Autonomic function tests during pre and post menstrual phases in young women

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Abstract

Correlation of hormonal with autonomic functions and behavioral changes during various phases of the menstrual cycle were studied. Fifty healthy women without systemic diseases and menstrual abnormalities in the age group of 19-30 years were tested for standard autonomic functions during pre and post menstrual phases. Assessment of sympathetic activity was carried out by recording the pulse rate, arterial blood pressure, orthostasis and cold pressor tests. The parasympathetic activities were measured by recording the heart rate and expiratory/inspiratory ratio. Statistical analysis was carried out by applying the student "t" test and "z" test. It was observed that sympathetic activity was increased during premenstrual phase but parasympathetic activity remained unchanged during the various phases of the menstrual cycle.

Keywords : *Autonomic nervous system, premenstrual phase, post menstrual phase*

Introduction

Different hormonal and behavioral changes take place in women especially during reproductive period of life. These changes are physical, psychological and behavioral. Mandler (1975) proposed that the autonomic nervous system (ANS) is responsible for these changes. Frank and many others described the premenstrual syndrome. These changes may be due to one or more variables like hormonal levels, personality characteristics, genetic determinants, social factors and physical and mental stress. The cumulative physiological effects of stress cause disruption of natural rhythms. The behavioral and psychological changes in response to hormonal imbalances during the premenopausal phase, pregnancy, and menopause involve the limbic system and hypothalamus. Most of the behavioral and emotional patterns are exhibited through the autonomic nervous system.

Material and Method

Fifty healthy female volunteers between the ages of 18-25 years were selected. It was ensured that they did not suffer from any systemic disease nor had menstrual disturbances. All volunteers were assessed for autonomic function tests during premenstrual phase (day 25 to 26) and postmenstrual phase (day 6 to 7) of the menstrual cycle for three consecutive cycles. Blood pressure was measured by sphygmomanometer by the auscultatory method, electrocardiogram (ECO) was recorded in lead II. All tests were carried out in the morning and afternoon hours. Volunteers were rested for five minutes before tests were carried out. The following parameters were recorded:

1. Sympathetic function tests:

(a) Pulse rate (per minute) by palpation.

(b) Arterial blood pressure (mm of Hg) by auscultatory method.

(c) Orthostatic variation in arterial blood pressure (difference in blood pressure in supine and standing postures). A decrease in systolic blood pressure of more than 20 mm of Hg and decrease in diastolic blood pressure more than 10 mm of Hg during standing, for a period of one minute was suggestive of autonomic dysfunction.

(d) Cold pressor test: The maximum blood pressure recording obtained with the hand immersed in water kept at a temperature of 4°C was considered as an index of response, Normally both the systolic and diastolic blood pressures should increase by at least 10 mmHg at the end of 1 minute of immersion. This

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feature was used to evaluate the peripheral vasoconstrictor mechanism.

Tests for parasympathetic functions

1. Heart rate response: The difference in the rate in supine and standing positions was recorded.

   Result: In normal individual the heart rate increases by at least 10 beats per minute in the standing position. The absence of this increase was interpreted as impairment of the autonomic function of the heart.

2. Expiratory: inspiratory ratio (E: I ratio): Result: E : I ratio was taken as the ratio of the longest R-R interval after release of strain to the shortest R-R interval during strain, It was used as an index of cardiac vagal function. A ratio of less than 1.2 was considered to be abnormal.

Results of parameters reflecting sympathetic activity

TABLE No 1: Comparision of autonomic function

Parameter	Premenstrual phase Mean ± SD	Post menstrual phase Mean ± SD	'Z' value	'P' value	Result
Pulse rate / min Supine	86.12 ± 4.33	77.0 ± 3.92	11.04	P<0.01	More significant
SBP(mm Hg)*	113.32 ± 4.59	106.2 ± 4.84	07.55	P<0.01	
DBP(mm Hg)**	71 .2 ± 4.27	65.32 ± 4.67	06.35	P<0.01	More significant
Standing					
SBP(mm Hg)*	109.96 ±5.11	104.28±4.83	05.74	P<0.01	
DBP(mm Hg)**	79.46 ± 4.39	73.12+ 4.02	07.53	P<0.01	More significant
Orthostatic variation in blood pressure					
SBP{mm Hg)*	- 2.18 ± 0.66	-1.72 ±0.47	02.01	P<0.05	Significant
DBP(mmHg)**	8.26 ±1.01	7.80 ±1.1 2	01.98	P<0.05	Significant
Cold pressure test					
SBP(mm Hg)*	123.24±4.16	115.64 ±4.25	09.04	P<0.01	
DBP(mmHg)**	90.01 ± 3.94	80.68 ±2.67	13.98	P<0.01	More significant

** Systolic blood pressure, ** Diastolic blood pressure*

Results of parameters reflecting parasympathetic activity

Table No 2: Comparison of autonomic functions

Parameter	Premenstrual Phase(n=50) {Mean ± SD)	Postmenstrual Phase(n=50) (Mean ± SD)	'Z' value	'P' value	Result
Heart rate	16.46 ±4.92	16.62 ±5.31	0.16	p > 0.05	Not Significant
E : 1 Ratio*	01.43± 0.23	01 .40 ±0.29	0.45	p > 0.05	Not Significant
Valsalva Ratio	01. 15 ±0.065	01.16 ±0.08	1.16	p>0.05	Not Significant

Expiratory: inspiratory ratio

Discussion

In the present study, premenstrual phase was taken as late luteal phase (LL) phase and postmenstrual phase was taken as early follicular phase(EL) phase of the menstrual cycle. The hormonal changes associated with the menstrual cycle were responsible for physiological and psychological changes in women. The pulse rate response, orthostatic variation in arterial blood pressure and cold pressure test were significantly altered ($p<0.05$) in the premenstrual phase as compared to the postmenstrual phase thus reflecting significant increase in sympathetic activity. This is explained by the fact that the female reproductive steroids are modulators of the hypothalamic pituitary (HPA) axis, which, in association

with the autonomic nervous system form stress systems which regulate the homeostasis of the body. This HPA axis is a CRH induced propio-melanocortin peptide, which inhibits gonadotrophin secretion from the hypothalamus, which in turn affects the ovarian estrogen and progesterone levels[4]. Gonadal hormone fluctuations during the menstrual cycle is associated with significant changes in multiple neurohormonal homeostatic mechanisms of the body[9].

Estrogen not only increases sympathetic baro-reflex sensitivity but also has a prolonged stimulatory action on CRH gene promoter and the central nonadrenogenic system which induces significantly increased changes in sympathetic activity responses during premenstrual phase than the postmenstrual phase. The changes in sympathetic activity may be due to one or more variables like hormonal levels (changing influence of the ovarian steroids in different phases), personality characteristics, genetic determinants and social factors; all of which may contribute directly or indirectly[2]. These observations are consistent with previous studies (which used multiple variables like our present study), where increased sympathetic activity was demonstrated in the premenstrual phase. An extensive review of literature regarding physical and psychological changes during the menstrual cycle was carried out[6].

It is concluded that changes occurring in the premenstrual phase were alike in sympathetic response[5], and that tension and anxiety were reliably associated with autonomic arousal[7]. It was observed that there was significant variation in orthostatic arterial blood pressure and cold pressure test results in the premenstrual period, thereby indicating an increased sympathetic activity. There was no change in parasympathetic activity[1].

It was observed that there was 60.7% prevalence of autonomic hyperactivity in the premenstrual period[8].

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