ORIGINAL ARTICLE

Correlation of Serum Level of Progesterone with Peak Expiratory Flow Rate (PEFR) in Different Phases of Menstrual Cycle

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ABSTRACT

The present study has been carried out to observe the correlation of endogenous serum progesterone level with PEFR during luteal and follicular phases of two consecutive menstrual cycles. This study was conducted on 30 healthy young female volunteers with age ranges of 20-24 years in the Department of Physiology of Bangladesh Shikh Mujib Medical University (BSMMU), Dhaka during July, 2005 to June, 2006. Serum progesterone level and PEFR of all subjects during all three phases of menstrual cycles were measured by ELISA method and a portable Spirometer respectively. Plasma progesterone level is highest during luteal phase; which is about 24 fold higher than that at follicular phases. (24.54ng/ml vs 1.4ng/ml). PEFR was positively correlated with progesterone level, but statistically not significant and it was significantly higher during luteal phase than follicular phase. This result indicates that changes in the pulmonary function occurred during different phases of menstrual cycle and this is more marked during luteal phase.

Key Words: Progesterone level, PEFR, Menstrual Cycle

Introduction

The reproductive system of women comprises regular menstrual cycle, which is an integral part of their lives. The duration of the cycle is, on an average, 28 ± 2 days from the starting of one menstrual period to the starting of the next. Menstrual cycle occurs in three phases menstrual, follicular and luteal which are regulated by the sex hormones- oestrogen and progesterone from the ovary and also by the gonadotropins- leutinizing and follicle stimulating hormone from the anterior pituitary. The level of these hormones in three phases of the menstrual cycle are fluctuating.

The plasma progesterone in menstrual phase is near about zero level. These changes of hormone levels associated with menstrual cycle are known to affect different organ systems, including the respiratory system. Variations in the functional parameters of this system may be related to fluctuations in the hormonal levels during the different phases of menstrual cycle[1].

For assessment of pulmonary function PEFR is usually measured[2]. Significant increase in PEFR was observed during the luteal phase where the progesterone level is higher in comparison to those of menstrual and follicular phases of menstrual cycle. Progesterone may also has a role in relaxation of the bronchial smooth muscle which ultimately causes improvement of lung functions during this phase[1,3].

On the contrary, different observations have shown that after addition of exogenous progesterone no further increase of the lung function parameter occurs during the different phases of menstrual cycle[4].

Though it is still controversial, all these changes of pulmonary parameter indicates existence of their relationships with progesterone level during luteal phase of menstrual cycle. It has also been shown that higher level of progesterone was positively correlated with PEFR in luteal phase of menstrual cycle[1].

Some of the investigators also proposed to supplement progesterone hormone as one of the important regimen along with other bronchodilators and they found better results in female patients suffering from bronchial asthma with acute exacerbations[1,5].

Establishment of relationship of progesterone level with improvement of lung function may be helpful to suggest the hormone therapy in treatment of the patients suffering from premenstrual exacerbation of asthma.

Therefore, the present study was attempted to observe the pulmonary function status in different phases of menstrual cycle in order to find out the correlation of progesterone level with the values of lung function parameter (PEFR) during the different phases of menstrual cycle in healthy adult girls.

Methods

This was a prospective observational study carried out at the Department of Physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from July, 2005 to June, 2006. Thirty (30) apparently healthy female volunteers within the age ranged from 20 to 24 years were selected from Z.H. Sikder Medical College, Dhaka as subjects. All the subjects were studied in three phases of menstrual cycle for two consecutive cycles in order to get more confirmatory results and they were grouped as follows:

Cycle I: All the subjects on whom the study was done in the first month were included in cycle I.

Cycle II: All the subjects of cycle I were studied in the second consecutive month and were considered as subjects of cycle II.

During the menstrual phase of menstrual cycles as the corpus luteum regresses the ovarian hormone level then reach to almost zero. And due to that the menstrual phase is considered as the base line data.

Each cycle was further divided on the basis of different phases of menstrual cycle as follows:

Phase A: During their menstrual phase (Baseline data)

Phase B: During their follicular phase or proliferative phase

Phase C: During their luteal phase or secretory phase

Inclusion criteria for the subjects were regularity of menstrual cycle, age being between 20 - 30 years and average height and weight. Subjects with irregular menstrual cycle, taking Oral Contractive Pills (OCP)s, having history of hypertension/cardiovascular diseases, diabetes, dysmenorrhoea, psychiatric illness or premenstrual symptoms like headache, irritability, oedema, insomnia were excluded from the study. On the very first day of visit, physical and clinical examinations were done and in the prefixed questionnaire all the information were recorded with informed written consent. Probable date of ovulation was calculated from menstrual history. Collection of blood sample to measure plasma progesterone level and measurement of PEFR for each individual were done in three phases mentioned earlier. Subjects appeared at BSMMU during Phase A-from the 1st to 3rd day of the menstrual cycle, Phase B- 9th to 11th day of the cycle and Phase C-19th to 23rd day of the cycle.

Plasma progesterone level was estimated by ELISA method. PEFR was measured at normal room temperature in relaxed state of the subjects by digital spirometer described by certain researcher[6].

Results and Observations

PEFR

Results are shown in Table I and Figure 1.

The mean (±SD) of the measured values of PEFR were 282 3.67, 286 4.53 and 310 2.94 liters/min in cycle I in phases A, B and C of studied women respectively.

The mean (±SD) of the measured values of PEFR were 284 3.75, 289 3.80, and 313 3.29 liters/min in cycle II in phases A, B and C of studied women respectively.

In Cycle I, PEFR was significantly increased ($p < 0.001$) in phase C in comparison to those of phases A and B. Though the value was increased in phase B than that of phase A in the same group, the difference between them was not statistically significant ($p > 0.001$).

In Cycle II, The mean value of PEFR was significantly increased ($p < 0.001$)) in phase C in comparison to those of phases A and B. Again this value was significantly increased ($P < 0.001$) in phase B than that of phase A.

PEFR was almost similar both in cycle I and II in different phases. Therefore no statistically significant differences of this value were observed in different phases.

Table I: PEFR in different phases of two consecutive menstrual cycles

PEFR (Liter/min)					
Cycles	Phase A		Phase B	Phase C	
I (1st Month)	282	±3.6	286 ±4.53	310	±2.94
II (2nd Month)	284	±3.75	289 ±3.80	313	±3.29

Statistical Analysis

P value	
Cycle I	Cycle II
A vs B > 0.001 ns	< 0.001***
A vs C < 0.001***	< 0.001***
B vs C < 0.001***	< 0.001***

Results are shown as Mean ± SD

ns = not significant,*** = significant at < 0.001, n = total number of subjects.

Cycles Phases

Cycle I = 1st month & Phase A = Menstrual phase (Baseline data)

Cycle II = 2nd month: Phase B = Follicular phase

Phase C = Luteal phase

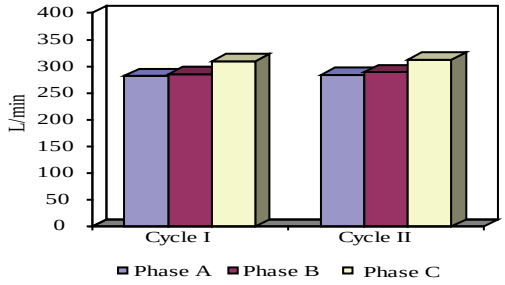

Figure 1: Mean PEFR at different phases of two consecutive menstrual cycles (n = 30)

Correlation of plasma progesterone level with PEFR

Correlation coefficient tests were done between plasma progesterone level and PEFR. In the study "r" values were obtained by this test between this hormone level and PEFR for lung function in phase C (luteal phase) of the two consecutive menstrual cycles. This relationship was not studied for phase A and phase B as the hormone level was negligible during these phases.

Results are shown in table II and figure 2.

Plasma progesterone level was positively correlated with the values of PEFR in phase C (luteal) in two consecutive menstrual cycles. The relationship was significant (P < 0.05).

Table II: Correlation of plasma progesterone level with PEFR during phase C (luteal phase) of two consecutive menstrual cycles (n = 30)

	r/p values
Cycles	PEFR
Cycle I	+ 0.185 0.50ns
Cycle II	+ 0.288 < 0.05*

Pearson's correlation coefficient test was done to obtain "r" value.

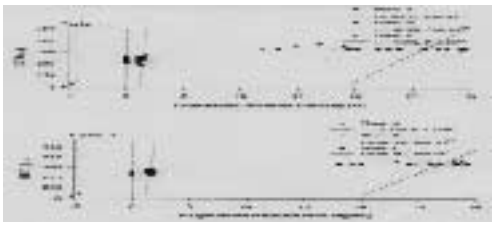

Fig 2: ***Correlation of serum progesterone level with PEFR during different phases of menstrual cycle (n = 30)***

Discussion

The present study was undertaken to evaluate the correlation of plasma progesterone with some aspects of pulmonary function parameter like PEFR during luteal and follicular phases of two consecutive menstrual cycles in apparently healthy females. As the hormone level becomes almost zero during menstrual phase,this phase was considered as the baseline and relationship during this phase was not observed. However, to find out the relationship, the plasma level of progesterone and lung function parameter was studied both during luteal and follicular phases and for comparision during all three phases between two consecutive menstrual cycle. Plasma level of progesterone was significantly higher in luteal phase in comparision to those of follicular and menstrual phases in both the consecutive menstrual cycle. These findings are

consistent with those of some others[3,5,7]. The findings of the present study also revealed similar increment in luteal phase than follicular and menstrual phases in both consecutive menstrual cycle. These difference in hormonal levels was statistaclly significant in cycle II, but not in cycle I. Relationships between plasma progesterone level and the different lung function parameter like PEFR was done by different observers. Positive correlation though not significant between hormone and PEFR has been supported by them[1,8].

Available body of literature have unrolled various suggestions highlighting the effect of higher progesterone level in changing lung function like PEFR during different phases of menstrual cycle in healthy adult females. The observed improved pulmonary function in luteal phase might be related to high progesterone level which induces hyperventilation by direct stimulation of respiratory center[3,12]. and increasing Oxygen consumption due to increased metabolic rate[9]. Moreover progesterone may potentiate prostagladin induced relaxation of bronchial smooth muscles.This relaxation is well marked during luteal phase[1,10].

In addition, role of progesterone as bronchial smooth muscle relaxant[11] and its associtionwith increased respiratory muscle indurance[1,9,12]. has also been put into account.Experimental evidence showed that physiological concentration of progesterone causes increased mRNA content of progesterone receptor at hypothalamus during luteal phase. Thus the stimulatory effect on these receptors induces hyperventilation[13] and thereby causes improvement in lung function[1,9,14]. From these limited study no valid conclusion can be drawn. But in the present study, observed improvement of pulmonary function during luteal phase of menstrual cycle is most likely due to increased level of plsma progesterone,noted in subjects of present series which is supported by less significant changes of lung function parameter during menstrual and follicular phases of menstrual cycle. In addition the positive correlation of plasma progesterone with PEFR was also in favour of the statement that, increased progesterone causes improvement of lung function.

References

1. Pai RP, Prajna P, D'Souza UJA. Correlative study on blood pressure and lung function profiles during different phases of menstrual cycle among Indian population. Thai Journal of Physiological Science 2004; 17: 30-34.
2. Da S, TK, Jana H. Basal oxygen consumption during different phases of menstrual cycle. Indian Journal of Medical Research (B) 1991; 94: 16-19.
3. Rajesh CS, Gupta and Vaney. Status of pulmonary function tests in adolescent females of Delhi. Indian Journal of Physiology and Pharmacology 2000; 44(4): 442-448
4. Resmi SS, Samuel E, Kesavachandran C, Shashidhar S. Efffect of oral contraceptives on respiratory function. Indian Journal of Physiology and Pharmacology 2002; 46(3): 361-366.
5. Beynon HLC, Garbett ND, Bames PJ. Severe premenstrual exacerbation of asthma: Effect of intramuscular progesterone. The Lancet, 1988; 2: 370-372.
6. Chemecky CC, Berger BJ, Laboratory tests and diagnostic procedures. 2006; 4:
7. Chhabra SK, Premenstrual asthma. Indian Journal of Chest Disease Allied Science 2005; 47: 109-116.
8. Golparvar M, Ahmadi F, Saghaei M. Effects of progesterone on the ventilatory performance in adult patients during partial support mechanical ventilation. jArchives of Inanian Medicine 2005; 8(1): 27-31.
9. Kaygisiz Z, Erkasap N, Soydan M, Cardiorespiratory responses to submaximal incremental exercise are not affected by night's sleep deprivation during the follicular and luteal phases of the menstrual cycle. Indian Journal of Physiology and Pharmacology 2003; 47(3): 279-287.
10. Harold A. Therapeutic use of progesterone in alveolar hypoventilation associated with obesity. American Journal of Medicine 1968; 44.
11. Lyons HA, Huang CT, Therapeutic use of progesterone in alveolar hypoventilation associated with obesity. American Journal of Journal of Medicine 1968; 44: 881-888.
12. Pauli BD, Reid RL, Munt PW, Wigle RD, Fokert L. Influence of menstrual cycle on airway function in asthmatic and normal subjects. American Review of Respiratory Diseases 1989; 140: 358-362.
13. Ganong WF, The female reproductive system. In: Review of Medical Physiology, 21st edition. USA: McGraw-Hill Companies Inc., 2006; pp. 437-450.
14. Okagaki T, Richart RM. Oxygen consumption of human endometrium during the menstrual cycle. Fertility Sterility 1970; 21(8): 595-598.