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Research Article

A comparative study of intraocular pressure changes in postmenopausal normotensive and hypertensive women

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ABSTRACT

Background: Elevated intraocular pressure is a major modifiable risk factor for preventing glaucoma. Changes in intraocular pressure are directly and significantly associated with changes in blood pressure. Menopausal women with hypertension are at an increased risk of developing elevated intraocular pressure. Aim of current study was to compare the intraocular pressure changes in postmenopausal normotensive and hypertensive women.
Methods: 35 normotensive and 35 hypertensive (based on JNC7 classification) postmenopausal women in the age group of 45-55 years participated in the study. Blood pressure was recorded in the sitting position with a mercury sphygmomanometer. Intraocular pressure was measured using Goldmann applanation tonometer.
Results: Mean Intraocular Pressure in postmenopausal normotensive women was 13.01 ± 2.61 mmHg while that of postmenopausal hypertensive women was 15.15 ± 2.16 mmHg which was statistically significant. A statistically significant correlation was observed between IOP and systolic blood pressure and positive correlation was obtained between IOP and diastolic blood pressure in postmenopausal hypertensive women.
Conclusion: Menopausal women are at an increased risk of developing hypertension due to age, hormonal changes and obesity which may lead to increased IOP. IOP is also directly and significantly related to systemic blood pressure hence postmenopausal women with systemic hypertension need periodic ophthalmologic examination. Detecting early IOP changes will help them in identifying the risk groups and formulating strategies for screening glaucoma.

Keywords: Intraocular pressure, Postmenopausal women, Glaucoma

INTRODUCTION

Glaucoma commonly known as the 'thief of sight' is the second leading cause of blindness worldwide markedly affecting women and Asians.[1,2] It is estimated that there are more than 60 million cases of glaucoma worldwide and is expected to increase to 80 million by 2020.

India has 12 million cases and accounts for 1/5th of the global burden of glaucoma.[3] According to world population projection for 2010 and 2020; India would become second in having the maximum number of glaucoma cases.

The prevalence of primary open angle glaucoma in rural South Indians aged 40 and above was 1.7% (AECS study)[4] and 3.5% in urban South India (CGS).[5]

Advancing age, increased body mass index, genetic and increased Intraocular Pressure (IOP) are the factors associated with increased risk of glaucoma.

IOP-induced ganglion cell injury is explained by mechanical (axonal) and ischemic (vascular) mechanisms.

Chronic IOP elevation causes deformation of the lamina cribrosa, which gives rise to mechanical compression of ganglion cell axons at the optic nerve head, leading to impaired axoplasmic transport. Lamina cribrosa distortion induced by IOP elevation causes compression of blood vessels at the optic nerve head which in turn reduces the ocular perfusion pressure, thus producing regional hypoxia and ischemia which is the basis of vascular mechanism.[6]

Changes in IOP are directly and significantly associated with changes in systemic blood pressure with age especially so after menopause. Menopause is defined as irreversible cessation of female reproductive cycle and menstruation. Menopause related increase in blood pressure has been attributed to oestrogen withdrawal, weight gain and age hence increased IOP is more common in postmenopausal women.

Not many studies have been done in South India among postmenopausal women relating systemic blood pressure with IOP. 'Vision 2020 right to sight' India program has considered glaucoma as one of the priorities among avoidable blindness and hence this study was chosen.

METHODS

The study was a descriptive comparative study carried out after obtaining institutional ethical committee clearance. A total of 70 females in the age group of 45 to 55 years, 35 normotensive (BP 100/60 to 118/78 mmHg) and 35 known hypertensive (≥140/90 mmHg) postmenopausal women who gave history of amenorrhea of more than one year (WHO) were included in the study based on JNC 7 criteria.[7]

Postmenopausal women who gave h/o glaucoma, family h/o glaucoma, ocular trauma, ocular surgeries, refractive errors, migraine, medical or surgical illness and who were on medications such as Beta blockers, diuretics and hormone replacement therapy were excluded from the study.

Written informed consent was obtained from all the subjects. All of them were examined by the ophthalmologist in the department of ophthalmology.

Anthropometric measurements

Height was measured to the nearest 0.1 cm without footwear using a wall mounted measuring tape and weight was measured in kg using a digital weighing scale. BMI was calculated from these values. Blood pressure was recorded using a mercury sphygmomanometer with subjects in a comfortable sitting position after 5 minutes rest. IOP was measured using Goldman applanation tonometer between 9AM to 11AM to avoid diurnal variations.

Subject was informed about the test. Aseptic precautions were taken to disinfect the applanation prism and wiped dry. Tonometer calibrated each time. The subject was made to sit comfortably before the slit lamp at the right height with her chin on the chinrest and forehead against the headband. Magnification of the slit lamp was set at x10. A drop of topical anaesthetic agent Proparacaine Hydrochloride ophthalmic solution 0.5% (Paracaine) was instilled into the right eye. Fluorescein strips were used to stain the eyes. The tonometer was moved forward slowly until the prism rested gently on the centre of the patient's cornea. With the other hand the calibrated dial on the tonometer was turned clockwise until the inner lines of the two fluorescein semicircles (mires) coincided. The reading on the dial was noted. The prism was withdrawn from the corneal surface and the tip wiped dry. The procedure was repeated for the other eye.

Statistical analysis

Analysis was done using SPSS version 17.0. The results were presented as Mean ± SD. After checking for normality of data distribution unpaired student's't' test was used to find the significance of study parameters between the two groups. Correlation analysis was performed to assess relationship between different variables. P value of 0.05 or less was considered statistically significant.

RESULTS

Table 1: Mean baseline parameters in postmenopausal normotensive women and postmenopausal hypertensive women.

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	Normotensive	Hypertensive	t value	P value
Age	50.20 ± 2.91	50.26 ± 3.37	-0.076	0.940
Height	153.51 ± 4.86	159.37 ± 7.94	-3.718	0.000
Weight	57.43 ± 8.49	58.20 ± 9.69	-354	0.724
BMI	24.35 ± 3.38	22.95 ± 3.54	1.699	0.094
SBP	108.1 ± 6.1	152.7 ± 12.0	-19.607	0.000
DBP	69.4 ± 5.5	96.0 ± 7.6	-16.722	0.000

Figure 1: Mean IOP in postmenopausal normotensive women was 13.01 ± 2.61 mmHg and 15.15 ± 2.16 mmHg in postmenopausal hypertensive women (P <0.05).

Table 2: Correlation analysis a statistically significant correlation of mean IOP with systolic BP in postmenopausal hypertensive women (P <0.05) and a positive correlation with diastolic BP in postmenopausal hypertensive women.

Figure 2: Scatter diagram relating mean IOP with systolic and diastolic BP.

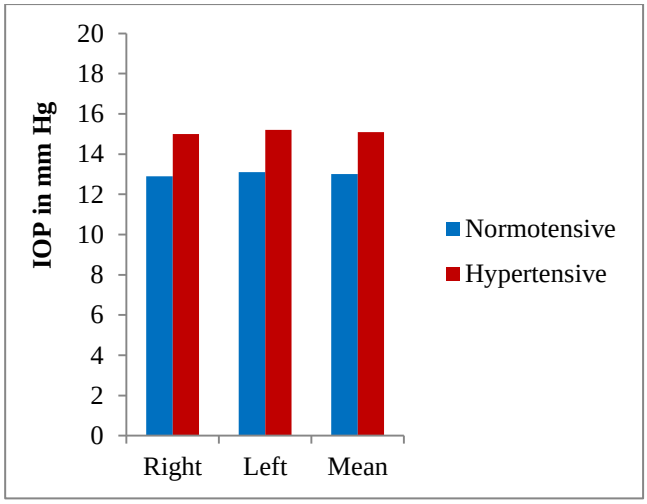

Figure 1: IOP in normotensive and hypertensive.

Table 2: Correlation analysis in postmenopausal hypertensive women.

Parameters	Group	Correlation coefficient spearman's rho value	P value
Age	Normotensive	0.163	0.350
	Hypertensive	0.128	0.464
BMI	Normotensive	0.242	0.161
	Hypertensive	0.211	0.223
Systolic BP	Normotensive	0.027	0.876
	Hypertensive	0.342	0.044*
Diastolic BP	Normotensive	0.108	0.536
	Hypertensive	0.312	0.068

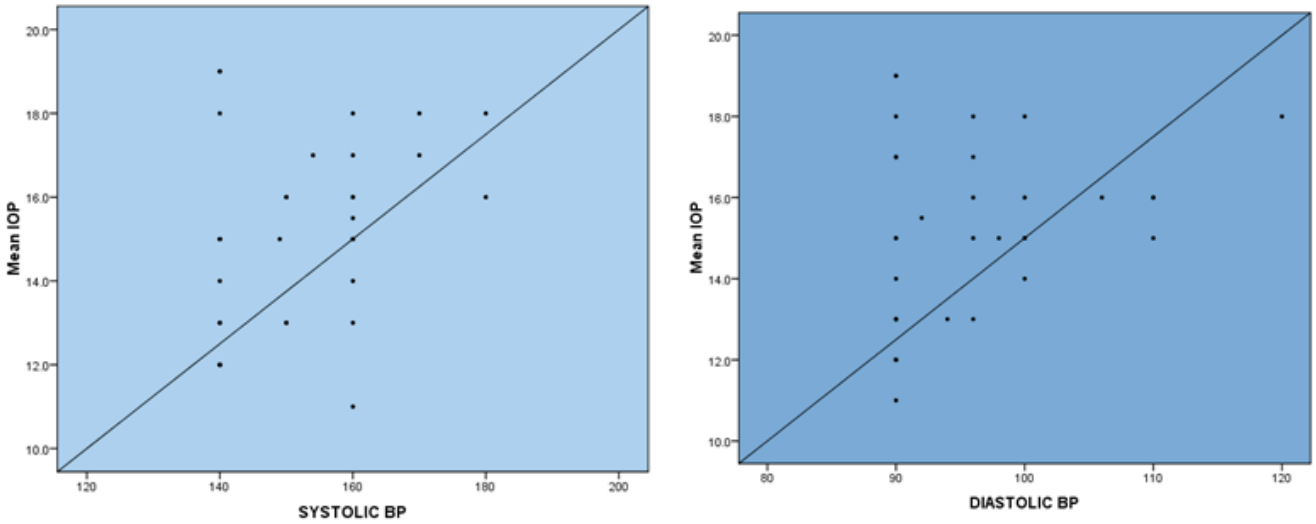

Figure 2: Correlation of IOP with systolic and diastolic BP of hypertensive postmenopausal women.

DISCUSSION

The intraocular pressure is the pressure within the eye which is maintained as a result of balance between constant formation and drainage of aqueous humour.[8] Normal range of IOP is 10-21 mmHg. Even though studies have concluded that IOP increased proportionally with degree of obesity our study did not show a positive correlation between BMI and IOP.

A change in blood pressure is directly associated with a change in IOP[9] and an elevated IOP is one of the major risk factors for glaucoma or glaucomatous neuropathy.

A study taken up by I. A. Qureshi in Pakistan showed that menopause significantly increases intraocular pressure. He concluded that mean IOP of postmenopausal hypertensive women was significantly higher than that of postmenopausal normotensive women. Mean IOP of postmenopausal hypertensive women was significantly higher than that of postmenopausal normotensive women in our study which is consistent with other studies.[10]

Studies have shown that there is a positive correlation between IOP and BP.[11,12] In the Beaver dam eye study conducted by Klein et al. there was significant correlation between IOP and both systolic and diastolic BP. Ravikisan et al. in their study have concluded that systolic, diastolic and mean arterial pressure were positively correlated to IOP and it was statistically significant.[13]

Some cross sectional and longitudinal studies have shown positive association between systolic BP and raised IOP.[14-17] We obtained a statistically significant correlation between IOP and systolic BP and a positive correlation with diastolic blood pressure which is similar to other studies.[18,19]

The role of systemic hypertension in the development and progression of glaucoma and the physiological basis of the relationship between blood pressure and IOP remains unclear. Hypothesis state that both elevated IOP and blood pressure might be driven by a common extrinsic factor such as an age-related increase in sympathetic tone. An increase in blood pressure tends to elevate ciliary artery pressure, thus increasing the ultrafiltration component of aqueous production, resulting in IOP elevation.[20,21] Increased arterial pressure can produce a small increase in venous pressure leading to reduced aqueous clearance which may also contribute.

Ocular Perfusion Pressure (OPP), which regulates blood flow to the optic nerve, depends on blood pressure and IOP. When OPP varies secondary to blood flow changes, the ability of the eye to buffer against changes in perfusion pressure (autoregulation) increases the risk of impaired metabolic supply (reduced oxygen and nutrients)[22] thus causing neuronal dysfunction.

Longstanding hypertension might also reflect a compromised peripheral vascular capacity and autoregulation to a higher IOP. Studies have also indicated that chronically elevated BP results in arteriosclerotic changes in the size of precapillary arterioles and capillary dropout leading to increased resistance to blood flow and thus reduced perfusion.[23]

CONCLUSION

Menopausal women are at an increased risk of developing hypertension due to age, hormonal changes and obesity which may lead to increased IOP. IOP is also directly and significantly related to systemic blood pressure hence postmenopausal women with systemic hypertension need periodic ophthalmologic examination. Detecting early IOP changes will help them in identifying the risk groups and formulating strategies for screening glaucoma.

Early diagnosis and management will help in reducing the incidence of blindness due to glaucoma. 'Vision 2020 right to sight' India program has considered glaucoma as one of the priorities among avoidable blindness.[24] Hence periodic ophthalmological examination in postmenopausal women will reduce the incidence of blindness in India.

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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol. 2006 Mar;90(3):262-71.
2. Qureshi IA. Intraocular pressure: a comparative analysis in two sexes. Clin Physiol. 1997 May;17(3):247-55.
3. Thomas R, Parikh R, George R, Kumar RS, Muliyil J. Five-year risk of progression of ocular hypertension to primary open angle glaucoma. A population-based study. Indian J Ophthalmol. 2003 Dec;51(4):329-33.
4. Ramakrishnan R, Nirmalan PK, Krishnada R, Thulasiraj RD, Tielsch JM, Katz J et al. Glaucoma in a rural population of Southern India: the Aravind comprehensive eye survey. Ophthalmol. 2003;110:1484-90.
5. Vijaya L, George R, Baskaran M, Arvind H, Raju P, Ramesh SV et al. Prevalence of primary open angle glaucoma in an urban south Indian population and comparison with a rural population. The Chennai glaucoma study: Ophthalmol. 2008;115:648-54.
6. Kaufman PL, Alm A. Ocular circulation. In: Kaufman PL, Alm A, eds. Alder's Physiology of the Eye: Clinical Application. 10th ed. Missouri: Mosby (Inc); 2003: 235-271.
7. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. J Am Med Assoc. 2003;289(19):2560-72.
8. Murgatroyd H, Bembridge J. Intraocular pressure. Continuing education in anaesthesia. Critical Care Pain. 2008;8(3):100-3.
9. Bulpitt CJ, Hodes C, Everitt MG. Intraocular pressure and systemic blood pressure in the elderly Br J Ophthalmol. 1975 Dec;59(12):717-20.
10. Qureshi IA. Age and intraocular pressure: how are they correlated? J Pak Med Assoc. 1995 Jun;45(6):150-2.
11. Klein BE, Klein R, Knudtson MD. Intraocular pressure and systemic blood pressure: longitudinal perspective: the Beaver dam eye study. Br J Ophthalmol. 2005 Mar;89(3):284-7.
12. J. A. Ebeigbe, P. N. Ebeigbe, A. D. A. Ighorojec. Intraocular pressure in postmenopausal Nigerian women with and without systemic hypertension. S Afr Optom. 2011;70(3):117-22.
13. Ravikiran Kisan, Swapnali Ravikiran Kisan, Anitha OR, Chandrakala SP, Rajendra S. Koujalagi. Correlation of intraocular pressure and blood pressure in different age groups. J Clin Diag Res. 2012;6(4):581-5.
14. Tina T. Wong, Tien Y. Wong. The relationship of intraocular pressure with age, systolic blood pressure and central corneal thickness in an Asian population. Invest Ophthalmol Vis Sci. 2009 Sep;50(9):4097-102.

15. McLeod SD, West SK, Quigley HA, Fozard JL. A longitudinal study of the relationship between the intraocular and the blood pressures. Invest Ophthalmol Vis Sci. 1990;31:2361-6.
16. Foster PJ, Machin D, Wong TY, Ng TP, Kirwan JF, Johnson GJ et al. Determinants of the intraocular pressure and its association with glaucomatous optic neuropathy in Chinese Singaporeans: the Tanjong Pagar study. Invest Ophthalmol Vis Sci. 2003;44:3885-91.
17. Wu SY, Leske MC. Associations with intraocular pressure in the Barbados eye study. Arch Ophthalmol. 1997;115:1572-6.
18. Tielsch JM, Katz J, Sommer A, Quigley HA, Javitt JC. Hypertension, perfusion pressure and primary open-angle glaucoma. Arch Ophthalmol. 1995 Feb;113:216-21.
19. Dielemans I, Vingerling JR, Algra D, Hofman A, Grobbee DE. Primary open-angle glaucoma, the intraocular pressure and the systemic blood pressure in the general elderly population. Ophthalmol. 1995 Jan;102(1):54-60.
20. Carel RS, Korczyn AD, Rock M, Goya I. Association between ocular pressure and certain health parameters. Ophthalmol. 1984;91:311-4.
21. Pederson JE, Green K. Aqueous humor dynamics: experimental studies. Exp Eye Res. 1973;15:277-97.
22. Stefansson E, Pedersen DB, Jensen PK, laCour M, Kiilgaard JF, Bang K, Eysteinsson T. Optic nerve oxygenation. Prog Retin Eye Res. 2005;24:307-32.
23. Stefansson E, Wagner HG, Seida M. Retinal blood flow and its auto regulation measured by intraocular hydrogen clearance. Exp Eye Res. 1988;47:669-78.
24. Rohit Saxena, Digvijay Singh, Praveen Vashist. Glaucoma: an emerging peril. Indian J Community Med. 2013 Jul-Sep;38(3):135-7.

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