

Comparison of intraocular pressure and retinal nerve fibre layer thickness in pre-menopausal and post-menopausal women attending outpatient department of BSMMU

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Article Info

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Abstract

In a menopausal lady, a reduced level of estrogen hormone leads to changes in the intraocular pressure (IOP) and retinal nerve fiber layer (RNFL) thickness in the eyes. This comparative study was carried out in the Outpatient Departments (OPD) of the Community Ophthalmology and Ophthalmology of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from April 2017 to June 2019 to identify any difference in IOP and RNFL thickness in pre-menopausal and post-menopausal women aged 40-65 years. In this study, 60 pre-and post-menopausal women were included. Participants 40-50 years old with irregular menstruation were classified as group A, while those 51-65 years old with no menstruation for at least 12 months were classified as group B. More than one-fourth (26.7%) of participants had HTN in group A and 53.3% in group B. HTN was significantly associated with group B. The rise in menopausal age had a significant impact on the mean IOP and RNFL. The mean IOP in right eye (RE) was 11.80 (3.31) mm of Hg in Group A and 15.63 (3.01) mm of Hg in Group B. The mean IOP in left eye (LE) was 12.27(3.78) mm of Hg and 15.47(2.84) mm of Hg in Group A and Group B, respectively. The mean IOP of both eyes was 12.03±3.48 mmHg in Group A and 15.55±2.82 mmHg in Group B. The mean difference of IOP in RE, LE and both were statistically significant between the two groups. The mean RNFL in RE was 103.97±7.42 µm in Group A and 98.90±6.21 µm in Group B. The mean RNFL in LE was 101.87±6.69 µm and 97.97±6.65 µm in Group A and Group B, respectively. The mean RNFL of both eyes was 102.92±7.77 µm in Group A and 98.45±7.86 µm in Group B. The mean RNFL was statistically significant between the two groups. Post-menopausal women are at an increased risk of developing elevated IOP and thin RNFL than premenopausal women.

Introduction

Intraocular pressure (IOP) is the pressure exerted by the continual renewal of fluid within the eyeball. The eye needs to serve its function of detecting light and converting it into electrochemical impulses in neurons. The longstanding rise of IOP may lead to glaucomatous visual field defects. It is worth mentioning that glaucoma blindness affects over 6.7 million people, ranking only second to cataracts (19.3 million) as a cause of blindness worldwide.¹ Being medically and surgically incurable, visual impairment from glaucoma presents a significant challenge to those concerned with preventing blindness. Menopause results from permanent cessation of menstruation due to loss of ovarian follicle

activity, reducing endogenous estrogen and progesterone production. Menopause is physiological but potentially affects various organs and systems of the body.

Besides IOP, RNFL thickness may reveal alteration in the post-menopausal period.² The post-menopausal level of IOP is higher and there is a reduction of 1-4 mmHg in response to hormone replacement therapy.^{3,4} Estrogen and progesterone hormones decrease IOP by vasodilator influence. Estrogen receptors on retinal ganglion cells are available and oral estrogen intake has been shown to have a protective effect on retinal ganglion cells in rat models.⁵ Estrogen loss in menopause may damage the optic nerve through several mechanisms. Firstly,



mechanical stress from raised IOP may damage the optic nerve.⁶ IOP may be regulated by estrogens which influence the aqueous production and outflow systems.⁷ Secondly, the vascular theory suggests that optic nerve degeneration is caused by decreased perfusion or vascular dysregulation.⁸ Estrogen influence in aqueous production and outflow system. It also affects the vascular tone and blood flow and has neuroprotective effects. Impaired blood flow due to lack of these hormones leads to increase IOP and RNFL thinning in menopausal women.⁹

Estrogen receptors are present in the human retina. HRT has been shown to improve pulsatility indexes in the retrobulbar vessels and hence lower IOP and protect RNFL. Several studies determined that the structural alteration in the retina appeared before the development of visual field defect. Thus, RNFL thickness analysis is an early tool for detecting glaucoma. Considering the facts mentioned above, the present study was aimed to assess the IOP and RNFL thickness in pre and post-menopausal women aged 40-65 years attending the Out-patients Department (OPD) of Bangabandhu Sheikh Mujib Medical University (BSMMU).

Methods

The study included 60 women between the ages of 40 and 65 who were visiting OPD. Based on their menstrual history, the patients were separated into two groups of 30: pre-menopausal (Group A) and post-menopausal (Group B). Group A included women aged 40- 50 years having irregular menstruation. Group B included women aged 51- 65 years, with cessation of menstruation for at least 12 months. A purposive sampling technique was applied to collect the sample from the study population. The patients who met the criteria of inclusion were only selected.

The study was conducted in full accord with the tenets of the Declaration of Helsinki. IOP of the study subjects was recorded using the Goldmann applanation tonometer (GAT) between 10 am and 12 pm to avoid diurnal variation. Participants sat comfortably before a slit lamp at a right height with chin on chin rest and forehead against headband. Magnification was set at x10. 0.5% Proparacaine Hydrochloride instilled into eyes. Fluorescein strips are used to stain the eyes. The tonometer was moved forward slowly until the prism rest on the center of the cornea.

On the other hand, the calibrated dial turned clockwise until the inner border of mires coincided; the procedure was repeated for the left eye. Prophylactic antibiotic was given to prevent infection. RNFL thickness was assessed by the NIDEK RS330 OCT machine at BSMMU Ophthalmology diagnostic lab. All the relevant data were collected in a pre-designed data sheet and compiled and tabulated for analysis.

Results

This comparative study aimed to measure IOP in pre- and post-menopausal women, measure their RNFL thickness and observe any difference in IOP and RNFL thickness in them. Age distribution of the study patients shows that half of the patients were 40-50 years old. (Figure - 1)

Hypertension distribution of the study patients shows that 8 (26.7%) patients had hypertension in group A and 16 (53.3%) in group B. The difference between the two groups was statistically significant (p-value <.05). (Table - I)

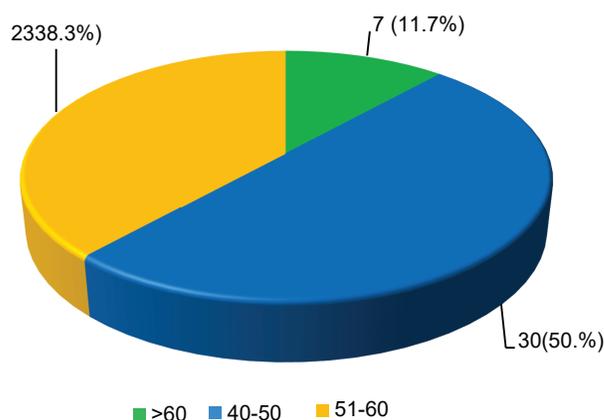


Figure-1: Pie chart showing distribution of the study patients by age

By duration of menopause, study patients show that almost half (43.3%) of the patients had a menopause duration of 6-10 years. The mean duration of menopause was 7.68 (4.90) years, ranging from 2 to 20 years.

The mean IOP was 13.12±1.78mm Hg in women having menopause for 2-5 years, 16.92±2.45 mm Hg in those having menopause for 6-10 years, 18.16±0.28 mm Hg in those with menopause for 11-15 years and 17.25±1.06 mm Hg in those attaining menopauses for 16-20 years. The difference was

Hypertension	Group-A (n=30)		Group-B (n=30)		P value
	n	%	n	%	
Present	8	26.7	16	53.3	0.035s
Absent	22	73.3	14	46.7	

s=significant, Group A= 40-50 Years, Group B= 51-65 Years

statistically significant (p -value $<.05$) among different duration of menopause (Table - II).

The mean (sd) RNFL in RE was 103.97 (7.42) μ m in Group A and 98.90 (6.21) μ m in Group B. The mean RNFL in LE was 101.87 (6.69) μ m in Group A and 97.97 (6.65) μ m in Group B. The mean (sd) RNFL both was 102.92 (7.77) μ m in Group A and 98.45 (7.86) μ m in Group B. The difference was statistically significant (p -value $<.05$) between the two groups. (Figure- 2)

The mean (sd) IOP in RE was 11.80 (3.31) mm Hg in Group A and 15.63 (3.01) mm Hg in Group B. The mean (sd) IOP in LE was 12.27 (3.78) mm Hg in Group A and 15.47 (2.84) mm Hg in Group B. The mean (sd) IOP in both eyes was 12.03 (3.48)

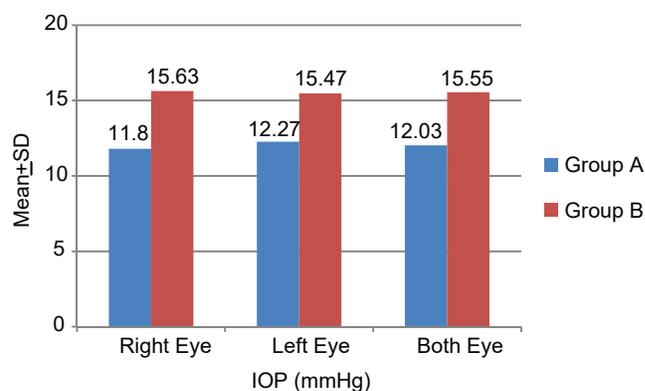


Figure - 3 : Bar diagram showing mean IOP of the study patients

Table-II

Correlation between duration of menopause with IOP(mm Hg) and RNFL(μ m) thickness (n=30)

Duration of menopause (years)	Number	IOP (mm Hg)	RNFL (μ m)
2-5	12	13.12 \pm 1.78	103.25 \pm 8.52
6-10	13	16.92 \pm 2.45	101.11 \pm 12.19
11-15	3	18.16 \pm 0.28	98.00 \pm 10.45
16-20	2	17.25 \pm 1.06	82.83 \pm 7.48
P value		0.001s	0.035s

s=significant

P value reached from ANOVA test

mm Hg in Group A and 15.55 (2.82) mm of Hg in Group B. The difference between the two groups was statistically significant (p -value $<.05$) (Figure - 3). By BMI, study patients show that two-thirds (66.7%) of patients belonged to BMI 21-23 kg/m² in group A and 25 (83.3%) in group B. The difference between the two groups was statistically non-significant (p -value $>.05$).

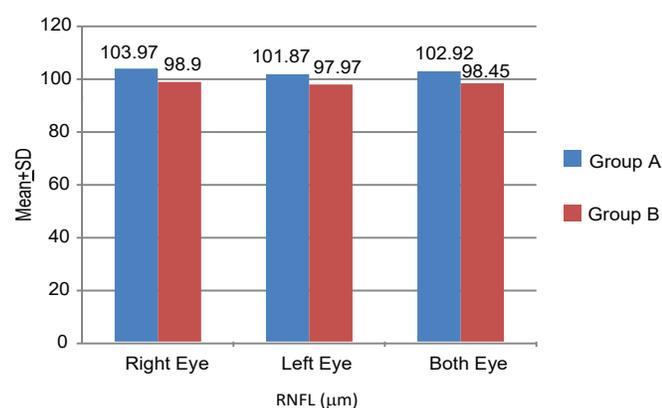


Figure - 2: Bar diagram showing mean RNFL of the study patients

Discussion

In this present study, it was observed that 50% of patients were 40-50 years old, and the mean age was 54.4 \pm 7.70 years, which varied from 40- 65 years. Fekke and Pasquale (2008) enrolled all females aged 40 to 60 years.⁸ Ozcan et al found the mean age of the pre-menopausal women was 49.6 \pm 2.8 years and 50.2 \pm 3.4 years for post-menopausal women.¹⁰

Nirmala et al showed in their study that menopausal women are at an increased risk of developing hypertension due to age, hormonal changes and obesity.¹¹ IOP is also significantly related to systemic blood pressure. Thus, post-menopausal ladies with systemic hypertension need periodic ophthalmologic examination. Detecting early IOP changes will help identify the risk groups and formulate strategies to screen for glaucoma. In this study, it was observed that 26.7% of patients had HTN in group A, but 53.3% were hypertensive in group B. HTN was significantly associated with group B. In this current study, it was observed that 43.3% of patients had a duration of menopause of 6-10 years and the mean duration of menopause was 7.68 \pm 4.90 years, ranging from 2-20 years. It is probable that the decrease in estrogen and progesterone levels after menopause may play a key role by altering any/several components of the IOP regulating mechanisms. In this study, it was observed that the mean IOP was 13.12 \pm 1.78 mm Hg in women attaining menopause for 2-5 years, 16.92 \pm 2.45 mm of Hg in the duration of menopause for 6-10 years, 18.16 \pm 0.28 mmHg in the duration of menopause for 11-15 years and 17.25 \pm 1.06 mmHg in the duration of menopause for 16-20 years. Shubhangi and Rai found in their study that IOP increased significantly with the number of years of menopause in cases where women with a history of attaining menopause for one year had an IOP of 16.38 \pm 3.31 mm of Hg.¹² As menopausal age increased to 5 years and above, and the mean IOP was 19.86 mm of Hg. In this study, IOP increased significantly (p -value $<.05$) with the attainment of menopausal age. IOP is higher in post-menopausal women compared to pre-menopausal women and there is a reduction of pressure by 1-4 mmHg in

response to HRT in menopausal women.^{3,4} On the other hand, the mean RNFL was $103.25 \pm 8.52 \mu\text{m}$ in post-menopausal women duration of menopause belonged to 2-5 years, $101.11 \pm 12.19 \mu\text{m}$ in menopause duration belonged to 6-10 years, $98.00 \pm 10.45 \mu\text{m}$ in menopause duration belonged to 11-15 years, and $82.83 \pm 7.48 \mu\text{m}$ in menopause duration belonged to 16-20 years. The mean RNFL thickness was significantly reduced with menopausal age increase.

The present study observed that the mean IOP was $12.03 \pm 3.48 \text{ mm Hg}$ in Group A and $15.55 \pm 2.82 \text{ mm Hg}$ in Group B. The IOP was significantly (p -value $< .05$) higher in Group B. Similarly, Shubhangi and Rai showed the mean IOP among pre-menopausal women was $17.04 \pm 2.35 \text{ mm Hg}$ and post-menopausal women was $20.65 \pm 4.47 \text{ mm Hg}$, which was significantly ($p < .05$) higher in post-menopausal women.¹² Panchami et al in their study observed significantly higher IOP in post-menopausal group as compared to those in pre-menopausal in south Indian females.¹³ It showed that estrogen and progesterone offered protection from raised IOP and that their withdrawal post-menopausally removed this protective veil. The mean RNFL thickness was $102.92 \pm 7.77 \mu\text{m}$ in Group A and $98.45 \pm 7.86 \mu\text{m}$ in Group B. The mean RNFL was significantly more in group A.

In this present study, it was observed that the mean BMI was $21.2 \pm 1.6 \text{ kg/m}^2$ in Group A and $21.8 \pm 1.6 \text{ kg/m}^2$ in Group B (p -value $> .05$). Leske and Podgor (1983) and Xu et al reported that an increase in body mass index (BMI) in menopausal women might play a greater role than hormonal changes.¹⁴ Panchami et al found BMI to be positively correlated with IOP.¹³

Conclusion

This study was undertaken to identify any difference in IOP and RNFL thickness in pre-menopausal and post-menopausal women aged 40-65 years. Post-menopausal women are at an increased risk of developing elevated IOP and thin RNFL than pre-menopausal women.

As the total number of years of attaining menopause increases, IOP increases and RNFL becomes thinner. So, this study helped us know that post-menopausal women need periodic ophthalmological evaluation for IOP and RNFL thickness analysis to help in the early detection and prevention of sequelae such as glaucoma.

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