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Original Article

Comparison of Intraocular Pressure Changes among Pre-Menopausal and Post-Menopausal Women

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ABSTRACT

Background: Glaucoma is the second leading cause of untreatable blindness. Due to decreased hormonal levels in post-menopausal women as compared to the pre-menopausal state, there is a high risk of glaucoma in post-menopausal women. Also, women with high BMI and BP have higher chances of raised IOP.
Aim: The study aims to compare intraocular pressure changes among pre-menopausal and post-menopausal women.
Material and Methods: This was a cross-sectional study conducted for a period of 3 months from April to June 2023 on 140 women of age group 40-55 years who were divided into 2 groups each having 70 women: pre-menopausal and post-menopausal. The study was started after getting clearance from the institutional ethics committee. Women underwent thorough examinations which includes BMI, BP, and IOP. All values were taken and compared using STATA and SPSS software.
Findings: The mean IOP in the pre-menopausal group was 11.75 mm of Hg and in the post-menopausal group was 13.42 mm of Hg which shows that in post-menopausal women the IOP is on the higher side and there are more chances of glaucoma in these women. The study has a p-value of 0.001.
Conclusion: The study concludes that IOP in post-menopausal is on the higher side in comparison to pre-menopausal women. It is due to the reduced estrogen levels as compared to the pre-menopausal state. It was also seen that the women in both groups who have raised BP and BMI have increased IOP in comparison to women with normal BP and BMI.

Key Words: *Glaucoma, post-menopausal, pre-menopausal, intraocular pressure, body mass index, blood pressure*

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INTRODUCTION

Despite the global increase in life expectancy, the age of menopause remains fixedaround the world. Menopause and postmenopausal diseases may become more prevalent as the percentage of older women increases [1]. It is well known that postmenopausal hormonal changes, particularly the drop in estrogen levels, play a significant role in increasing the frequency of visual side effects and visual illnesses [2].

Menopause is said to occur after 12 consecutivelong stretches of amenorrhea. Menopause age is typically thought to be 51 years in the United States and 45 years in India. Early menopause or premature ovarian failure is the term used when a period ends before the age of 40 and lasts more than a year. Oestrogen, progesterone, and testosterone serum levels have been shown to decline with menopause and aging. Menopause is atimeframe when the ovaries quit delivering estrogen and progesterone.

Oestrogen is a well-known vasodilator and neuroprotective hormone. Due to the existence of estrogen receptors in the retina and its vasculature, post-menopausal withdrawal can affect the retina [3].

The etiology of primary open-angle glaucoma (POAG) may involve sex hormones [4]. Retinal ganglion cells have estrogen receptors, and estrogen may have a variety of effects, including neuroprotection [5], improving visual blood flow, and lowering intraocular pressure (IOP) [6]. Animal studies revealed the neuroprotective effects of exogenous estrogen [7]. Oestrogen metabolism gene variations were generally linked to POAG in women, and hormone therapy was associated with a decreased incidence of POAG [8]. Oestrogen affects nitric oxide (NO) signaling, enhancing the blood flow to the eyes and lowering IOP.

On the side of this, NOS3 (the gene coding for endothelial NO synthase [eNOS]) variations were related to POAG characterized by IOP > 21 mmHg while diagnosis in these women [9, 10 & 11]. Premenopausal status has been used to explain lower IOP [12, 13]. Additionally, post-menopausal women's greater weight records [14] of which are associated with higher estrogen levels, have been linked to a lower chance of POAG [15, 16].

Estradiol and estrone are the main biological estrogens during pre-menopause, while estrone is the predominant circulating estrogen following menopause, and research generally supports the possibility that systemic estrogen levels may have an impact on glaucoma-related biological cycles [17].

One of the essential components that must be kept within normal ranges for the eye to fulfil its function as a light-assembling and transducer organ is intraocular pressure (IOP). By maintaining a balance between aqueous humor generation and drainage, the pressure inside the eye is kept constant [18]. It is estimated that glaucoma, which is the primary cause of permanent visual impairment, will affect 76 million people worldwide by 2040 [19, 20]. IOP can be affected by a wide range of factors, including the time of day, pulse, respiration rate, exercise, liquid admission, basic medications, topical treatments, and pregnancy.

Although glaucoma is complex and can occur at any intraocular pressure (IOP), elevated IOP continues to be an important causative factor for glaucoma development. Menopause is connected to modest IOP rises, as IOP in post-menopausal women is 1 to 3 mm Hg higher than in age-matched pre-menopausal women [21, 22].

There is a connection between open-angle glaucoma and early menopause. Open-angle glaucoma risk was increased in women who experienced regular menopause before the age of 45. IOP was essentially higher in the post-menopausal group than in the pre-menopausal females. The connection between IOP and blood pressure (BP) was incredibly beneficial. Increased BP may lead to increased ultrafiltration of aqueous humour due to elevated ciliary artery pressure in the ciliary body, as well as elevated episcleral venous pressure, which affects aqueous humour outflow, resulting in increased IOP. Studies have even shown a correlation between hormone replacement treatment (HRT) and a reduction in IOP in post-menopausal women. IOP may be affected by hormonal changes in menopausal women; the lower the amount, the higher the IOP in post-menopausal women. IOP was also seen to be affected by the body mass index (BMI) of women the more the index is more is the IOP [8, 21].

The goal of this study was to examine the progression in IOP with menopausal status, and the relationship between BMI, BP, and IOP changes in pre-menopausal and post-menopausal women.

MATERIAL AND METHODS

The study was a cross-sectional study carried out at a tertiary care hospital in a rural area of Panipat, Haryana after getting ethical clearance. A total number of 140 women of age group 40-55 years were taken for the study. The study was done for a period of 3 months from April to June 2023. They were divided into 2 groups each having 70 women: pre-menopausal and post-menopausal.

Inclusion Criteria

1) 70 females aged below 55 years, who had attained menopause for more than one year, were taken in the postmenopausal group.
2) 70 females who were still menstruating were taken in the premenopausal group.

Exclusion Criteria

1) Women beyond the age range of 40 – 55 years.
2) Women with a history of premature menopause/surgical menopause.
3) Women with a previous history of Glaucoma or on medication for Glaucoma.
4) Women with diseases like diabetes mellitus/ heart disease.
5) Women on medications like steroid hormones/ oral contraceptive pills/anti-VEGF.
6) Women with a family history of glaucoma.
7) Women with a history of ocular surgery in the past 3 months.

A detailed history including personal, past, and systemic history was taken from all the women after taking informed written consent. A thorough clinical examination was done of every participant. Blood pressure was measured by using a mercury sphygmomanometer, with the subject in a resting posture and after 15 minutes in this posture. Height and weight of all women were taken and BMI was calculated in the unit of kilogram per meter.

IOP was recorded by using anon-contact tonometer. The subjects were made to sit with the chin contacting the chin rest and the front head contacting the forehead rest and IOP was estimated by the Non-Contact Tonometer (HUVITZ, HNT1 2022 made in Korea). The readings by the NCT were taken three times and the average rounded-off reading was taken as the final value since it has been found that NCT records the first reading higher.

After collecting data, it was entered into a Microsoft Excel spreadsheet. A comparison of IOP between both the pre-menopausal and post-menopausal groups was done. The data were analyzed using SPSS and STATA software.

The study aimed to know IOP changes in post-menopausal women and to compare IOP in pre-and post-menopausal women. It also aims to find the correlation between BMI, SBP, and IOP.

RESULTS

Table 1: Shows the distribution of pre-menopausal women based on IOP.

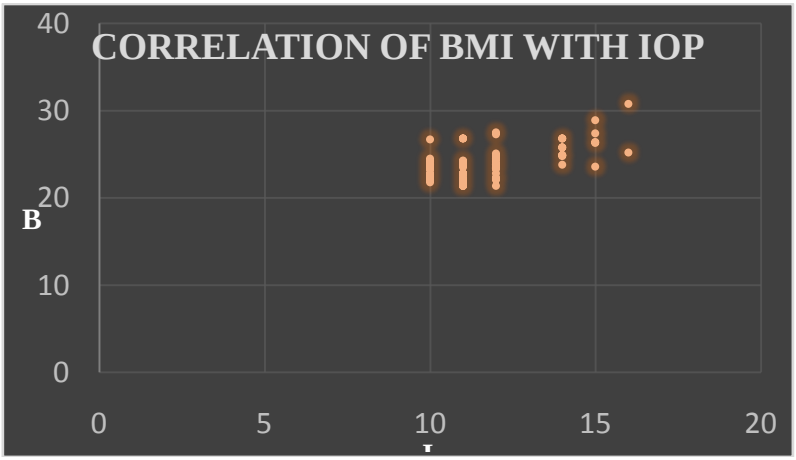
IOP (mm Hg)	NUMBER OF FEMALES
10	19
11	18
12	18
13	0
14	8
15	5
16	2

The table shows the distribution of pre-menopausal women according to IOP. It was seen that the maximum women had IOP between 10-12 mm of Hg and the mean IOP in the pre-menopausal group was 11.75 mm of Hg.

Table 2: Shows the distribution of post-menopausal women based on IOP.

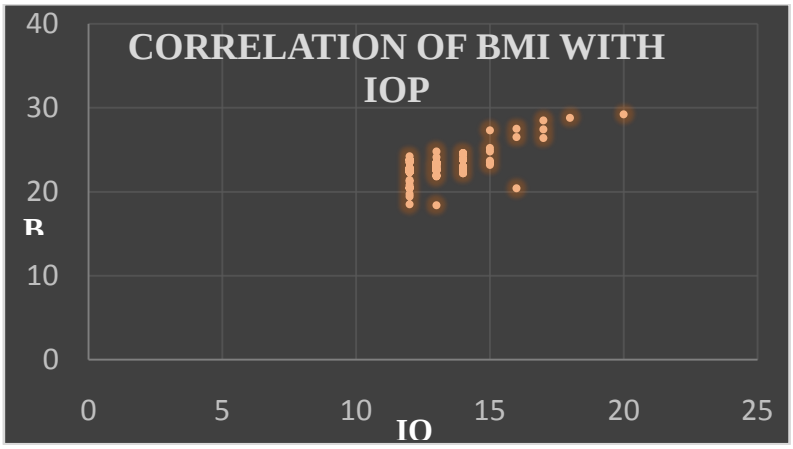
IOP (mm Hg)	NUMBER OF FEMALES
12	26
13	19
14	10
15	6
16	3
17	4
18	1
19	0
20	1

The table shows the distribution of post-menopausal women according to IOP. It was seen that the maximum number of women had IOP between 12-14 mm of Hg and the mean IOP in the pre-menopausal group was 13.42 mm of Hg. The difference between the mean IOP in both groups was 1.67 mm of Hg.



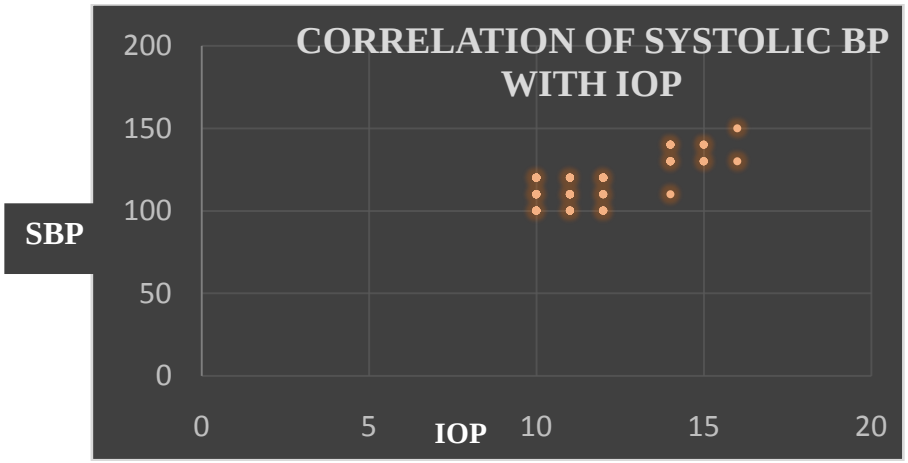
Scatter Plot 1: Shows the correlation of BMI with IOP in pre-menopausal women.

The plot shows the correlation between BMI and IOP in pre-menopausal women and we can see that with increasing BMI the IOP also increases. The maximum IOP values seen in this group are less than that in the post-menopausal group because here menopause-induced rise of IOP is not present. It also tells that obesity is a risk factor for glaucoma.



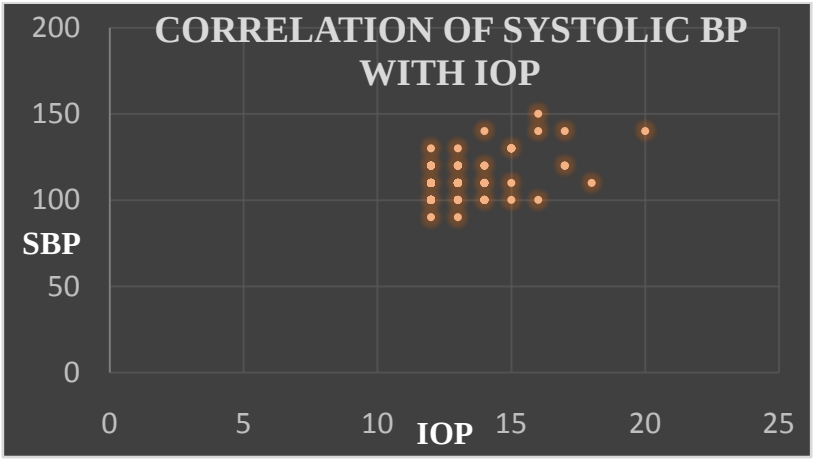
Scatter Plot 2: Shows the correlation of BMI with IOP in post-menopausal women.

The plot shows the correlation between BMI and IOP in post-menopausal women and we can see that with increasing BMI the IOP also increases and in this group, the values of IOP are even higher than that in the pre-menopausal group as the effect of reduced hormones also increase IOP.



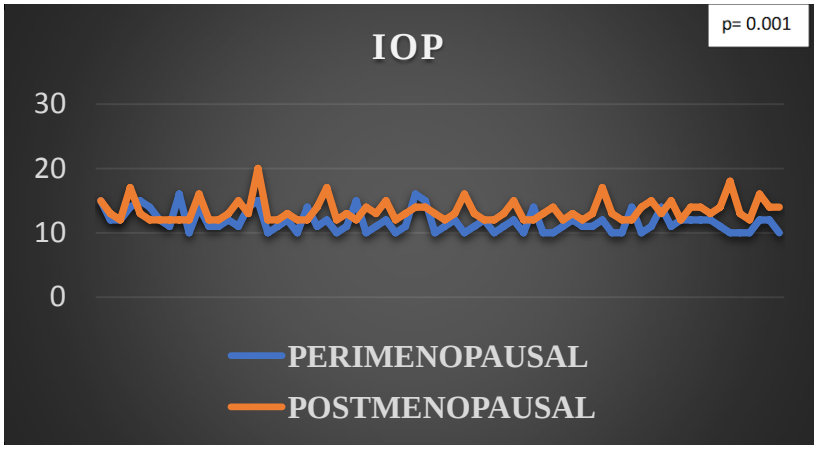
Scatter Plot 3: Shows the correlation of SBP with IOP in post-menopausal women.

The plot shows the correlation between SBP and IOP in pre-menopausal women and we can see that with increasing SBP the IOP also increases. So, BP has a positive impact on IOP and hypertensive patients are at risk of developing glaucoma.



Scatter Plot 4: Shows the correlation of SBP with IOP in post-menopausal women.

The plot shows the correlation between SBP and IOP in post-menopausal women and we can see that with increasing SBP the IOP also increases. Here the chances of developing glaucoma are even higher than that in the pre-menopausal group as 2 risk factors for raised IOP are present (menopause and SBP).



Line chart 1: Shows the correlation between IOP in pre-menopausal and post-menopausal women.

The line chart shows that the IOP in pre-menopausal women lies within the normal range if any other predisposing factor (BMI and BP) for raised IOP is absent. But the IOP values in the post-menopausal age group are higher than that in the pre-menopausal group which shows that the reduction in estrogen levels leads to a rise in IOP. The difference between the mean IOP in both groups was 1.67 mm of Hg. The p-value of the study is 0.001.

DISCUSSION

In our study, we found that there was a significant difference (p value = 0.001) between the mean IOP in pre-menopausal (11.75 mm of Hg) and post-menopausal women (13.42 mm of Hg). Our study shows that there was a difference of 1.67 mm of Hg between both groups. IOP changes in pre-menopausal and post-menopausal women had been reported previously and had been investigated for the association with high BP and high BMI [23, 24 & 25]. Panchami *et al* have also done a study on 120 southern Indian females aged 40–55 years, with 60 females in the pre-menopausal group and 60 females in the post-menopausal group they reported that IOP was 3.24 mm Hg higher in the postmenopausal group [21].

It was because in the pre-menopausal state, the estrogen and progesterone prevent the rise of IOP but in the post-menopausal state due to the withdrawal of hormones the IOP increases. Tint *et al* in their study found that the post-menopausal women who were taking hormone replacement therapy were having significantly lower IOP in comparison to women who were not taking any hormonal therapy [26].

In our study, we also found that IOP in both groups was affected by BMI and BP. We found that there was a positive correlation between IOP and both of these factors. The more the BMI the higher the IOP. Panchami *et al* also found that BMI and IOP were positively correlated [21]. It was also seen that in post-menopausal females with raised BMI due to dual effect the IOP was more raised. The reason behind this was found to be excess fat in orbit which causes a raised pressure in the episcleral venous plexus and decrease aqueous outflow [27].

It is not uncommon for women to experience changes in their eye health and vision at the menopausal age taking a proactive approach to their eye health is key to recognize these common conditions earlier and to reduce the number of cases of glaucoma in the post-menopausal age group the women were counseled to have frequent eye checkups so that we can prevent these dreaded complications.

CONCLUSION

The study concludes that IOP in post-menopausal is on the higher side in comparison to pre-menopausal women. The mean IOP in pre-menopausal age women was 11.75 mm of Hg and that in post-menopausal women was 13.42 mm of Hg. The difference between the mean IOP in both groups was found to be 1.67 mm of Hg. It is due to the reduced estrogen levels as compared to the pre-menopausal state. It was also seen that the women in both groups who have raised BP and BMI have increased IOP in comparison to women with normal BP and BMI.

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REFERENCES

1. Dalal PK, Agarwal M. (2015). Postmenopausal syndrome. *Indian J Psychiatry*. 57 (2):222–32.
2. Peck T, Olsakovsky L, Aggarwal S. (2017). Dry eye syndrome in menopause and peri-menopausal age group. *J Midlife Health*. 8(2):51–4.
3. Deschenes MC, Descovich D, Moreau M. (2010). Postmenopausal hormone therapy increases retinal blood flow and protects the retinal nerve fiber layer. *Invest Ophthalmol Vis Sci*. 51(5): 2587–600.

4. Munaut C, Lambert V, Noel A. (2001). Presence of estrogen receptor type beta in the human retina. *Br J Ophthalmol*. 8 5(7):877–82.
5. Nakazawa T, Takahashi H, Shimura M. (2006). Estrogen has a neuroprotective effect on axotomized RGCs through ERK signal transduction pathway. Brain Res. 1093(1):141–9.
6. Altintas O, Caglar Y, Yuksel N, Demirci A, Karabas L. (2004). The effects of menopause and hormone replacement therapy on quality and quantity of tears, intraocular pressure, and ocular blood flow. Ophthalmologica. 218(2):120–9.
7. Russo R, Cavaliere F, Watanabe C. (2008). 17Beta-estradiol prevents retinal ganglion cell loss induced by the acute rise of intraocular pressure in rats. Prog Brain Res. 173:583–90.
8. Pasquale LR, Loomis SJ, Weinreb RN. (2013). Estrogen pathway polymorphisms to primary open-angle glaucoma: an analysis accounting for gender from the United States. Mol Vis. 19:1471–81.
9. Kang JH, Wiggs JL, Rosner BA. (2010). Endothelial nitric oxide synthase gene variants and primary open-angle glaucoma: interactions with sex and postmenopausal hormone use. *Invest Ophthalmol Vis Sci*. 51(2):971–9.
10. Magalhaes da Silva T, Rocha AV, Lacchini R. (2012). Association of polymorphisms of endothelial nitric oxide synthase (eNOS) gene with the risk of primary open-angle glaucoma in a Brazilian population. Gene. 502(2):142–6.
11. Hulsman CA, Westendorp IC, Ramrattan RS. (2001). Is open-angle glaucoma associated with early menopause? *Am J Epidemiol*. 154(2):138–44.
12. Sorrentino C, Affinito P, Mattace Raso F. (1998). Effect of hormone replacement therapy on postmenopausal ocular function. Minerva Ginecol. 50(1–2):19–24.
13. Treister G, Mannor S. (1970). Intraocular pressure and outflow facility. Effect of estrogen and combined estrogen-progestin treatment in normal human eyes. Arch Ophthalmol. 83(3):311–8.
14. Simpson ER. (2003). Sources of estrogen and their importance. *J Steroid Biochem Mol Biol*. 86(3–5):225–30.
15. Pasquale LR, Willett WC, Rosner BA, Kang JH. (2010). Anthropometric measures and their relation to incident primary open-angle glaucoma. Ophthalmology. 117(8):1521–9.
16. Ramdas WD, Wolfs RC, Hofman A, De Jong PT, Vingerling JR, Jansonius NM. (2011). Lifestyle and risk of developing open-angle glaucoma: the Rotterdam study. *Arch Ophthalmol*. 129(6):767–72.
17. O'Connell MB. (1995). Pharmacokinetic and pharmacologic variation between different estrogen products. *J Clin Pharmacol*. 35(9):18S–24.
18. Murgatroyd H, Bembridge J. (2008). Intraocular pressure. Continuing Education in Anaesthesia. Critical Care and Pain. 8(3):100–3.
19. Quigley HA, Broman AT. (2006). The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol*. 90: 262–7.
20. Wang W, He M, Li Z, Huang W. (2019). Epidemiological variations and trends in health burden of glaucoma worldwide. *Acta Ophthalmol*. 97: 349–55.
21. Panchami, SR, Shenoy JP, Shivakumar J, Kole SB. (2013). Postmenopausal intraocular pressure changes in South Indian females. *J Clin Diagn Res*. 7: 1322–4.
22. Qureshi IA. (1996). Ocular hypertensive effect of menopause with and without systemic hypertension. *Acta Obstet Gynecol Scand*. 75: 266–9.
23. Ebeigbe JA, Ebeigbe PN, Ighoroje AD. (2011). Intraocular pressure in postmenopausal Nigerian women with and without systemic hypertension. *S Afr Optom*. 70:117–22.
24. Park BJ, Park JO, Kang HT, Lee YJ. (2013). Elevated intraocular pressure is associated with metabolic syndrome in postmenopausal women: the Korean National Health and Nutrition Examination Survey. Menopause. 20:742–6.
25. Toker E, Yenice O, Temel A. (2003). Influence of serum levels of sex hormones on intraocular pressure in menopausal women. *J Glaucoma*. 12:436–40.
26. Tint NL, Alexander P, Tint KM, Vasileiadis GT, Yeung AM, Azuara-Blanco A. (2010). Hormone therapy and intraocular pressure in nonglaucomatous eyes. Menopause. 17:157–60.
27. Klein BEK, Klein R, Linton KL. (1992). Intraocular pressure in an American community: The Beaver Dam Eye Study. *Invest Ophthalmol Vis Sci*. 33:2224–28.