



INTRA OCULAR PRESSURE IN NORMOTENSIVE AND HYPERTENSIVE SUBJECTS OF SAME AGE GROUP

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Abstract: Intra ocular pressure (IOP) is pressure exerted by aqueous humour. Aqueous humour maintains shape and nutrition of the eye ball. IOP is affected by various factors. Systemic hypertension affects formation and circulation of intra ocular fluid. Elevated IOP may lead to glaucoma and then to blindness. In this study intra ocular pressure and blood pressure were compared in normotensive and hypertensive subjects of same age group. 100 male and female subjects of age group 45- 55yrs with normal blood pressure and 100 male and female subjects of age group 45-55yrs with newly diagnosed hypertension were included in the study. IOP measured using Perkin's applination tonometer. Blood pressure measured in supine position. Statistical analysis was done by Pearson's coefficient correlation and unpaired 't' test. Mean IOP recorded in both right and left eye was equal. IOP showed linear correlation with systolic blood pressure and diastolic blood pressure. Mean IOP in hypertensive was more than mean IOP in normotensive subjects. Elevated systemic blood pressure is responsible for raised IOP which can progress to glaucoma. So to increase awareness regarding ocular complications of hypertension is important.

Key words: IOP; systolic blood pressure; diastolic blood pressure

INTRODUCTION

Intra ocular pressure (IOP) is the pressure exerted by aqueous humour in the intraocular tissue. Aqueous humour is the fluid present in the anterior and posterior chambers of the eye ball. Aqueous humour maintains shape and nutrition of eye the ball. Intra ocular pressure maintains structural and functional integrity of the eye ball¹. A transparent and colourless medium of refractive index 1.33 between the cornea and lens is essential for optical properties of eye. Aqueous humour provides this type of medium. IOP depends upon balance between production and drainage of the aqueous humour. The mean IOP varies between 10 and 21 mm Hg (mean 16 ± 2.5). IOP is affected by various factors like age, sex and blood pressure. Changes in blood pressure are directly associated with changes in IOP². Any abnormalities in the IOP result in dysfunction of the eye, which in turn affects the vision³. Systemic hypertension is one of the causes for elevation in IOP. Elevated IOP may lead to development of glaucoma. Glaucoma is a slowly progressive optic neuropathy and is the leading cause of blindness⁴. This study was done to compare IOP in normotensive and hypertensive subjects of same age group. According to recent classification of hypertension, criteria for defining prehypertension, hypertension (stage I and II) and isolated systolic hypertension is as follows:⁵

Table: Criteria for prehypertension, hypertension and hypertension

Blood pressure classification	Systolic blood pressure (mmHg)	Diastolic blood Pressure (mmHg)
Normal	< 120	< 80
Pre hypertension	120 - 139	or 80 -89
Stage 1 hypertension	140 - 159	or 90 - 99
Stage 2 hypertension	>160	or > 100
Isolated systolic hypertension	> 140	And < 90

MATERIALS AND METHODS

Patients attending Ophthalmology out Patient Department, Navodaya Medical College, Hospital and Research Centre, Raichur were chosen using simple random criteria. Study was conducted during Jan 2011 to Dec 2011. Permission from the ethical committee of institution was obtained for the study. Written consent from the participants was obtained. IOP measured in sitting position in each eye separately using Perkin's applination tonometer. Average of three reading was taken. Blood pressure measured in supine position.

Inclusion criteria

- 100 male and female subjects of age group 45-55 yrs. with normal blood pressure
- 100 male and female subjects of age group 45-55 yrs. with newly diagnosed hypertension

Exclusion criteria

- History of ocular surgery or any other surgery, diabetes mellitus, smoking and alcoholism.

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- Blind subjects, history of any ocular disease, history of any medical illness, subjects taking any medicine.

Statistical Methods

Software used: SPSS 17.0 version (statistical package for social science). Statistical analysis was done by Pearson correlation coefficient to study relation between two constant variables intraocular pressure and blood pressure. Unpaired ‘t’ test to compare two different groups.

RESULTS

Table 1: Descriptive statistics of normotensive group

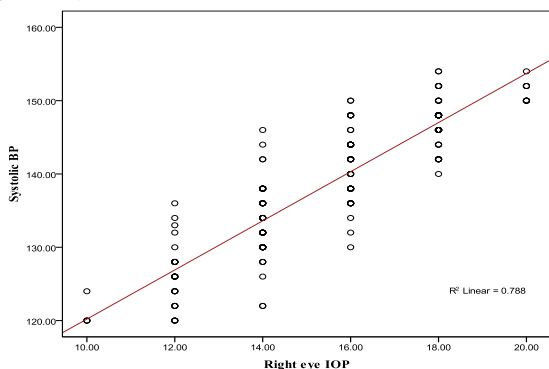
	N	Minimum	Maximum	Mean	Std. Deviation
Age in Years	100	45.00	55.00	49.1200	3.55698
Height in meter	100	1.53	1.80	1.6226	.06841
Weight in kg	100	48.00	78.00	59.4600	7.14980
Systolic BP	100	120.00	138.00	131.0100	5.68446
Diastolic BP	100	70.00	88.00	78.3800	4.22302
Pulse Pressure	100	38.00	68.00	52.6300	5.21198
Mean arterial pressure	100	86.70	104.70	95.9210	4.07553
Right eye IOP	100	10.00	16.00	13.6400	1.56683
Left eye IOP	100	10.00	16.00	13.6400	1.56683
Valid N (list wise)	100				

Table 2: Descriptive statistics of hypertensive group

	N	Minimum	Maximum	Mean	Std. Deviation
Age in Years	100	45.00	55.00	49.1900	3.55816
Height in meter	100	1.50	1.80	1.6224	.06905
Weight in kg	100	47.00	87.00	62.2500	10.12086
Systolic BP	100	140.00	154.00	146.460	3.44486
Diastolic BP	100	78.00	94.00	85.9000	4.09360
Pulse Pressure	100	52.00	68.00	60.5600	3.69635
Mean arterial pressure	100	98.70	112.70	106.0910	3.47595
Right eye IOP	100	14.00	20.00	17.4200	1.37201
Left eye IOP	100	14.00	20.00	17.4200	1.37201
Valid N (list wise)	100				

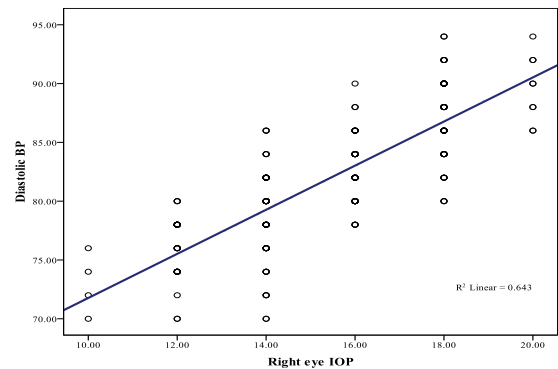
As mean IOP in left eye and right eye were same, correlation of right eye IOP with blood pressure is plotted.

Graph 1: Correlation of systolic blood pressure and IOP (Right eye)



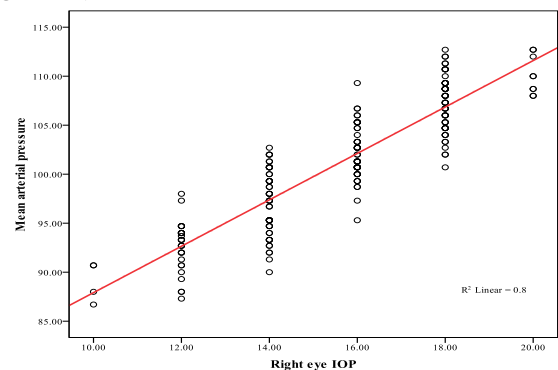
Graph shows linear positive correlation with $r = 0.887$ and $p < 0.001$

Graph 2: Correlation of diastolic blood pressure and IOP (Right eye)



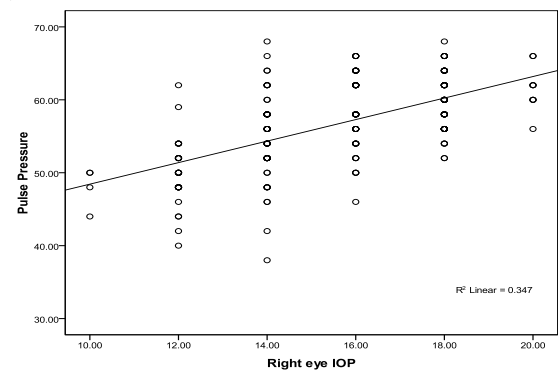
** . Correlation is significant at the 0.01 level (2-tailed). Linear relationship is significant by Pearson correlation coefficient. ($r = 0.802$, $p < 0.001$)

Graph 3: Correlation of mean arterial pressure and IOP (Right eye)



The scatter plot shows a linear relationship which was significant by Pearson correlation coefficient. ($r = 0.895$, $p < 0.001$)

Graph 4: Correlation of pulse pressure and IOP (Right eye)



Correlation is significant at the 0.01 level (2-tailed). Pearson correlation coefficient ($r = 0.589$, $p < 0.001$)

DISCUSSION

In our study mean IOP in right and left eye is 13.64 mmHg \pm 1.56 in normal group. Mean IOP of hypertensive group is 17.62 mmHg \pm 1.37 in right and left eye. There is no difference in IOP measured in right and left eye in both normal as well as hypertensive group. Normally there is similar variation in IOP of right and left eye in 24 hours.⁶ As per study done by SP Gupta, P Mehata, in average Indian Population the range of intraocular pressure with Goldmann's Applanation Tonometer is from 13.70 to 16.3 mm. Hg.⁷ There is significant linear positive correlation between IOP and systolic blood pressure as well as diastolic blood pressure. IOP is increasing significantly with pulse pressure and mean arterial blood pressure. Our findings are similar to many studies such as Rotterdam Study,⁸ Blue Mountain study,⁹ Beaver Dam Eye Study,¹⁰ Beijing eye study,¹¹ The Central India Eye Study,¹² showing increase in IOP with increase in systolic and diastolic blood pressure. Our results show that in the same age group the hypertensive subjects have higher mean IOP than the mean IOP of the normal subjects. IOP increases with increase in systolic blood pressure and diastolic blood pressure. Our results are similar to results obtained by Sedon JM, Schwartz B¹³, O Onkaya, Ajuluchukwu and H T Alimi¹⁴, A A JJeche, A Daudi¹⁵, JA Ebeigbe, PN Ebeigbe and ADA Ighorje¹⁶.

Multiple mechanisms are responsible for rise in IOP in systemic hypertension. When blood pressure increases, it increases ultra-filtration of aqueous humour. Increased aqueous humour in turn increases intra ocular pressure. Increased IOP affects drainage of the aqueous humour via the episcleral veins and also affects the pressure gradient between the aqueous in the anterior chamber and in the episcleral veins. Sympathetic tone in blood vessels in hypertensive subjects is increased and may be responsible for increased intra ocular pressure.¹⁷⁻²¹ In hypertensive subjects atherosclerotic changes are common and rennin, angiotensin levels are elevated. All these factors could affect episcleral venous pressure, which plays important role in regulation of aqueous humour outflow across the trabecular meshwork into Schlemm's canal and influence local IOP. Systolic blood pressure has a greater effect on the IOP than diastolic blood pressure because systolic blood pressure is the maximum pressure exerted by heart during left ventricular contraction.²²⁻²⁴

CONCLUSION

Elevated systemic blood pressure is responsible for raised IOP which can progress to glaucoma and blindness. Blindness creates familial, economic and social problems. Systemic hypertension runs in families and the relatives of hypertensive

patients are at higher risk to develop hypertension and also it's ocular complications such as glaucoma. So to increase awareness regarding ocular complications of hypertension is important. All subjects in pre hypertensive and hypertensive group must go for regular check-up of intra ocular pressure to avoid complications such as glaucoma and blindness in future.

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