

A COMPARATIVE STUDY ON THE EFFECT OF SYSTEMIC ARTERIAL PRESSURE ON THE INTRAOCULAR PRESSURE IN NORMOTENSIVE AND HYPERTENSIVE INDIVIDUALS OF BOTH GENDERS



Physiology

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ABSTRACT

Back ground and objective: Glaucoma is a second leading cause of irreversible blindness globally which is asymptomatic in early stages and is preventable. High intraocular pressure is one of the major risk factors of glaucoma that can be controlled by the regulation of systemic blood pressure. This study is aimed to know the influence of blood pressure on the intraocular pressure.

Methods: We have selected 100 participants of both genders aged between 45 – 55 years, and divided into them into normotensive / hypertensive male and female groups with 25 subjects in each group. Their blood pressure is recorded by mercury sphygmomanometer and intraocular pressure is examined by Goldman applanation tonometer.

Results: In our test results we found that systolic blood pressure is having a positive correlation with the intraocular pressure in all the test groups with a significant p value, and it is also observed that in normotensive and hypertensive female groups both systolic blood pressure and intraocular pressure is high when compared with the opposite male group.

Conclusion: By our study we conclude that the systolic blood pressure is definitely influencing the intraocular pressure and it is more significant in females in post reproductive period. Since systolic blood pressure is a modifiable risk factor that increases intraocular pressure which leads to glaucoma and permanent loss of vision, it has to be diagnosed early and controlled. A comprehensive eye examination is essential for the hypertensives after 40years particularly in females to protect their vision.

KEYWORDS

Glaucoma, Intraocular pressure, Goldman applanation tonometry.

INTRODUCTION

Eye is a precious structure gifted by the nature to perceive the beauty of this colorful world, so protection of vision is given at most importance. About 2.2 billion people are living with visual impairment in the world; out of them at least 1 billion cases are preventable. Out of these preventable cases glaucoma are about 6.9 millions. Projected number of people estimated to have glaucoma by 2030 is about 95.4 million globally¹⁵. Glaucoma stands second among the causes of irreversible blindness in the world^{8,12}. As per the WHO estimations out of 8.9 million blind people in India 12.8% are due to glaucoma¹⁰. So prevention of glaucoma will protect the vision in these.

Glaucoma is a complex disease caused by the progressive and irreversible damage to the ganglion cells and axons of the optic nerve^{5,14}. Glaucoma is asymptomatic in early stages and it leads to permanent loss of vision later. It is of two types open angle and closed angle, 80% of the cases are of open angle glaucoma and is more common after 40 years^{5,11}. The major risk factor of the glaucoma is raised intraocular pressure, which is the pressure exerted by the intraocular fluids on the coats of the eyeball. Normal intraocular pressure is necessary for the maintenance of proper shape and optical functions of the eye². Intraocular pressure is kept within the physiological range (10 – 21 mmHg)¹⁰ by the balance between the secretions of aqueous humor from the ciliary body and the drainage through the trabecular mesh work⁶. Raised intraocular pressure produces the mechanical stress on the posterior eye structures causing the damage. So monitoring of intraocular pressure is essential especially after 40 years³.

Intraocular pressure is not constant; it fluctuates with every heart beat by 1 mmHg^{1,10}. Many factors influence intraocular pressure, out of them systolic blood pressure is more significant. Raised blood pressure increases the ciliary arterial pressure and produces the ultrafiltration of aqueous humor which is responsible for the raise in ocular pressure³. Since the blood pressures increase with age due to vascular changes, intraocular pressure also raises with age¹³. The rate of vascular changes is not same in both genders, it is more pronounced in women after menopause⁴. So this study is aimed to

find out the relation between the systemic arterial blood pressure and intraocular pressure in both genders and early detection of the age related blood pressure change to prevent intraocular hypertension and protection of vision.

METHODS:

The present study was conducted by the Physiology department, Guntur Medical College, Guntur in the Government General Hospital, Guntur for a period of one year. The participants were selected randomly from the outpatient departments of Medicine, Ophthalmology, and Gynecology & Obstetrics.

After getting the permission from the institutional ethical committee, the subjects were explained about the study and return consent was obtained. The eligible subjects volunteered for the study were selected according to inclusion criteria.

INCLUSION CRITERIA:

1. Age between 45 – 55 years.
2. Healthy individuals of both genders.
3. BMI < 25.
4. Normotensives and newly diagnosed hypertensives not on medication.
5. Non-diabetic, non-smoker, non-alcoholic.
6. N/o refractive errors, ocular trauma, ocular surgery, and family H/o glaucoma.
7. N/o systemic diseases.
8. N/o medication like beta blockers, diuretics, and hormonal therapy.

Total 100 participants of both genders were selected and detailed history was obtained. After complete systemic examination the subjects underwent comprehensive ocular examination.

Blood pressure was recorded on the right upper limb in supine posture after giving adequate rest using mercury sphygmomanometer. Average of three reading was taken.

BMI was calculated by the formula weight (Kg) / height (m²)

Intraocular pressure was measured by Goldman applanation tonometer in the morning session to avoid the diurnal variation.

PROCEDURE:

The applanation prism was disinfected and kept dry before examination. The graduation '0' on the prism was aligned with white marker point on the tonometer head. The tonometer calibrated dial was set at 10 mmHg. Slit lamp magnification was set at x 10. The selected participants were explained about the procedure and made to sit comfortably before the slit lamp in a perfect position. A drop of topical anesthesia (Amethocaine hydrochloride 0.5%) was instilled into the inferior conjunctival sac and dry fluorescent strip was used to stain the

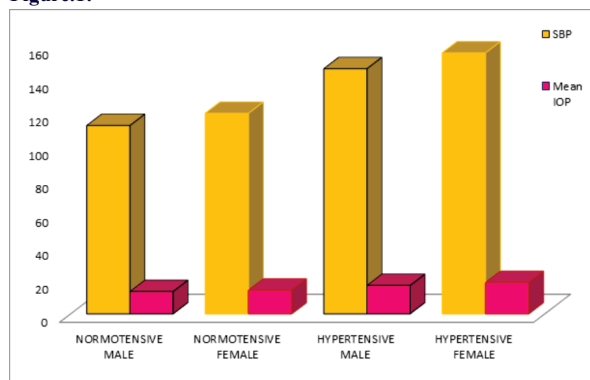
RESULTS:

Table.1: Intraocular pressures of both eyes and blood pressures of the participant groups are presented in the following table

Group	Number of subjects	SBP mmHg	DBP mmHg	PP mmHg	MAP mmHg	IOP Left mmHg	IOP Right mmHg	Mean IOP mmHG	SBP – Systolic blood pressure DBP – Diastolic blood pressure PP – Pulse pressure MAP – Mean arterial pressure IOP – Intra ocular pressure
Normotensive Male	25	112.48±3.57	70.72±4.07	41.76±5.30	84.63±3.19	13.28±0.91	13.37±0.87	13.33±0.06	
Normotensive Female	25	119.76±2.10	74.16±4.68	46.0±5.32	89.49±3.35	14.12±1.34	14.12±1.34	14.12±0.0	
Hypertensive Male	25	146.40±3.26	80.88±2.45	65.44±3.24	102.69±2.28	16.97±1.66	16.98±1.65	16.98±0.01	
Hypertensive Female	25	155.84±4.39	81.60±3.16	74.24±4.80	106.34±2.82	18.64±2.15	18.76±2.14	18.70±0.07	
P – value		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	

Table.1: The above measurements show that blood pressures are high in females of both normotensive and hypertensive groups and the corresponding intraocular pressures are also high in females of both groups with a P-value <0.0001 which is statistically significant.

Figure.1:



The above bars are representing the systolic blood pressure and mean intraocular pressure; from this it is clearly seen that systolic blood pressure and mean intraocular pressures are significantly raised in both normotensive and hypertensive females when compared with the opposite group.

DISCUSSION:

Vascular aging decreases the arterial elasticity and compliance leading to hypertension⁴ responsible for rise in the intraocular pressure in aged. In females these changes are significant because of the hormonal change after the reproductive period. Raised intraocular pressure is a major risk factor for the glaucoma. Glaucoma is the second leading cause globally for the irreversible blindness^{4,8,12,14}. So this cascade of the events leading to blindness can be prevented by just monitoring and controlling the blood pressures at an early stage.

In our study "A comparative study on the effect of systemic arterial pressure on the intraocular pressure in normotensive and hypertensive individuals of both genders" we have selected total 100 participants of both genders between 45 – 55 years of age. We made them into four groups' normotensive male, hypertensive male, normotensive female and hypertensive female with 25 members in each group. Their test results show a clear raise in systolic blood pressure, with moderate raise in diastolic blood pressure, pulse pressure and mean arterial pressures in normotensive and hypertensive female groups when compared to that of male groups. Similarly the intraocular pressures are also raised in the female group, but within physiological limits. From these results we observe the positive relation between the

cornea. Fluorescein was used just to make tonometry prism visible. The tonometer was moved forward slowly until the prism is centered to the patient's cornea, with the other hand the tonometer calibrated dial was turned clockwise until the inner lines of the two fluorescein semicircles coincide. Reading on the dial was noted and the procedure was repeated with the other eye. The examination was done by a qualified on-duty ophthalmologist.

STATISTICAL ANALYSIS:

The intraocular pressure of both eyes and blood pressure recording data of each group were presented as mean and standard deviation (SD). Normotensive and hypertensive groups of both genders were compared by using student t test and P value < 0.05 were taken as significant.

systolic blood pressure and the intraocular pressure and also more significance in female of this particular age group¹⁷.

In our study the mean systolic blood pressure in normotensive male is 112.48 ± 3.57 mmHg and mean intraocular pressure is 13.33 ± 0.06 mmHg, in normotensive female the mean systolic blood pressure is 119.76 ± 2.10 mmHg and mean intraocular pressure is 14.12 ± 0.0 mmHg, in hypertensive male the mean systolic blood pressure is 146.40 ± 3.26 mmHg and mean intraocular pressure is 16.98 ± 0.01 mmHg, and in hypertensive female the mean systolic blood pressure is 155.84 ± 4.39 mmHg and mean intraocular pressure is 18.70 ± 0.07 mmHg with a significant P value <0.0001 in all the groups. These results are clearly presenting the positive relation between the mean systolic blood pressure and the mean intraocular pressure in all the test groups, which is correlating with the study of C.J.Bulpitt et al., Ravikiran kisan et al., Tina T. wong et al.^{1,10,13}.

It is also observed in the studies that mean systolic pressure and mean intraocular pressure is more in females when compared with males of both normotensive and hypertensive groups of the same age. These findings are concurring with Minu Liz Abraham et al., Mohammed Jeelani et al.^{6,7}. Female between 45 – 55 years fall in postmenopausal age group, estrogen withdrawal in them will reduce the vascular protection^{2,8,9}. So the vascular changes like increased arterial stiffening and decreased compliance in them are responsible for increased systemic blood pressures reflecting on the intraocular pressure⁴.

CONCLUSION:

From these observations we conclude that systolic blood pressure is definitely having a positive influence on the intraocular pressure. In female after the reproductive period the blood pressures are raised, may be due to the vascular changes influence by the hormonal variations resulting in a significant increase in intraocular pressures.

So early detection and treatment of hypertension in all individuals especially after 40 years of age and motivating people to have regular eye checkup particularly examination of intraocular pressure in hypertensives, more specifically post-menopausal women will be best way to prevent glaucoma and blindness. Since the glaucoma cases are projected to increase globally, there is an urgent need to adapt a comprehensive eye examination to protect the vision.

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