IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 3 Ver. II (Mar. 2015), PP 80-86
www.iosrjournals.org

A Study On Primary Open Angle Glaucoma In Systemic Hypertensive Patients Attending Assam Medical College, Dibrugarh

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Abstract: *Glaucoma is the second leading cause of world blindness. It has multifactorial causation and hypertension is one of the risk factors for primary open angle glaucoma(POAG).A hospital based cross sectional study was carried out to study the occurrence of POAG in systemic hypertensive patients. A total of 400 patients with systemic hypertension between 40-70 years of age attending Department of Ophthalmology, Assam Medical College and Hospital or referred here for evaluation were screened 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 present in 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: *Blood pressure, primary open angle glaucoma, intraocular pressure, hypertension .*

I. Introduction

The first description of 'glaucoma' appeared in the Hippocrates writings as "glaucosis"; the description stated "that once the pupil has the colour of the sea – eye sight is destroyed and you will often find that the other eye is also blind".[1]

Glaucoma is a heterogenous group of optic neuropathies with a complex genetic basis. It reduces vision, often without any symptoms and warning.[2] Open angle glaucoma is a slowly progressive neuro degeneration of retinal ganglion cells and their axons characterized by specific pattern of optic nerve head and visual field damage.[3]India accounts for a minimum of 12.9% of primary open angle glaucomatous blindness in the world and these figures are expected to be doubled by 2020 A.D.[4]

Despite extensive research over many years, the causal events leading to open-angle glaucoma (OAG) are not well understood.[5] Although elevated intraocular pressure (IOP) is thought to play a major role in the development and progression of the disease, it is generally well understood that other factors, particularly those affecting the blood supply to the optic nerve head may play a significant role.[6] Numerous studies have been conducted to investigate the relationship between OAG and vascular factors such as systemic hypertension, hypotension, atherosclerosis, and vasospasm.[7-10] According to the vascular theory of OAG pathogenesis, low blood pressure (BP), particularly in the face of elevated IOP, can reduce perfusion pressure (PP) at the optic nerve head, causing ischemic damage to the retinal ganglion cells.[11,12] In systemic hypertension, chronically elevated 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.[13] Also, disruption of the autoregulatory mechanisms of blood flow in the optic nerve head vascular beds at high levels of BP may further contribute to reduced perfusion.[14] This conflicting scenarios regarding the possible effect of high or low blood pressure levels on OAG risk have not been clarified.

Paul Mitchel et al[15] in the Blue Mountains Eye Study reported that Hypertension was significantly associated with OAG, after adjustment for OAG risk factors including IOP, odds ratio (OR) 1.56, 95% confidence interval (CI) 1.01-2.40. This relation was strongest in subjects with poorly controlled treated hypertension (OAG prevalence 5.4%), compared with normotensive subjects (OAG prevalence 1.9%), independent of IOP (OR 1.88, CI 1.09-3.25). The population attributable risk for hypertension (20.4%) was higher than for other identified OAG risk factors. Bonomi L et al [7] in the Egna-Neumarkt Study found a positive correlation between systemic blood pressure and IOP, and an association was found between diagnosis of primary open-angle glaucoma and systemic hypertension. Klein et al[16] in the Beaver Dam Study reported that

Intraocular pressures were significantly correlated with systolic and diastolic blood pressures at both baseline and follow up. There were significant direct correlations between changes in systemic blood pressures and changes in intraocular pressure. There was a 0.21 (95% CI: 0.16 to 0.27) mm Hg increase in IOP for a 10 mm Hg increase in systolic and 0.43 (0.35 to 0.52) mm Hg increase in IOP for a 10 mm Hg increase in diastolic blood pressure. Dielemans et al [9] in the Rotterdam Eye Study concluded that systemic blood pressure and diastolic blood pressure are positively associated with IOP and high tension glaucoma

Encouraged from the study by various workers, the present study was carried out with following aims and objectives:-

- To study the occurrence of primary open angle glaucoma in systemic hypertensive patients.
- To study the relationship between intraocular pressure and blood pressure of various range.

II. Materials And Methods

The present study was carried out in the Department of Ophthalmology, Assam Medical College and Hospital, Dibrugarh for a period of one year from July 2013 to June 2014. Patients with systemic hypertension between 40 to 70 years of age attending Assam Medical College and Hospital, Dibrugarh who came directly to Department of Ophthalmology or who were referred here for evaluation were screened for detection of primary open angle glaucoma. Hypertension was defined as a past history of hypertension currently receiving antihypertensive treatment, or a systolic blood pressure ≥140 mmHg and/or a diastolic blood pressure ≥ 90 mmHg at the time of examination as per the Joint National Committee (JNCC) Guidelines.

2.1 Sample Size:

The sample size was calculated as follows:

$n = 4pq/d^2$, where $p = 50\%$

$q = 1 - p = 50\%$

$d = 5\%$

$n = 400$

2.2 Inclusion Criteria:

a) IOP > 21 mmHg (by Applanation tonometry) with visual field defects.
b) IOP > 21 mmHg (by Applanation tonometry) with optic nerve head changes.
c) Optic nerve head changes with visual field defects.

2.3 Exclusion Criteria:

a) Closed angle on gonioscopy.
b) Corneal scarring or media opacities.
c) All secondary glaucomas.
d) Ocular surgeries done recently.
e) Patients presenting with secondary hypertension.

2.4 Methodology:

Patients were briefly explained about the study and tests they would undergo and informed consent was obtained from all patients. A detailed ocular and medical history was taken and patients underwent complete ophthalmic examination including measurement of visual acuity, refraction, slit lamp bi-microscopy with +78D and +90D lens and gonioscopy with Goldmann three mirror lens. IOP was measured in each eye with Goldmann applanation tonometer and the median value of three measurements was taken. Visual field examination was done with Humphrey Field Analyzer(HFA). Systemic blood pressure was measured by random zero sphygmomanometer with the participant in sitting position. The average of three consecutive measurements of systolic and diastolic B.P was used in the analysis.

III. Results And Observations

3.1 - Age distribution of hypertensives in the study group (Table 4.1) : In the present study mean age of the patients was found to be 53.80 ± 13 years. The total no. of hypertensive patients observed in 40-49 years is 122 (30.50%), 50-59 years is 183 (45.75%) and 60-70 years is 95 (23.75%). Maximum number of patients was found in the age group of 50-59 years and least number of cases in 60-70 years age group. Onakoya et al [17] observed that the mean age of hypertensive patients was 56.7 ± 12.95 years in their study. Majority of the hypertensive patients were found in 51-60 years followed by 60-70 years. Yadav et al [18] (2008) reported the mean age of hypertensive patients to be 54.9 ± 11.0 years. The mean age of males was 51.2 ± 11.5 and females was 48.4 ± 11.4.

3.2 - Sex distribution of hypertensives in the study group (Table 4.2) : On analysis of the sex distribution, males 247(61.75%) were found to be affected more as compared to females 153(38.25%) with male: female ratio of 1.61: 1. Hypertension was present more in males as compared to females. Yadav et al [18] (2008) observed that the prevalence of hypertension was high in males 42.9% than females 34.2%. Bhardwaj R et al [19] (2010) reported the prevalence of hypertension to be 39.8% in males and 33.15% in females. Hypertension was more prevalent in males.

3.3 - Sex-wise distribution of POAG in hypertensive patients (Table 4.3) :In the present study, overall proportion of POAG cases was 3.75%. Among the males 4.05% (10 out of 247) and females 3.27% (5 out of 153) POAG cases were found. Suraj Shakya-Vaidya et al [20] (2013) reported a prevalence of POAG of 5.50% in males and 2.22% in females. The overall odds of POAG increased 2.72 fold among hypertensive patients. Mitchell P et al[15] in The Blue Mountains Eye Study reported a prevalence of OAG 3.0% in hypertensive patients. Hypertension was significantly associated with OAG after adjustment for OAG risk factors including IOP, Odds ratio (OR) 1.56. The relation was strongest in subjects with poorly controlled treated hypertension (OAG prevalence 5.4%)

3.4 - Age-wise distribution of POAG in hypertensive patients (Table 4.4): In the present study, 13.33% of POAG cases were present between 40–49 years, 66.67% cases present between 50–59 years and 20% cases between 60–70 years. The majority of POAG cases in the study are between 50–59 years. Memarzadeh F et al[6] in the Los Angles Latino Eye Study reported the prevalence of OAG of 10.7% in 40–49 years, 18.2% in 50–59 years and 30.3% in 60–69 years. Rate of POAG was higher in higher age group.

3.5 - Comparison of mean intraocular pressure among normal patients and those diagnosed (Table 4.5) : In the present study, Mean right eye IOP values of Normal patient were 14.23 ± 3.00 mmHg, of NTG were 15.14 ± 0.69mm Hg, of POAG were 24.07 ± 1.28mmHg and of OHT were 24.33 ± 0.71mmHg.The mean left eye values of Normal patients were 14.15 ± 2.76mmHg, NTG were 13.71 ± 1.11mmHg, POAG were 22.53 ± 1.30mmHg and OHT were 24.33 ± 1.32mmHg. Onakoya et al[17] reported the mean IOP of POAG patients in the hypertensive group was 28.45mmHg ± 10.3. Dielemans I.et al[9] in their study observed the mean IOP to be 15.23 mm Hg among hypertensives.

3.6 - Change in IOP over various range of Systolic blood pressure (Table 4.6) and Diastolic blood pressure (Table 4.7): In the present study, a positive correlation ($p<0.001$) was found between change in intraocular pressure and blood pressure over various range. The intraocular pressure increased progressively in both eye of POAG patients with increasing systolic and diastolic blood pressure. The Blue Mountains eye study and Egna-Neumarkt study also showed a positive correlation between intraocular pressure and blood pressure. In both the study there was a linear rise in IOP with rise in blood pressure levels (systolic and diastolic). Klein et al[16] in the Beaver Dam Eye Study observed a significant direct correlations between changes in systemic blood pressure and changes in intraocular pressure.

3.7 - Distribution of POAG among the study population (Table 4.8) : In the present study the overall proportion of POAG cases was 3.75%. Among the cases diagnosed as POAG 4.05% (10 out of 247) were males and 3.27% (5 out of 153) were females. Mitchell P et al[15] reported rate of open angle glaucoma patients was 3.0 % among hypertensive patients and observed that hypertension was significantly associated with open angle glaucoma after adjustment of OAG risk factors including IOP, odds ratio(OR) 1.56 confidence interval (Cl) 1.01-2.40.

IV. Tables And Figures

Table 4.1 – Age Distribution of Hypertensives In The Study Group:

AGE GROUP (in years)	NUMBER (n)	PERCENTAGE (%)
40—49	122	30.50
50—59	183	45.75
60—70	95	23.75
TOTAL	400	100.00

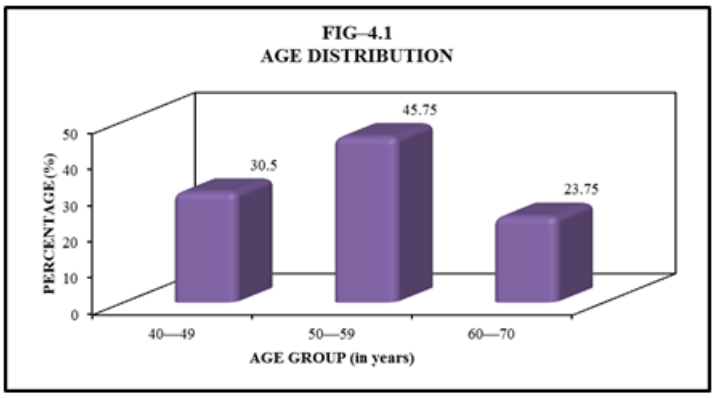


Table 4.2 - Sex Distribution Of Hypertensives In The Study Group:

SEX	NUMBER (n)	PERCENTAGE (%)	RATIO (Male: Female)
Male	247	61.75	1.61: 1
Female	153	38.25	
TOTAL	400	100.00	

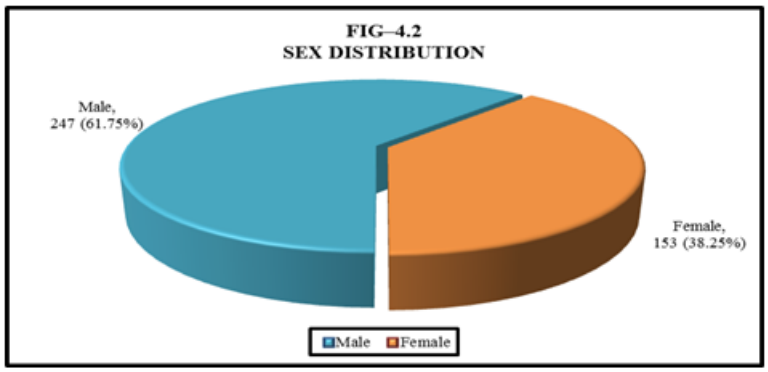


Table 4.3: Sex-wise Distribution Of Patients With POAG

SEX	TOTAL NUMBER OF PATIENTS (n)	DIAGNOSED								"p" VALUE
		Primary Open Angle Glaucoma		Normal Tension Glaucoma		Ocular Hypertension		Normal		
		n	%	n	%	n	%	n	%	
Male	247	10	4.05	3	1.21	6	2.43	228	92.31	
Female	153	5	3.27	4	2.61	3	1.96	141	92.16	0.8977
TOTAL	400	15	3.75	7	1.75	9	2.25	369	92.25	

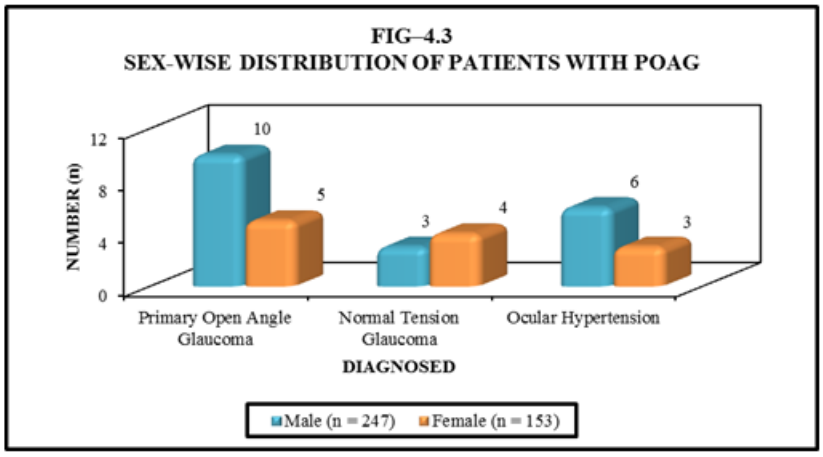


Table 4.4: Age-wise Distribution Of POAG Among Hypertensive Population Studied

AGE GROUP (in years)	MALE		FEMALE		TOTAL	
	N	%	n	%	n	%
40—49	1	50.00	1	50.00	2	13.33
50—59	6	60.00	4	40.00	10	66.67
60—70	3	100.00	0	0.00	3	20.00
TOTAL	10	66.67	5	33.33	15	100.00

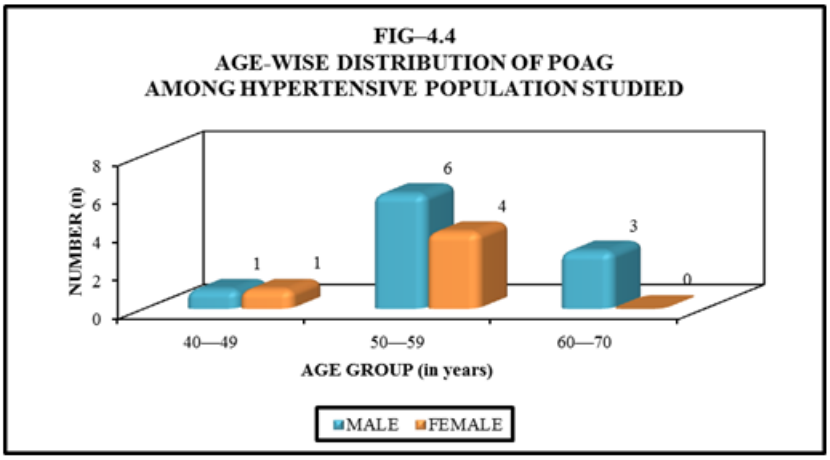


Table 4.5 -Comparison Of Mean Intraocular Pressure Among Normal Patients And Those Diagnosed:

EYE		DIAGNOSED			
		Primary Open Angle Glaucoma (mmHg)	Normal Tension Glaucoma (mmHg)	Ocular Hypertension (mmHg)	Normal (mmHg)
Right Eye	Mean ± S.D.	24.07 ± 1.28	15.14 ± 0.69	24.33 ± 0.71	14.23 ± 3.00
	Range	22—27	14—16	23—25	10—25
Left Eye	Mean ± S.D.	22.53 ± 1.30	13.71 ± 1.11	24.33 ± 1.32	14.15 ± 2.76
	Range	22—26	12—15	23—27	10—24

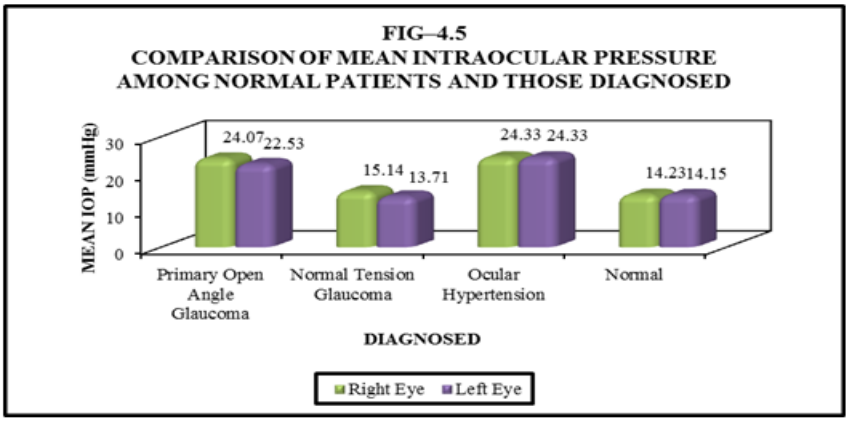
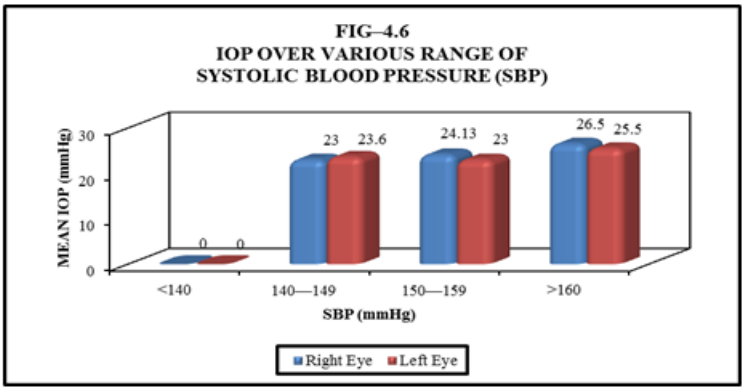


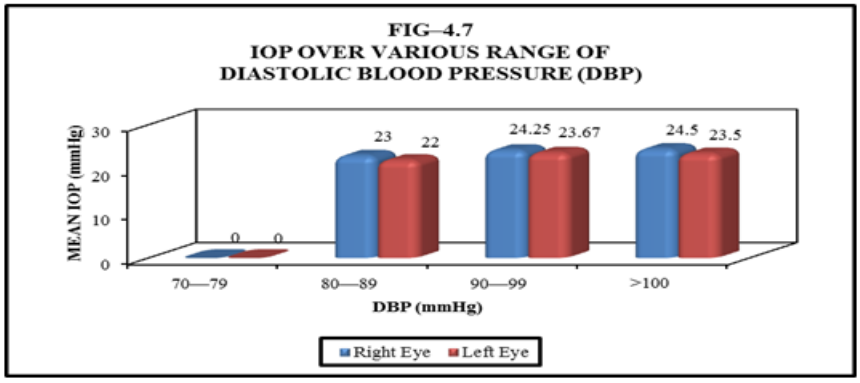
Table 4.6- IOP Over Various Range Of Systolic Blood Pressure:

SYSTOLIC BLOOD PRESSURE (mmHg)	TOTAL NUMBER (n)	PATIENTS WITH RAISED IOP		IOP mmHg	
		n	%	Right Eye	Left Eye
<140	3	0	0.00	–	–
140—149	164	5	3.05	23.00 ± 0.71	23.60 ± 1.52
150—159	178	8	4.49	24.13 ± 0.64	23.00 ± 0.76
>160	55	2	3.64	26.50 ± 0.71	25.50 ± 0.71



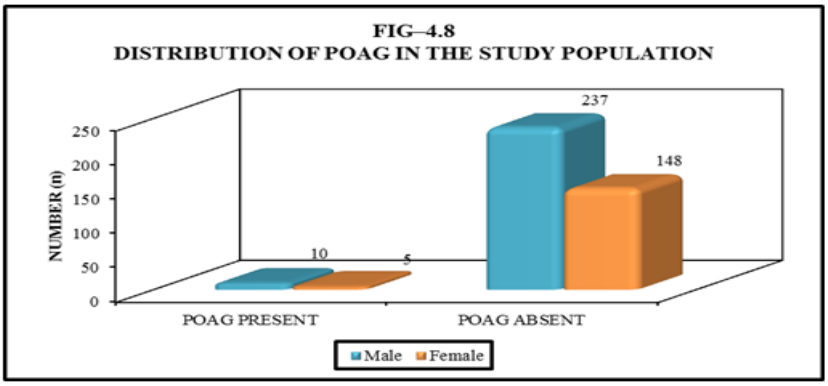
Table–4.7 IOP Over Various Range Of Diastolic Blood Pressure :

DIASTOLIC BLOOD PRESSURE (mmHg)	TOTAL NUMBER (n)	PATIENTS WITH RAISED IOP		IOP mmHg	
		n	%	Right Eye	Left Eye
70—79	1	0	0.00	–	–
80—89	34	1	2.94	23.00	22.00
90—99	305	12	3.93	24.25 ± 1.36	23.67 ± 1.37
>100	60	2	3.33	24.50 ± 0.71	23.50 ± 0.71



Table–4.8 Distribution Of POAG In The Study Population

SEX	POAG PRESENT		POAG ABSENT		TOTAL
	n	%	n	%	N
Male	10	4.05	237	95.95	247
Female	5	3.27	148	96.73	153
TOTAL	15	3.75	385	96.25	400



V. Conclusion

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. Based on the observations and results of this study, a positive association between POAG and systemic hypertension was found as 3.75% of POAG cases were present in the systemic hypertensive population (as compared to 2.56% in normal population). Intraocular pressure was found to be significantly correlated ($p<0.001$) with systolic and diastolic blood pressure levels and the intraocular pressure increased with increasing systolic as well as diastolic blood pressure levels. It was observed that the proportion of POAG with systemic hypertension was more in males compared to females. Therefore, it is important to screen for primary open angle glaucoma in systemic hypertensive patients along with regular monitoring of intraocular pressure and blood pressure levels.

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