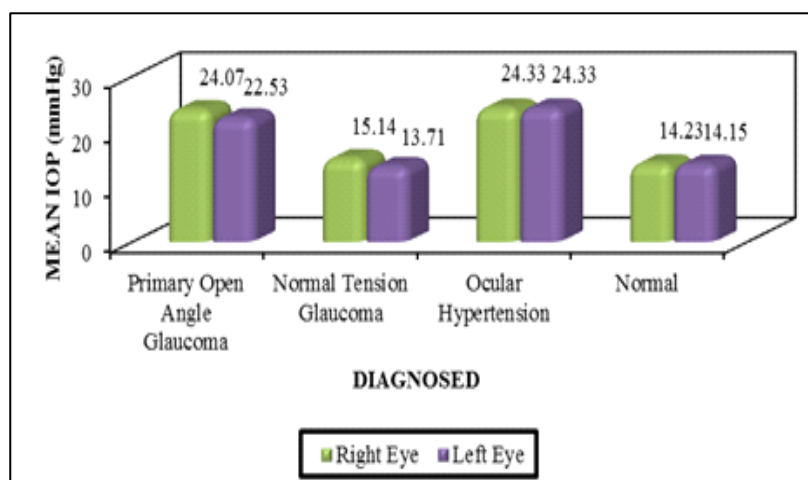
Systolic Blood Pressure (mmHg)	Total Number (N)	Patients With Raised IOP		IOP mmHg	
		N	%	Right eye	Left eye
<140	03	00	00	---	--
140 – 149	164	05	3.05	+23.00	+23.60
150- 159	178	08	4.49	+24.00	+23.00
>160	55	02	6.64	+26.50	25.50

Diastolic Blood Pressure (mmHg)	Total Number (n)	Patients with Raised IOP		IOP mmHg	
		N+2.00D BE N6	%	Right Eye	Left Eye
70-79	01	0	00	--	--
80-89	34	01	2.94	23.00	22.00
90-99	305	12	3.93	24.25	23.67
>100	60	01	3.33	24.50	23.50

The distribution of POAG in the study population is as follows 10(4.05%) males and 5(3.26%) females which is quite significant.

**Table 5: Distribution of POAG in the study population**

Sex	Poag Present		POAG Absent		Total
	Number	%	Number	%	
Male	10	4.05	237	95.95	247
Female	05	3.26	148	96.73	153
Total	15	3.75	385	96.25	400



**Fig. 1: Comparison of mean intraocular pressure among normal patients and those diagnosed**

164 patients had systolic blood pressure between 140-149. Of which 5 had raised IOP OF 23 mmHg in both eyes. 178 had a blood pressure of 150-159 mmHg of which 8 had a intraocular pressure of more than 24mmhg in the right eye and 23mmHg in the left eye. 55 patients had a systolic blood pressure of greater than 160mmHg with a IOP greater than 26mmHg in the right eye and 25.5mmHg in the left eye. Correlating diastolic blood pressure with IOP, only 1 patient had a diastolic value of 70-79mmHg and his IOP was normal. 34 had blood pressures between 80-89mmHg and their IOP was 23 in the right and 24 in the left eye. 305 had pressures between 90-99mmHg and their IOP was greater than 24 mmGh in the right eye and 23 mmHg in the left eye. 60 patients had diastolic blood pressures above 100mmHg and their IOP was greater than 24.5 in the right eye and 25.5 in the left eye.

**Discussion**

Primary open angle glaucoma is a major health concern worldwide because of its usually silent, progressive nature and it is one of the leading preventable causes of blindness in the world. Glaucoma involves a characteristic optic neuropathy, often with elevated intraocular pressure. The introduction of the ophthalmoscope in 1850 permitted the visualization of the excavated optic neuropathy in eyes with a normal or with a dilated greenish-gray pupil. Physicians developed a better appreciation of the role of intraocular pressure in both conditions, which became subsumed under the rubric “glaucoma”.<sup>1</sup> Among the three principle subtypes of glaucoma, primary open angle glaucoma (POAG) occurs most frequently. Till date, 25 loci have been found to be linked to POAG. However, only three underlying genes (Myocilin, Optineurin and WDR36) have been identified. In addition, at least 30 other genes have been reported to be associated with POAG. Despite strong genetic influence in

POAG pathogenesis, only a small part of the disease can be explained in terms of genetic aberration. Current concepts of glaucoma pathogenesis suggest it to be a neurodegenerative disorder which is triggered by different factors including mechanical stress due to intra-ocular pressure, reduced blood flow to retina, reperfusion injury, oxidative stress, glutamate excitotoxicity, and aberrant immune response.<sup>2</sup> There are several articles studying the clinical profile and distribution of various subtypes of glaucoma in a referral practice. Das J, Bhomaj S, et al studied the profile of glaucoma in a major eye hospital in North India.<sup>3</sup> McLeod SD et al did a longitudinal study of the relationship between intraocular and blood pressures.<sup>4</sup> Anderson DR et al commented on blood flow autoregulation in the optic nerve head and vascular risk factors in glaucoma.<sup>5</sup> The blue mountain eye study and the Beaver Dam study have both studied the association of systemic hypertension and glaucoma.<sup>6,7</sup> There are several studies studying the systemic associations and clinical profile of glaucoma patients in north India. Bhardwaj R. et al. Prevalence, Awareness and Control of Hypertension in Rural Communities of Himachal Pradesh, where in the found a strong association of glaucoma with hypertension. Suraj Shakya-Vaidya et al: also found non communicable diseases such as hypertension and diabetes strongly associated with primary open angle glaucoma. But there are very few studies on the association of systemic hypertension and glaucoma in south India. Hence our study is aimed at finding any such association.

### Conclusion

Based on the observations and results of our study, a positive correlation between POAG and systemic hypertension was found as 3.75% of patients with both POAG and systemic hypertensive population. Only 2.56% in normal population had glaucoma. Intraocular pressure was found to be significantly correlating ( $p < 0.001$ ) with intra ocular lens in place with normal funus with raised systolic and diastolic blood pressures and diastolic blood pressure levels. Family history of POAG is significant. First-degree relatives of patients with POAG are at increased risk. Risk to siblings is four times and to offspring twice than normal population risk.

Many studies suggest a correlation between diabetes and POAG and systolic as well as diastolic blood pressure levels. It was observed that the prevalence of POAG with systemic hypertension was more in males compared to females. Therefore, it is important to screen for primary open angle glaucoma in patients with systemic hypertension along with regular monitoring of intraocular pressure and blood pressure levels.

**Conflict of Interest:** None.

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