

Original article:

A comparative study of evaluation of cardiovascular sympathetic functions in different phases of menstrual cycle

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ABSTRACT

Autonomic nervous system provides the physiological background for the physical, psychological or behavioral changes, as many of the usual physical symptoms during the menstrual cycle are thought to be manifestations of autonomic disturbances. A present study was planned to assess cardiovascular sympathetic functions during various phases of menstrual cycle in 50 healthy, volunteers with no irregular menses, menorrhagia and oligo-menorrhoea. Sympathetic functions were evaluated by recording Pulse rate, Arterial blood pressure, Orthostatic hypotension and Cold-Pressor test in pre and post menstrual phases with statistically significant results ($p < 0.01$) in premenstrual phase. Study concludes that there were significant responses to sympathetic function tests in the premenstrual phase as compared to postmenstrual phase, reflecting an increased sympathetic activity in premenstrual phase.

Keyword: Autonomic nervous system; menstrual cycle; cardiovascular system

INTRODUCTION

In addition to many changes in the reproductive system, there occurs a regular fluctuation in numerous functions affecting all body systems, during the menstrual cycle including physical, psychological or behavioral.

Mandler (1975) presented the view that it is the autonomic nervous system (ANS) which provides the physiological background for the perceived changes. Many of the usual physical symptoms described are those

which are thought to be manifestations of autonomic disturbances.

The premenstrual syndrome (PMS) was described by Frank many years ago and subsequently by others. Certain autonomic changes have also been reported during these phases, though more so during premenstrual phase. These changes might be due to one or more variables like hormonal levels, physical as well as mental stress, personality characteristics, genetic determinants and social factors which may

contribute directly or indirectly. Most often the cumulative physiological effect of stress causes disruption of the natural rhythms and balancing mechanism of female hormones, there by compromising overall health as well as sexual and reproductive health. During the perimenopausal period and early menopause, there is a progressive hormonal imbalance which might help to explain the characteristics “hot flushes” and so called climacteric depression. The behavioral and psychological changes in response to hormonal imbalance during premenstrual phase and menopause involve limbic system and hypothalamus. Most of the behavioral and emotional patterns are exhibited through ANS. Therefore, a present study was planned to assess sympathetic functions during various phases of menstrual cycle.

MATERIALS AND METHODS

The present study of assessment of sympathetic functions in different phases of MC was conducted in the Department of physiology Rural Medical College Loni, Maharashtra, India. History taking and medical examination was carried out. The nature of the test was explained to the subjects.

Inclusion criteria - For the study, total 50 healthy female volunteers, between 18-25 years, from among the students of Rural Medical College Loni, were selected.

Exclusion criteria - Subjects less than 18 years & more than 25 years, suffering from any major illness, with irregular menses, menorrhagia and oligo-menorrhoea were excluded from study. Special emphasis was

given in history for finding out any symptoms suggestive of autonomic neuropathy.

All the volunteers were assessed for sympathetic functions during premenstrual phase i.e. around 25th -26th day of menstrual cycle and during postmenstrual phase i.e. on 6th -7th day of menstruation. Physical parameters like age in years & weight in Kgs were noted in each volunteer.

Blood pressure was recorded with sphygmomanometer by auscultatory method. Electrocardiogram (ECG-CARDIART 108T-British physical laboratories India limited) recordings were carried out in Lead II. All the following tests for assessment of cardiovascular sympathetic functions were carried out in the morning and afternoon hours with the consent of volunteers.

1. **Pulse rate (per minute)** by palpatory method.

2. **Arterial blood pressure (mm of Hg)** recording by auscultatory method.

3. **Orthostatic variation in arterial blood pressure:**

Procedure: After recording the blood pressure in supine position by auscultatory method, the subject was asked to stand up and after 50 seconds the blood pressure was recorded.

Any change in blood pressure is determined as the difference between the recording while supine and standing position.

Result: A decrease in systolic blood pressure >20mm of Hg and decrease in diastolic blood pressure >10mm of Hg during 1

minute standing suggest autonomic dysfunction.

4. Cold pressor test:

Procedure: The subject was asked to immerse the hand in ice cold (4°C) water for one minute and the blood pressure was recorded in supine position by auscultatory method.

This maximum blood pressure recording obtained with a hand in 4°C water was taken as an index of response.

Result: Normally both systolic and diastolic blood pressure should increase at least by 10mm of Hg at the end of 1 minute of immersion.

This is used to evaluate the peripheral sympathetic vasoconstrictor mechanism.

OBSERVATIONS AND RESULT

Table No.1: Comparison of mean values of sympathetic functions:

Sympathetic function tests	Premenstrual (LL)Phase (n=50)	Postmenstrual (EL)phase (n=50)	'Z' value	'p' value	Result
	Mean ±SD	Mean ±SD			
Pulse rate (per min)	86.12 ± 4.33	77.0 ± 3.92	11.04	p<0.01	More significant
Supine					
SBP(mm Hg)	113.32 ± 4.59	106.2 ± 4.84	7.55	p<0.01	More significant
DBP(mm Hg)	71.2 ±4.27	65.32 ± 4.67	6.35	p<0.01	
Standing					
SBP(mm Hg)	109.96 ± 5.11	104.28 ± 4.83	5.74	p<0.01	More significant
DBP(mm Hg)	79.46 ± 4.39	73.12 ± 4.02	7.53	p<0.01	
Orthostatic variation in arterial blood pressure					
SBP(mm Hg)	-2.18 ± 0.66	-1.72 ± 0.47	2.01	p<0.05	Significant
DBP(mm Hg)	8.26 ± 1.01	7.8 ± 1.12	1.98	p<0.05	
Cold Pressor test					
SBP(mm Hg)	123.24 ± 4.16	115.64 ± 4.25	9.04	p<0.01	More Significant
DBP(mm Hg)	90.1 ±3.94	80.68 ± 2.67	13.98	p<0.01	

The statistical analysis for sympathetic tests was carried out separately in premenstrual and postmenstrual phases by applying “unpaired t test”. After analyzing cardiovascular sympathetic functions were compared between premenstrual and postmenstrual groups by applying the statistical significance test (‘p’ value). Sympathetic activity were compared during pre and post menstrual phases. It was observed that pulse rate, blood pressure and cold pressor test were statistically more significant ($p < 0.01$), while orthostatic variation in arterial blood pressure was statistically significant ($p < 0.05$) in premenstrual phase as compared to post menstrual phase of menstrual cycle.

DISCUSSION

1. PREMENSTRUAL AND POSTMENSTRUAL PHASES:

In the present study the premenstrual phase was taken as late luteal (LL) phase of menstrual cycle and postmenstrual phase as an early follicular (EL) phase of menstrual cycle. In the present study, responses to pulse rate, orthostatic variation in arterial blood pressure and cold pressor test were significantly ($p < 0.05$) altered in premenstrual phase as compared to that of postmenstrual phase, reflecting a significant increase in sympathetic activity. This can be explained on the basis that female reproductive steroids are modulators of HPA axis, which in association with ANS, form the stress system which regulates homeostatic mechanisms of the body. The gonadal hormones fluctuation during the

menstrual cycle is associated with significant changes in multiple neurohumoral homeostatic mechanisms of the body¹¹. Estrogen increases sympathetic baroreflex sensitivity and also has a prolonged stimulatory action on CRH gene promoter and central non adrenergic system which indicates changes in sympathetic activity responses significantly more during premenstrual (LL) phase than postmenstrual (EF) phase³. A large number of studies in relation to the menstrual cycle were carried out by earlier workers but no consistent picture could be emerged.^{1,2,4,6,7,8,9}

An excellent review of different studies of physical and psychological changes throughout the menstrual cycle in three forms, namely the behavioural, autonomic and cortical was done⁴.

It was observed that there were significant responses to orthostatic variation in arterial blood pressure, cold pressor test in the premenstrual period indicating an increased sympathetic activity. It was proved that there was a prevalence of 60.7% for autonomic reaction in the premenstrual period⁵.

Some studies used different variables for testing the autonomic functions than that of the present study but the results were consistent in both the studies, though the autonomic variables studied in present study were different from other studies. In contrast to present study, in some of the studies subjects were tested premenstrually and postmenstrually for their autonomic reactivity during stress (cold pressor test, mental arithmetic) and for their acquisition

of conditioned electro-dermal responses and found no difference in the two phases¹⁰.

CONCLUSION:

The present study, evaluates sympathetic functions in different phases of menstrual cycle and concludes that there were significant responses to orthostatic variation in arterial blood pressure and cold pressor

test in the premenstrual (LL) phase as compared to postmenstrual (EF) phase, reflecting an increase in the sympathetic activity. These changes may be due to gonadal steroids imbalance during postmenstrual (EF) and premenstrual (LL) phases of menstrual cycle which in turn affects the HPA axis and ANS significantly.

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