

INTRAOCULAR PRESSURE CHANGES IN NORMAL AND MODERATELY HYPERTENSIVE POST MENOPAUSAL WOMEN

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ABSTRACT: BACKGROUND: Elevated Intraocular Pressure (IOP) causes a mechanical stress situation, leading to damage of neurons in retina and their axons resulting in progressive loss of visual field and blindness seen in Glaucoma. Changes in IOP are directly and significantly associated with changes in systemic blood pressures. Blood pressure increases with age in most populations, especially so after menopause. Menopausal women with hypertension are at increased risk of developing elevated IOP. There are limited data about association of moderate changes in blood pressure that often go with treatment for hypertension with IOP. This work was undertaken to study the effect of moderate systemic hypertension on IOP in postmenopausal women. **MATERIALS AND METHODS:** 40 Normotensive and 40 Hypertensive postmenopausal women participated in the study. All participants satisfied inclusion and exclusion criteria and gave informed consent. Participants underwent detailed clinical and ophthalmologic examination and IOPs were measured using Schiottz Indentation Tonometer. **RESULTS:** Mean IOP was 15.28+/-2.54 mmHg in normotensive and 19.47+/-3.37 mmHg, in moderately Hypertensive women. IOP was significantly increased ($P < 0.001^{**}$) among the hypertensive post menopausal women compared to normotensives. Subjects with higher SBP had significantly higher IOP ($p < 0.001$). The mean IOP also showed a significant correlation (p value of 0.001**) to the total number of years after attainment of menopause. **CONCLUSIONS:** Elevated IOP was seen in postmenopausal women with moderate hypertension associated with treatment. It is therefore essential that postmenopausal hypertensive women are screened regularly for increases in IOP, the only modifiable risk factor for Glaucoma.

KEY WORDS: Elevated Intraocular pressure, moderate hypertension, post menopausal women, Glaucoma, Schiottz Indentation Tonometer, systolic blood pressure and diastolic blood pressure

INTRODUCTION: Increased Intraocular pressure (IOP) remains an important risk factor for the development or progression of glaucoma.(1, 2) IOP under normal physiological condition is 10-22(16+/-6) mm of Hg. Elevated IOP causes a mechanical stress situation, leading to damage of neurons in retina and their axons resulting in progressive loss of visual field and blindness seen in Glaucoma.(2) Glaucoma is the second leading cause of blindness worldwide, markedly affecting women and Asians.(3) Other Baseline factors associated with increased risk for progression to Glaucoma includes advancing age,(4) gender,(5) body mass index, diurnal variation in IOP.(6) It is also seen that changes in IOP are directly and significantly associated with changes in systemic blood pressure.(7, 8)

In India more than 60 million women are in the age of 55 yrs because of aging population.(9) With women living longer than before, a majority would spend one third of their life in postmenopausal age. Blood pressure increases with age in most populations, especially after menopause there is a sharp increase in the prevalence of hypertension in women.(10) It is evident that postmenopausal women are at increased risk of developing elevated IOP and glaucoma because of presence of multiple risk factors mentioned above. It is seen that of those with glaucomatous visual field loss, less than 50% have received an appropriate diagnosis or treatment according to population surveys.(11, 12)

Cardiovascular disease is the leading cause of mortality and morbidity in women.(13) and medical intervention has been successful in lowering blood pressure and the subsequent risk of the systemic sequel of high blood pressure. There are limited data about association of IOP to moderate changes in blood pressure that often seen in subjects with treatment for hypertension. In addition, our search did not reveal any studies on association of intraocular pressure to systemic blood pressure in postmenopausal women Indian women. This work is undertaken to study the relationship of IOP and moderate systemic hypertension in postmenopausal women.

MATERIALS AND METHODS: Total of eighty postmenopausal women with a history of one year of amenorrhea and aged more than 45 years participated in this study. There were 40 Normotensive and 40 Hypertensive postmenopausal women. Postmenopausal women with history of Ocular trauma, ocular surgery, refractive errors, on medications such as beta-blocker drugs, oral contraceptive pills and any other medical/surgical illness were excluded from study. Also those having family history of glaucoma were also excluded from the study.

The subjects who satisfied inclusion and exclusion criteria were invited to take part in the study. Informed consent was taken from each participant. Detailed clinical examination, including anthropometric measurements like height in meters, weight in kilograms & body mass index was performed. We ensured that women in both groups had normal visual field and normal optic disc, after detailed ocular examination by an ophthalmologist, normal visual fields was confirmed with automated perimetry. Glaucoma status if present was determined and those women were excluded from the study. All subjects menopausal history, including number of years after menopause was recorded.

Measurement of arterial blood pressures and Intra Ocular Pressure: All the subjects were allowed to rest for 30 minutes in comfortable chair before measuring blood pressure. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) was recorded using mercury sphygmomanometer by both palpatory and auscultatory method. The blood pressure was taken three times and average served as the mean control blood pressure for the subjects. The pulse

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pressure (Systolic blood pressure - Diastolic blood pressure) and Mean arterial pressure (DBP+1/3PP) were also calculated.

The intra ocular pressure was measured by using the Schiotz indentation tonometer. The instrument was calibrated before each use. The subjects were in a supine position on an examination table and the cornea was anesthetized with 4% Lignocaine drops. The right eye was examined first with the patient fixing her left eye gaze in straight ahead position using the left index finger in supine position. Then the lids were separated with right hand index and thumb & the foot plate of the tonometer was placed vertically on the centre of the cornea using the left hand .the reading on the scale was recorded. A conversion table Friedenwald nomogram (REF) was used to derive the IOP in mm Hg from scale reading and the plunger weight. IOP was recorded first in the right eye and then in the left eye. All the recordings were taken in the morning hours between 10 AM to 1 PM to maintain constancy of testing and to prevent any diurnal variations in IOP.

STATISTICAL ANALYSIS: All analyses were done using the SPSS software package. Results on continuous measurements are presented as Mean \pm SD and results on categorical measurements are presented as %. Significance was assessed at 5% level of significance. Student t test (two tailed, independent) was used to find the significance of study parameters between two groups.

RESULTS: Postmenopausal women in the age group 46 to 54years took part in the study. The Clinical profile of both groups is shown in table-1. Age, Weight and BMI was comparable in both groups. IOP was significantly ($P<0.001$) increased among hypertensive post menopausal women when compared to normotensive post menopausal women, shown in figure-1.

In our study increase in the IOP was more closely related to systolic blood pressure and pulse pressure than with that of diastolic pressure. In addition, we saw that as the total number of years of attainment of menopause increased, the mean IOP also increased, (figure-2) Correlation analysis was performed and with a f value of 5.183, this relationship was statistically significant ($p<0.001$). IOP correlated positively to age and BMI in our study. We also observed that women with IOP pressures >21 mm of Hg was more in post menopausal hypertensive group than normotensive group, of these 13 women had unioocular increase(Right eye) and 5 had binocular increase compared to one women in the postmenopausal normotensive group.

Table-1 Clinical profile of both study and control groups that is normotensive and Hypertensive post menopausal women

Variables	Normotensive postmenopausal women	Hypertensive postmenopausal women	P value
Age in years	50.88 \pm 2.64	51.68 \pm 2.27	0.150
Weight (kg)	59.00 \pm 8.52	56.70 \pm 8.52	0.231
Height (cm)	1.71 \pm 0.07	1.64 \pm 0.12	0.001**
BMI (kg/m ²)	20.20 \pm 3.63	21.53 \pm 5.14	0.186
Pulse rate (beats/min)	71.15 \pm 4.64	73.55 \pm 6.48	0.060+

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SBP (mm Hg)	117.90±6.88	134.40±7.65	<0.001**
DBP (mm Hg)	75.10±5.10	84.05±7.20	<0.001**
PP (mm Hg)	43.05±7.58	49.85±7.15	<0.001**
MAP (mm Hg)	89.45±4.65	100.67±6.77	<0.001**
IOP (mm Hg) Right Eye	15.28±2.54	19.47±3.37	t=6.295; P<0.001**
IOP (mm Hg) Left Eye	14.13±2.89	17.79±2.69	t=5.851; P<0.001**

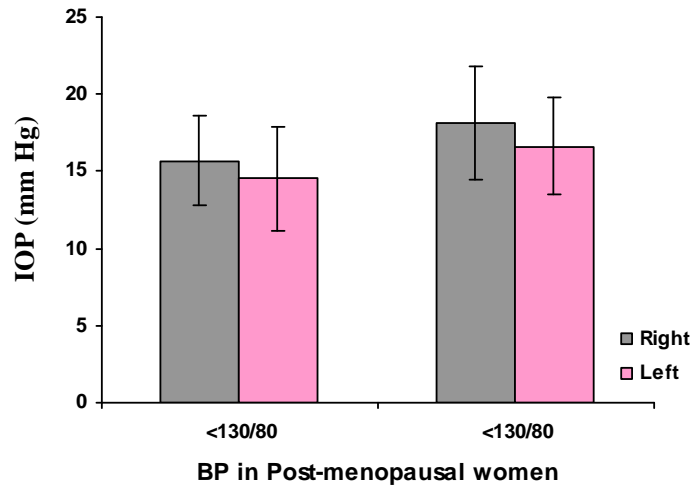


Figure- 1 shows the relation between blood pressure and intraocular pressure in post menopausal women.

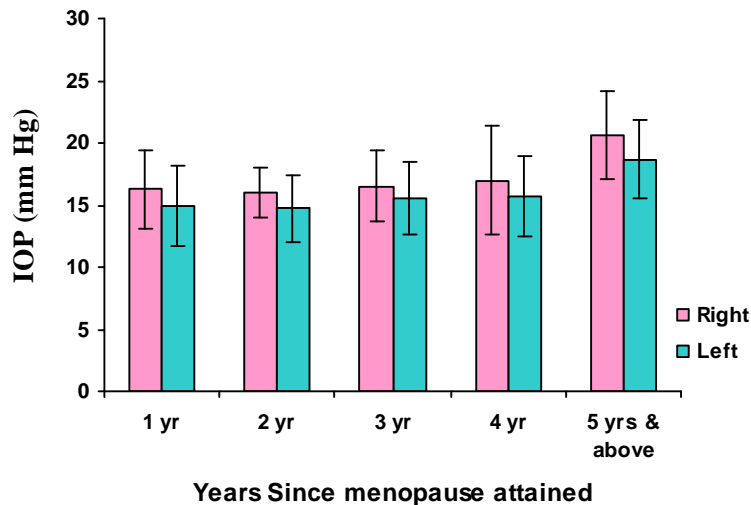


Figure- 2 Relation of Mean IOP to number of years after attainment of menopause.

DISCUSSIONS: We did not find other studies in India comparing IOP values in normotensive and hypertensive postmenopausal women. Qureshi et al in Pakistan, found that the mean intraocular pressures in postmenopausal women was more than the control group, who were of same age group and still menstruating(14) and also that Mean intraocular pressure of hypertensive postmenopausal women was significantly ($p < 0.05$) higher than that of normotensive postmenopausal women,(15) which is similar to the results we obtained. The result we obtained was consistent with other studies also.(7, 8, 11, 14, 16) In our study, increase in the IOP was more closely related to systolic blood pressure and pulse pressure than with that of diastolic pressure, similar results were seen in a study by Bulpitt et al,(7) whereas in an another study IOP were significantly correlated with both systolic and diastolic blood pressures at both baseline and follow up.(8)

Studies have also shown that systemic hypertension treated with hypotensive medications may be a risk factor for increased progression of optic nerve parameters in glaucoma suspects compared with age-matched normotensive subjects. (17) The patients with systemic hypertension showed a statistically significant increase in cup-to-disk area ratio and decrease in rim-to-disk area ratio and global Retinal Nerve Fiber Layer (RNFL) thickness with time(17). A study by Topouzis et al found that in patients without glaucoma, the DBP < 90 mm Hg that results from antihypertensive treatment was associated with increased cupping and decreased rim area of the optic disk.(18)

IOP was correlated to age and BMI in our study which is consistent with other studies.(5) IOP progressively increased with increasing age and this increase was statistically significant a decade earlier in women compared to 51-60 years in men, In the Pakistan study, IOP increases with age in both sexes, but more markedly in women. Left eye IOP was negligibly higher in all age groups of both sexes. Ocular hypertension (IOP > 21 mmHg) was more in women (5.3%) compared to men (2.1%). Menopause is associated with an increase in IOP. (5) A survey in Pakistan shows that their mean IOP of Pakistani population is similar to the IOP found in other epidemiologic investigations; the prevalence of ocular hypertension, however, seems to be slightly higher.(19)

In our study, IOP increased in women as the number of years after they attained menopause-increased. Although direct effect about number of years after attaining menopause is not shown in earlier studies, studies show that there was an increased risk of open angle glaucoma in women who experienced an early natural menopause (20)

A less than 10% decline in blood pressure during the night is known as a non-dipping blood pressure (BP) pattern. The study found that Non-dippers were older ($P = 0.04$), postmenopausal ($P = 0.003$) and had lower stress scores ($P = 0.02$) than their dipper counterparts. (21) One Possible rationale for increased intraocular pressure in hypertensive menopausal women is that hypertension and postmenopausal status itself significantly predicted non-dipping and that evidence suggests that hypertensive non-dipping women are at greater risk for target organ damage.

Another rationale could be higher testosterone in menopausal women seems to have a tendency to increase IOP.(22) Effect of hormone replacement therapy (HRT) in postmenopausal women on IOP has shown mixed results. One study shows that after 2 months of HRT, the IOP had decreased ($p < 0.001$). (23) but another study found that mean IOP of postmenopausal women receiving HRT was not significantly different from that of menopausal women not receiving HRT. (22)

Systemic hypertension treated with hypotensive medications may be a risk factor for increased progression of optic nerve parameters in glaucoma suspects compared with age-matched normotensive subjects.(17)

CONCLUSIONS: Increasing age, gender, higher BMI, postmenopausal status increases risk of hypertension in menopausal women, in addition, to these factors, non-dipping blood pressures, presence of hypertension, hypotensive medications itself and possibly increasing testosterone levels puts the postmenopausal women at an increased risk of developing Intraocular pressure. In addition, we saw that as years of attainment after menopause increased IOP also increased in our study. An elevated IOP in the affected eye is now seen as a risk factor for glaucoma rather than its cause. Presently IOP is the only modifiable risk factor that can be used to prevent progressive optic neuropathy.(2). It is therefore essential that menopausal women are screened regularly for increases in IOP.

REFERENCES:

1. Thomas R, Parikh R, George R, Kumar RS, Muliyl 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.
2. Pan Y, Varma R. Natural history of glaucoma. *Indian J Ophthalmol.* 2011 Jan;59 Suppl:S19-23.
3. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol.* 2006 Mar;90(3):262-7.
4. Qureshi IA. Age and intraocular pressure: how are they correlated? *J Pak Med Assoc.* 1995 Jun;45(6):150-2.
5. Qureshi IA. Intraocular pressure: a comparative analysis in two sexes. *Clin Physiol.* 1997 May;17(3):247-55.
6. Werne A, Harris A, Moore D, BenZion I, Siesky B. The circadian variations in systemic blood pressure, ocular perfusion pressure, and ocular blood flow: risk factors for glaucoma? *Surv Ophthalmol.* 2008 Nov-Dec;53(6):559-67.
7. Bulpitt CJ, Hodes C, Everitt MG. Intraocular pressure and systemic blood pressure in the elderly. *Br J Ophthalmol.* 1975 Dec;59(12):717-20.
8. 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.
9. Rao KA, editor. *Text book of Gynaecology.* 1st ed: Saunders: Elsevier 2008.
10. Mohan V, Deepa M, Farooq S, Datta M, Deepa R. Prevalence, awareness and control of hypertension in Chennai--The Chennai Urban Rural Epidemiology Study (CURES-52). *J Assoc Physicians India.* 2007 May;55:326-32.
11. Dielemans I, Vingerling JR, Algra D, Hofman A, Grobbee DE, de Jong PT. Primary open-angle glaucoma, intraocular pressure, and systemic blood pressure in the general elderly population. The Rotterdam Study. *Ophthalmology.* 1995 Jan;102(1):54-60.
12. Mitchell P, Smith W, Attebo K, Healey PR. Prevalence of open-angle glaucoma in Australia. The Blue Mountains Eye Study. *Ophthalmology.* 1996 Oct;103(10):1661-9.
13. Colombel A, Charbonnel B. Weight gain and cardiovascular risk factors in the postmenopausal women. *Hum Reprod.* 1997 Oct;12 Suppl 1:134-45.
14. Qureshi IA. Intraocular pressure: association with menstrual cycle, pregnancy and menopause in apparently healthy women. *Chin J Physiol.* 1995;38(4):229-34.

15. Qureshi IA. Ocular hypertensive effect of menopause with and without systemic hypertension. *Acta Obstet Gynecol Scand.* 1996 Mar;75(3):266-9.
16. JA Ebeigbe PEaAI-. Intraocular pressure in postmenopausal Nigerian women with and without systemic hypertension. *S Afr Optom.* 2011; 70((3)): 117-22
17. Punjabi OS, Stamper RL, Bostrom AG, Lin SC. Does treated systemic hypertension affect progression of optic nerve damage in glaucoma suspects? *Curr Eye Res.* 2007 Feb;32(2):153-60.
18. Topouzis F, Coleman AL, Harris A, Jonescu-Cuypers C, Yu F, Mavroudis L, et al. Association of blood pressure status with the optic disk structure in non-glaucoma subjects: the Thessaloniki eye study. *Am J Ophthalmol.* 2006 Jul;142(1):60-7.
19. Qureshi IA, Xi XR, Huang YB, Lu HJ, Wu XD, Shiarkar E. Distribution of intraocular pressure among healthy Pakistani. *Chin J Physiol.* 1996;39(3):183-8.
20. Hulsman CA, Westendorp IC, Ramrattan RS, Wolfs RC, Wittteman JC, Vingerling JR, et al. Is open-angle glaucoma associated with early menopause? The Rotterdam Study. *Am J Epidemiol.* 2001 Jul 15;154(2):138-44.
21. Routledge FS, McFetridge-Durdle JA, Dean CR. Stress, menopausal status and nocturnal blood pressure dipping patterns among hypertensive women. *Can J Cardiol.* 2009 Jun;25(6):e157-63.
22. Toker E, Yenice O, Temel A. Influence of serum levels of sex hormones on intraocular pressure in menopausal women. *J Glaucoma.* 2003 Oct;12(5):436-40.
23. Altintas O, Caglar Y, Yuksel N, Demirci A, Karabas L. The effects of menopause and hormone replacement therapy on quality and quantity of tear, intraocular pressure and ocular blood flow. *Ophthalmologica.* 2004 Mar-Apr;218(2):120-9.