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Research Article

ASSOCIATION OF BODY MASS INDEX, ATHEROGENIC INDEX AND SERUM LIPID MARKERS WITH INTRAOCULAR PRESSURE IN POSTMENOPAUSAL INDIAN WOMEN

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ABSTRACT

Elevated IOP is one of the most consistent risk factors for the development or progression of glaucoma which has been associated with various systemic factors. The present study was designed to assess the influence of body mass index, serum lipid profile and atherogenic index on intraocular pressure in postmenopausal women. Sixty premenopausal and sixty postmenopausal women were included in this study. IOP was assessed using Goldmann applanation tonometer. In each subject body mass index and Serum lipids and atherogenic index were analyzed. Mean IOP was significantly (P<0.001) higher in postmenopausal than in premenopausal group. Atherogenic index, Serum lipid parameters except HDL-C (High density lipoproteins – Cholesterol) was significantly increased (P<0.001) and showed a significant positive correlation with IOP in post-menopausal group. The lipid markers and the increased BMI might be suggested as independent risk factors for elevation of IOP in postmenopausal women

Keywords: Glaucoma, Lipids, Postmenopausal women, Cholesterol, Atherogenic index.

INTRODUCTION

Menopause is an estrogen-deficient state resulting from the loss of ovarian activity. Due to the increased awareness and longevity in 21st century, most women seek help of the clinician[1]. At the time of menopause a woman must readjust her life from one that has been physiologically stimulated by estrogen and progesterone production to one devoid of these hormones. The loss of estrogen often causes marked physiologic changes in the function of the body and the eye is no exception[2-5]. The influence of sex hormones on IOP has been the focus of some studies[6-9]. Due to the interplay of other hormones and the effect that estrogen has on other important risk factors, post-menopausal women are actually at higher risk for developing cardio vascular diseases, alteration in the visual functions and ocular hemodynamics[10, 11] Elevated intraocular pressure (IOP) is one of the major risk factors for glaucomatous visual field defects[12]. The increase in eye pressure is a typical age-related phenomenon which may also be the result of an estrogen deficiency .The most common type of glaucoma is primary (open-angle) glaucoma, which occurs in approximately 4% of people aged over 50 years, with a higher frequency in women than in men[13-15]. The diagnosis of glaucoma is usually performed at the

onset of presbyopia, when people mostly report to the clinic for the first time for eye check[16]. It is also about this age that the majority of menopausal symptoms occur.

A number of changes that occur in the lipid profile after menopause are associated with increased cardiovascular disease risk[17]. Lack of estrogen is an essential factor in this mechanism. After menopause, there is loss of ovarian function. This results in adverse changes in glucose and insulin metabolism, body fat distribution, coagulation, fibrinolysis and vascular endothelial dysfunction. There is also derangement of lipoprotein profile independent of age[18-19]. High level of BMI is strongly associated with risk of increased intraocular pressure[20]. Till date, there has been no study relating factors like body mass index, serum lipid profile and intraocular pressure in postmenopausal women in particular. Hence the present study was aimed to assess the association of body mass index and serum lipid markers with intraocular pressure in post-menopausal Indian woman.

MATERIAL AND METHOD

A group of 120 women, 60 premenopausal aged between 25-45 years and 60 postmenopausal aged between 55-70 years were studied. They were of the same social class and selected from workers and students Kasturba Medical College Manipal University, Mangalore. Some of the postmenopausal women were relatives of the workers. They were randomly selected by a lucky dip of yes or no after an informed consent and ethical clearance from the relevant ethical committee of our institution was obtained. Exclusion criteria include obesity, pregnancy, diabetes mellitus, hypertension, hormonal contraception and heavy exercise. Fasting venous samples (10ml) were collected in heparinized bottles. This however, was done on the 7th day of the L.M.P. for the premenopausal group. Sample was centrifuged and plasma was separated and stored in plastic tubes at 4oC. Samples were analyzed spectrophotometrically. Total cholesterol (TC) was estimated by CHOD-PAP method[21]. Triglyceride (TG) was estimated by GPO-POD method. High density lipoproteins (HDL) were analyzed by kits (supplied by Roche Diagnostic Gmbh D-68298 Mannheim)[22]. The concentration of Very low density lipoprotein cholesterol (VLDL-C) was estimated according to the Fridewald's equation[23]. According to Fridewald, low density lipoprotein cholesterol (LDL-C) can be calculated as follows: LDL-C = Total cholesterol - (HDL-C) - (VLDL-C). Atherogenic index of plasma (AIP) calculated as log (TG/HDL-C)[24]. Goldmann applanation tonometry[25-26] was performed by means of a Haag±Streit Goldmann tonometer in conjunction with a Haag±Streit biomicroscope. Following topical corneal anaesthesia (4% lignocaine and 0.25% fluorescein) two measurements were taken, the IOP reported here being the mean of these two values. If the two values differed by more than 2 mmHg, a third measurement was taken and the IOP was considered the median of these. A magnification of 10X was used with a cobalt blue filter to detect the applanation end-point.

STATISTICAL ANALYSIS[27]

Statistical Analysis was done using SPSS for windows version. Results were presented as mean ± standard deviation (Mean ± SD).Test for significance was done using Student T-test and pearsons coefficient.P values less than or equal to 0.05 were considered as significant.

RESULTS

Mean IOP was significantly ($P<0.001$) higher in postmenopausal than in premenopausal group (Table 1). There was a significantly increased ($P<0.001$) TC, TG, LDL-C, VLDL-C and Atherogenic index in postmenopausal than premenopausal group (Table 1). No significant difference was observed in the HDL-C levels of both groups (Table 1). Total cholesterol, LDL, VLDL, Atherogenic index and increased BMI had a significant positive correlation with IOP in post-menopausal group whereas negative correlation was observed in premenopausal group (Table 2). HDL-C levels did not show any significant correlation in both the groups (Table 2)

Table 1: Comparison of serum lipid profile and intraocular pressure in between the premenopausal and postmenopausal group (n = number of subjects)

Parameters	Premenopausal (n=60)	Postmenopausal (n=60)
Intraocular pressure	15.1 ±1.7	18.47±3 ; P<0.001**
Total cholesterol	157.5±21.9	21.9±105.1 ;P<0.001**
Triglycerides	98.7±47.8	147.5±77.9 ;P<0.001**
HDL-C	42.6±3.56	42.6±4. 9; Not significant
LDL-C	95.8±17.1	177.4±107.7; P<0.001**
VLDL-C	20±9.3	30.4±15.4; P<0.001**
Atherogenic index	3.7 ±0.5	5.9±2.7 ; P<0.001**

P< 0.0001*** - Premenopausal and Post-menopausal group

Table 2: Correlation of IOP with Lipid profile and BMI in Premenopausal women and Post-menopausal woman; (n = number of subjects)

Parameters	Premenopausal (n=60)		Postmenopausal (n=60)	
	(R value)	(P value)	(R value)	(P value)
Total cholesterol	.133	.311	.347	0.007
Triglycerides	-.144	.272	.319	0.01
HDL-C	.086	.512	.025	.853
LDL-C	.155	.236	.332	0.01
VLDL-C	.022	.869	.299	0.021
Atherogenic index	-.027	.836	.339	0.008
BMI	-.037	.905	.445	0.002

P< 0.001-Just significant; P< 0.0001- Highly significant

DISCUSSION

The present study indicates the association of lipid profile, BMI with intraocular pressure. It is suggestive of the influence of the decline in female reproductive hormones on elevated IOP, BMI and altered lipid profile. Estrogen is known to have vasodilatory effects in the systemic circulation. Decreased estrogen levels during menopause may therefore complicate or contribute to ocular pathologies as estrogen receptors are found in both retinal and choroidal tissue[28].

BMI in menopausal women may play a greater role than hormonal changes. Menopause-related hormonal changes can lead to weight gain The mechanism of effect of BMI on IOP may be due to excess intra-orbital fat tissue, an increase in episcleral venous pressure and consequent decrease in outflow facility[29]. Obesity increases blood viscosity through increasing red cell count, haemoglobin, and heamatocrit, thus increasing outflow resistance of episcleral vein[29]. Further obesity is also risk factor for diabetes and hypertension which also have effect on IOP[30]. The outcome of this study confirms the importance of weight control in preventing increased in IOP in the post-menopausal age.

Knowledge of the normal level of intraocular pressure during various stages of female reproductive cycle may help during glaucoma screening. Several biologic mechanisms could explain the association between menopause and increased IOP. Decrease in estrogen and progesterone levels after menopause plays a key role[31]. Estradiol increases endothelial nitric oxide levels by enhancing the activity of the enzyme nitric oxide synthase III. After menopause there is reduction in nitric oxide synthase III activity so the mean IOP also increases due to reduced facility of aqueous outflow[32].

Lipid profiles are affected by metabolic conditions and alterations in lipid metabolism have been implicated in atherosclerosis and coronary heart disease[33-34]. Results from this study on lipid profile in postmenopausal women indicate that menopause alters the lipid profile in women. Estrogen, one of the important female sex hormone has a role in lipid metabolism, which affects the serum cholesterol and lipoprotein levels thereby indirectly having a role in coronary heart disease. The increase in the LDL cholesterol level after menopause might be caused by decreased LDL receptor activity .These prominent findings strongly support the role of the serum

lipid markers in IOP elevation. The increase in blood viscosity and decrease in outflow channel capacity due to hyperlipidemia contribute to the elevation in IOP[35-38]. The result of the present study is in agreement with the other studies.

CONCLUSION

Elevated IOP is associated with increased total cholesterol, triglycerides, LDL-cholesterol and high BMI. The lipid markers and the increased BMI might be suggested as independent risk factors for elevation of IOP in postmenopausal women Therefore, post-menopausal woman with altered lipid profile and BMI needs a continuous monitoring for IOP to prevent glaucomatous visual field defects. Clinicians should introduce lifesyle modifications in a gradual and graded manner in the post-menopausal period so as to improve a reduction in glaucoma occurrence.

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