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Original Article

VARIATIONS IN INTRAOCULAR PRESSURE DURING DIFFERENT PHASES OF MENSTRUAL CYCLE AMONG INDIAN POPULATION

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The menstrual cycle affects many physiological processes. For instance, changes in circulating estrogen have been linked to cardiovascular and memory changes. Many of the cyclic physiological changes during diestrous mimic changes that occur during the later stages of pregnancy, when circulating estrogen concentration is very high. In addition to the effects of the menstrual cycle on cardiovascular and nervous system, it also has been reported to effect intraocular pressure. To test the effect that different phases of menstrual cycle have on intraocular pressure, the present study measured intraocular pressure in various phases of menstrual cycle in young women. Seventy-five Indian females between 18-25 years of age who displayed consistent 28 days menstrual cycles were included as the subjects. Intraocular pressures were measured by Schioetz applanation tonometer (Winters tonometer), deduced from Zeiger Ausschlag scale reading, and expressed as mm of Hg. There was an approximately 1 mm Hg increase in the intraocular pressure of the women during the luteal compared to the follicular and menstrual phases of the cycle. Most (62.66%) of the subjects exhibited a significant increase in the intraocular pressure in the luteal phase of menstrual cycle. These results indicate that intraocular pressure increases during the luteal phase of the menstrual cycle in normal female subjects, an effect that could relate to mildly impaired vision and non-compliance with contact lenses during the luteal phase.

Key words: intraocular pressure, menstrual cycle, luteal, follicular

During the past several decades, it has become quiet apparent that hormonal changes during the different phases of menstrual cycle exert a significant influence on the different physiological and biochemical parameters. The potential protective role of female sex hormones in ocular diseases and subsequent changes in visual performance during menstruation were well documented (Guttridge, 1994). Menstrual cycle is associated with transient ocular changes because of ovarian hormonal variations. Intraocular pressure (IOP) is dependent mainly on the aqueous outflow, ocular rigidity and the rate of aqueous formation (Vaid et al., 1975). Qureshi et al. (1998) observed an increase in the IOP between 20th and 22nd day and a second peak in pressure from 13th to 15th days in 1,400 Pakistani women and showed no significant differences during the cycle. Available literature suggests that, association between different phases of

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menstrual cycle and variation in intraocular pressure is inconsistent. During pregnancy, IOP was least compared to menstruating women but was highest in postmenopausal women (Qureshi, 1995). Studies on the effect of estrogen and progesterone, alone or in combination, on IOP revealed no specific influence of these hormones on IOP and were contradictory (Qureshi et al., 1997). However, Green et al. (1984) were of the view that, pharmacologically administered doses of progesterone or estrogens influence the IOP and the effect was mediated through aqueous outflow pathway. The level of IOP is determined by the rate of aqueous humor formation and its outflow. At the steady state, the rate of aqueous formation equals the rate of outflow and is affected by the integrity of blood-aqueous barrier, blood flow to ciliary body, neurohumoral regulation of vascular tissue, and the ciliary epithelium (Paciorek et al., 1980). Ciliary body is the important structure related to the production of aqueous humor, which is supplied by the anterior and posterior ciliary arteries. Hormonal variations of menstrual cycle may affect the hemodynamic changes in ophthalmic and posterior ciliary arteries and subsequently the IOP. Hence, the aim of the present study was to elucidate the intraocular pressure changes if any, during the different phases of menstrual cycle in normal Indian female subjects.

Materials and Methods

Healthy female volunteers aged between 18-25 years (N=75), from in and around of Mangalore district, India (Indian ethnicity) with menstrual history like regularity, associated dysmenorrhoea, history of premenstrual symptoms such as headache, irritability, edema, and age of menarche were collected for screening the subjects. Exclusion criteria included irregular menstrual cycle, use of oral contraceptive pills, histories of hypertension, cardiovascular abnormalities, diabetes mellitus, ocular infections, dysfunctional uterine bleeding, psychiatric illness, and/or using medications for bleeding of the uterus.

The subjects were briefed about the study and a written consent was obtained before the test. IOP was determined during mid point of menstrual, follicular, and luteal phases and the same was repeated in the next consecutive menstrual cycle. Even though Goldmann applantation is the gold standard, in the present study, IOP was measured by Schioetz applanation tonometer (Winters tonometer), since it is one of the conventional and accurate and reliable methods. Two drops of 0.5% local proparacaine were applied to the eyes of the subjects 5 minutes before using the tonometer. Subject was asked to lie down with eyes open staring at the ceiling. Blinking was avoided. Under aseptic precautions, tonometer was gently placed on the cornea. IOP reading was recorded using three different weights (5.5 g, 7.5 g, and 10 g) in order to detect any abnormal scleral rigidity. IOP record was done using three different accepted weights mainly to detect and confirm any rigidity of sclera. Respective IOP values were deduced from the Zeiger Ausschlag Scale reading and expressed in mm of Hg. All the recordings were done at 10.00am to avoid any diurnal variations.

Statistical analyses

Data were expressed as mean ± SEM. Comparison of data was done statistically by using one-way analysis of variance (ANOVA) followed by least significance difference (LSD) test. $P<0.05$ was considered as the level of significance.

Results

Out of the 75 volunteers, 62-66% subjects exhibited a significant increase in IOP. Eight subjects showed increase in IOP during menstrual phase (10.66%), 12 during follicular phase (16%) and 8 did not show any change (10.66%) during all the 3 phases of the cycle. IOP values were significantly higher with all the three weights during luteal phase compared to menstrual and

follicular phase (P<0.05). During luteal phase, it was maximum (P<0.01) compared to the menstrual and follicular phases (Table 1). Simultaneous blood pressure was recorded but it did not show any significant change during the different phases (data not shown).

Table 1. IOP changes in various phases of menstrual cycle

IOP-mm of Hg	Menstrual phase (N=75)	Follicular phase (N=75)	Luteal phase (N=75)
IOP with 5.5 g	17.06 ± 0.27	17.52 ± 0.26	18.57 ± 0.30**
IOP with 7.5 g	17.03 ± 0.34	17.19 ± 0.26	18.37 ± 0.30**
IOP with 10 g	16.65 ± 0.27	17.00 ± 0.26	18.08 ± 0.30**

Values are Mean ± SEM. ** P<0.01 when compared to other phases.

Discussion

The cyclical variation in ovarian hormonal levels during menstrual cycle is associated with characteristic changes in physiological functions. Menstrual cycle is also associated with transient ocular changes because of a reduced tolerance to contact lens wear and changes in visual performance (Guttridge, 1994). The influence of hormonal fluctuations during menstrual cycle on IOP is still to be clarified. In the present study, IOP showed a marked increase during the luteal phase in 62.66% of subjects compared to the menstrual and follicular phases. As early as 1923, Salvati noted an increase in the IOP during normal menstrual cycle. Similar studies also reported an increase between 20th and 22nd days and a subsequent peak from 13th to 15th days of the cycle (Qureshi et al., 1998) but these changes were not statistically significant. The significant increase in IOP during the luteal phase as observed in the present study may be a consequence of an increase in aqueous humor formation since the different factors influencing the aqueous secretion are well pronounced during this phase of menstruation because of the combined effects of ovarian hormones. The outflow of the aqueous remains stable at baseline all along the different phases of menstrual cycle since the endogenous progesterone levels has no effect on the outflow pathways (Green et al., 1984). Further, Green et al. could not find any correlation between IOP and different phases of menstrual cycle and hormonal changes observed during the cycle were reported not to have any influence on IOP (Gharagozoloo et al., 1991; Qureshi et al., 1997). However, there are confirmative studies reporting the influence of ovarian hormones on IOP (Kars et al., 1977). Presents of estrogen and progesterone in the blood has been shown to increase the amount of aqueous formation and may influence the observed increase in IOP (Vaid et al., 1975), as observed in the present study. Changes in the aqueous dynamics with age may also be a likely factor affecting IOP, as it was known to decrease with advancing age due to a decrease in production and drainage through uveoscleral pathway of aqueous humor. By considering these contradictory findings, we hypothesize that, because of characteristics of ocular tissue, their secretions may result in an increased IOP along with the fluctuations of ovarian hormones secretion. Several lines of evidence have support the possibility of sex hormones regulating the IOP either by affecting the rate of aqueous formation or the facility of outflow (Green et al., 1984). Our findings indicating a significant increase in IOP during the luteal phase is of importance to the clinician and taken into consideration while screening the women for glaucoma.

In summary, these results indicate that intraocular pressure increases during the luteal phase of the menstrual cycle in normal female subjects, an effect that could relate to mildly impaired vision and non-compliance with contact lenses during the luteal phase of women from Mangalore, India. However, further studies are required to confirm these findings especially using a large group of subjects to represent the Indian population.

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