



CORRELATION OF INTRAOCULAR PRESSURE WITH SYSTEMIC HYPERTENSION

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ABSTRACT **BACKGROUND:** Systemic hypertension is one of the key modifiable risk factors for the rise in intraocular pressure which leads to glaucoma. This study was undertaken to see the relationship between intraocular pressure and systemic hypertension in adults aged >40yrs, to diagnose ocular hypertension and its consequences at the earliest.

AIM: To study the relationship between intraocular pressure and systemic hypertension among adults aged >40 yrs.

METHOD: A hospital-based cross-sectional study was done between February 2021 to November 2021. It included 50 subjects with more than five years history of systemic hypertension. The subjects having increased central corneal thickness (>560µm), obesity and myopia were excluded from the study. The study subjects underwent routine ophthalmic examination, intraocular pressure was measured with Goldmann's applanation tonometer before pupil dilatation and blood pressure measured by sphygmomanometer after 10 minutes of rest. The variables were analysed using percentages and mean ± standard deviation.

RESULTS: Intraocular pressure increases with age up to 60 years, later on intraocular pressure decreases with further increase in age. In subjects aged 40-60years intraocular pressure increases with systemic blood pressure (p<0.001).

CONCLUSION: Hypertension was a contributing factor for raised intraocular pressure in subjects aged 40-60yrs. So, routine assessment for raised blood pressure is required for screening glaucoma.

KEYWORDS : Intraocular ocular pressure, Systemic hypertension, Goldmann's applanation tonometer.

BACKGROUND:**Intraocular pressure**

Intraocular pressure clearly plays an important role in the development of glaucoma and is one of the strongest known risk factors for the condition.¹ Numerous studies across multiple ethnicities show an increased prevalence^{2,3,4} and incidence^{5,6} of glaucoma as intraocular pressure increases.

Higher systolic and diastolic blood pressures are associated with increased intraocular pressure^{7,8}. In the Baltimore Eye Study, was 1.5 mmHg higher for patients with systolic blood pressure over 160 mmHg when compared to systolic blood pressures lower than 110mmHg.² The idea that insufficient perfusion of the optic nerve may contribute to glaucoma led the Baltimore Eye Study investigators to examine the relationship between primary open - angle glaucoma and diastolic perfusion pressure (defined as the difference between diastolic blood pressure and intraocular pressure).

The intraocular pressure is maintained by an equilibrium between the aqueous production from the ciliary body and its drainage via the trabecular complex. The mean intraocular pressure varies between 10 and 21 mmHg (mean 16 ± 2.5)⁹

Any abnormalities in the intraocular pressure may result in the dysfunction of the eye, which in turn may affect the vision. The intraocular pressure is affected by various systemic parameters like age, gender, and blood pressure. The intraocular pressure tends to increase with the age of a person and a change in blood pressure is directly associated with a change in the intraocular pressure^{10,11}.

An elevated intraocular pressure is one of the major risk factors for developing glaucoma or glaucomatous neuropathy and its progression^{12,13}.

Glaucoma is the second leading cause of blindness, which is responsible for 23% of all blindness cases.¹³

If ocular hypertension or glaucoma are detected early and treated appropriately, their progression and blindness can be prevented. Yet, in

the physiologic arena, the detailed variation of the intraocular pressure with blood pressure about different age groups affecting the visual functioning is still not available completely.

Hence, this work was undertaken to study the relationship between intraocular pressure and blood pressure in different age groups, so that the prediction of ocular hypertension and its consequences could be forecasted by using more common clinical parameters i.e., blood pressure and age.

MATERIALS AND METHOD:

The present study was conducted in MVJ medical college, on patients presenting to the OPD. It was a cross - sectional study done on 50 patients with systemic hypertension. The patients selected for the study were between the age group of 40 – 60 years with systemic hypertension for minimum five years.

Patients with a known case of glaucoma, central corneal thickness >560µm, ocular inflammatory diseases like iridocyclitis, pathological myopia, and obesity were excluded from the study.

The written informed consent of the patients was taken. After a brief history and clinical examination, the blood pressure recording was done in patients in the supine position after a five minutes rest, with a mercury sphygmomanometer, in the right upper limb by both the palpatory and the auscultatory methods.

Intraocular pressure was measured with Goldmann's applanation tonometer. The cornea was anesthetized with 2–3 drops of 0.5% topical paracaine, and the tear film was stained with sodium fluorescein. With the cornea and biprism illuminated by a cobalt blue light from the slit lamp, the biprism is brought into gentle contact with the apex of the cornea. The fluorescence of the stained tears facilitates visualization of the tear meniscus at the margin of contact between cornea and biprism. The fluorescent semicircles are viewed through the biprism, and the force against the cornea is adjusted until the inner edges overlap. The influence of the ocular pulsations is seen when the instrument is properly positioned, and the excursions must be averaged to give the desired endpoint. The intraocular pressure is then read directly from a scale on the tonometer housing.¹⁵

Pachymetry was done to measure the central corneal thickness. After the procedure, a prophylactic antibiotic, ciprofloxacin eye drops was instilled in both eyes to prevent infections.

Statistical Method:

The present study was a cross-sectional and comparative study. Data collected were entered into MS Excel. Table and charts were generated using MS Word. The variables were presented using percentage standard deviation and Karl Pearson's Coefficient of Correlation. The association was analyzed using Chi-Square test.

P<0.05 is considered as statistically significant.

RESULTS:

The study sample was divided into two groups based on their age groups, between 41–50yrs and 51–60yrs respectively shown in table-1.

The mean IOP between each group in both males and females is shown in table-1. The IOP increased with the age of both men and women.

The comparison between, the mean intraocular pressure and systolic blood pressure in each study group is shown in table-2. The comparison between, the mean intraocular pressure and diastolic blood pressure in each age group is shown in table- 2. As the age increased, the intraocular pressure of the subject also increased.

Intraocular pressure increases with age up to 60 years, intraocular pressure decreases with further increase in age. As age increases incidence of blood pressure increases. In patients aged 40 to 60 years, hypertension was positively associated with intraocular pressure.

A correlation analysis was done to assess the relationship between age, systolic blood pressure, diastolic blood pressure. The variables were analyzed using percentages, standard deviation and Karl Pearson's Coefficient of Correlation, shown in graphical presentation.

Table 1

GENDER	AGE	NO. OF SUBJECT	INTRAOCULAR PRESSURE	
			MEAN	SD
MALES (TOTAL 24)	41- 50 YRS	10	14.4	1.57
	51- 60 YRS	14	16.5	1.82
FEMALES (TOTAL 26)	41- 50 YRS	14	14.2	1.54
	51- 60 YRS	12	15.5	1.7

Table 2

AGE	NO. OF SUBJECTS	SBP(mm Hg)	SYSTOLIC BLOOD PRESSURE (SBP)		DBP (mmHg)	DIASTOLIC BLOOD PRESSURE (DBP)	
			MEAN	SD		MEAN	SD
41- 50YRS(TOTAL 24)	6	<120	115.6	4.96	<80	78.3	1.96
	10	120-139	125.8	6.21	80-90	87.4	4.23
	8	140-160	148.25	7.28	>90	97.7	1.66
51- 60YRS(TOTAL 26)	8	<120	116	2.61	<80	78.75	1.48
	9	129-139	130	4	80-90	87.55	3.57
	9	140-160	150.2	8.51	>90	96.22	4.05

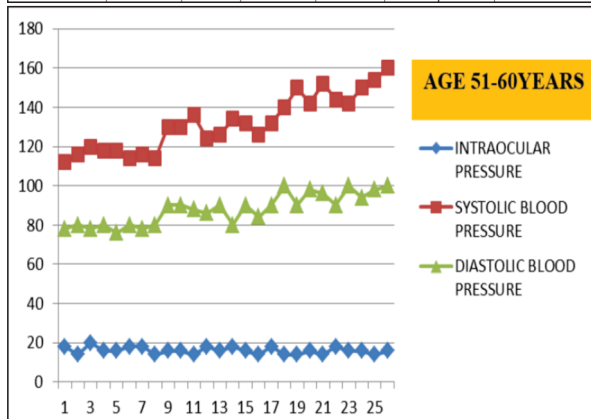


Figure 1. This Graph Shows The Comparison Of Intraocular Pressure With Both Systolic And Diastolic Blood Pressure In 41 – 50 Age Group

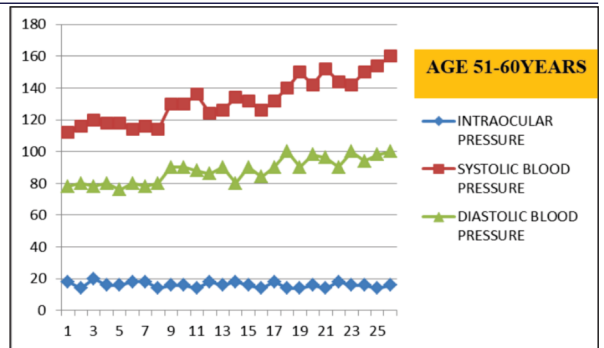


Figure 2. This Graph Shows A Comparison Of Intraocular Pressure With Both Systolic And Diastolic Blood Pressure In 51 – 60 Age Group.

DISCUSSION:

Glaucoma is the commonest cause of irreversible blindness worldwide and the second most common cause of blindness overall, after cataract. It affects approximately 70 million people and among them, 7 million are blind.¹⁸

The Hippocratic aphorisms include two mentions of blindness, one of which may refer to glaucoma: 'When headache develops in cases of ophthalmia and accompanies it for a long time, there is a risk of blindness.'¹⁵

IOP clearly plays an important role in the development of glaucoma and is one of the strongest known risk factors for the condition. The importance of intraocular pressure in causing glaucomatous damage is supported by the finding that in patients with asymmetric intraocular pressure, visual field loss is usually more severe in the eye with the higher intraocular pressure.¹

Higher systolic and diastolic blood pressures are associated with increased intraocular pressure.¹⁷

Insufficient perfusion of the optic nerve may contribute to glaucoma led the Baltimore Eye Study investigators to examine the relationship between primary open-angle glaucoma and diastolic perfusion pressure (defined as the difference between diastolic blood pressure and intraocular pressure).¹

Our study indicates that both systolic blood pressure and diastolic blood pressure were positively independently correlated to the intraocular pressure and that the correlations were statistically significant. The study conducted by Le A, Mukesh BN, Mc Carthy, and Taylor HR found that a change in the intraocular pressure was directly and significantly associated with a change in the blood pressure¹⁹. A positive association between the systolic blood pressure and a raised intraocular pressure has constantly been shown in both cross-sectional and longitudinal studies. The Beaver dam eye study conducted a study that showed that the diastolic blood pressure was positively associated with a raised intraocular pressure¹¹.

The intraocular pressure may have been increased by four mechanisms:¹⁶

1. Increased retinal blood volume after a rise in central retinal vein pressure because of increased pressure in the adjacent central retinal artery.
2. Increased blood volume in the ciliary body and decreased facility of aqueous outflow owing to an increase in resistance in the episcleral and anterior ciliary veins.
3. Increased filtration of aqueous fluid in the ciliary body owing to the increased perfusion pressure in the ciliary arteries.
4. Obstruction to aqueous drainage at the anterior chamber angle.

Systemic hypertension shows a positive relationship with increasing age.

In this study, we demonstrated that results were similar to those previously reported from other studies showing positive intraocular pressure measurements. The systolic blood pressure and the diastolic blood pressure were positively and significantly correlated with the intraocular pressure.

It is clear that these physiological changes are dynamic and will

certainly influence intraocular pressure.

CONCLUSION :

Our present study has re-emphasised that hypertension is a contributing factor for raised intraocular pressure in subjects aged 40-60yrs.

So routine assessment of blood pressure is desirable for glaucoma screening.

Financial Disclosure: Nil

Conflict Of Interest: Nil

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