Indian J Physiol Pharmacol 2013; 57(4) : 443–447

Short Communication

Symathovagal imbalance in premenstrual syndrome

Megha Kulshreshtha[1]*, Yogesh Kumar[1], Vinay Agarwal[1] and Vandana Dhama[2]

Departments of [1]Physiology and [2]Obstetrics & Gynecology,
LLRM Medical College, UP, India

Abstract

Premenstrual syndrome (PMS) is a group of psycho behavioural symptoms experienced by many susceptible young women prior to menstruation. It is suggested that there is altered autonomic activity in the late leuteal phase of their endometrial cycle. The present study is aimed to see the autonomic reactivity in women suffering from PMS and to compare it with control ones. The results revealed that the autonomic activity-sympathetic as well as parasympathetic, is insignificantly higher in PMS group during follicular phase. During leuteal phase, the parasympathetic activity is significantly lowered but the sympathetic activity is significantly increased. A positive correlation was also seen between both limbs of autonomic system with number of symptoms. It appears that increased sympathetic activity coupled with decreased parasympathetic activity during the leuteal phase might be responsible for psycho- physiological changes in these women. However, the exact mechanism is still unknown.

Introduction

Premenstrual syndrome is a major clinical entity affecting a large segment of female population. It is defined as any physical or behavioural experience that is discriminately different during the premenstrum compared to other times in menstrual cycle (1, 2). It is estimated that 50–80% of menstruating women experience some degree of physical and psychological premenstrual symptomatology and that 3–5% have symptoms of sufficient severity to disrupt social or psychological functioning. It is also reported that premenstrual symptoms include heterogeneous assay of psychological and physical complaints that occur or intensify during the week before onset of menstrual bleeding and the symptoms may range from mild to disability (3). Although the intensity of symptoms varies, most definitions require that the woman's unique constellation of symptoms be present in multiple consecutive cycles (4). Although PMS is widely recognized, its etiopathogenesis is not yet understood and it lacks definitive, universally accepted diagnostic criteria. It is proposed that the altered functioning of the autonomic nervous system in the late leuteal phase could be associated with its symptoms (5). Most of the work has been carried out in western world to see the autonomic variations during premenstrual syndrome but only fewer studies are reported in India. Therefore, the present study is planned to investigate the differences in autonomic activity between the "baseline" follicular and the premenstrual phases amongst women suffering from PMS and compares them with controls in Northern Uttar Pradesh region.

***Corresponding author :**
Dr. Megha Kulshreshtha, Department of Physiology, LLM Medical College, Meerut,
Email : drvivekmishra_2006@yahoo.co.in

(received on January 4, 2013)

Materials and Methods

Selection of subjects

Forty-five young female subjects between 18-36 years of age and having history of regular menstrual cycle were recruited for the study after obtaining the approval of Institutional Ethical Committee, of LLRM Medical College, Meerut, India. They were classified into two groups on the basis of the scores obtained by their Menstrual Distress Questionnaire (6), which was used to evaluate physical, emotional, and behavioural symptoms accompanying the menstrual cycle of the subjects. All the subjects were assessed for autonomic functions during the follicular and late leuteal phases for three consecutive cycles and the average of three values was taken as final reading for that test. Cycle phase was determined by the onset of menstruation. Subjects with premenstrual stress symptoms served as PMS group. The AFT of PMS subjects was compared with age-matched females with no history of PMS symptoms and they served as control group. Subjects not giving consent for study, or those having history of irregular periods, diabetes mellitus, hypertension, cardiovascular disease, steroid therapy or any other drugs that may alter the autonomic status, smoking and alcoholism were excluded from the study.

Laboratory conditions and recording of personal and clinical data

Each test was performed under thermo neutral conditions and at same time of day in all the subjects. The tests were conducted according to the recommended protocol used in clinical studies (7, 8). The subjects abstained from coffee, tea or cola for 6 hours before study. A light breakfast was allowed 2 hours before study. All the measurements were performed on the 7th and 21st day of menstrual cycle for follicular phase and luteal phase respectively, between 11.30 am to 2.30 pm in an isolated autonomic function laboratory of the Physiology department, the temperature of which was maintained between 25 degree C and 27 degree C. After obtaining the written informed consent and detailed family and menstrual history from the subjects, their age, height, body weight, body mass index (BMI), was reordered. Blood pressure (BP) of all the subjects was recorded by mercury sphygmomanometer by slandered Riva Rocci methods and heart rate by an automatic ECG recording machine (ASPEN).

For BP recording, the subject was asked to seat upright with back straight on a wooden armed chair keeping one forearm on a wooden table kept in front and close to the subject. The height of the table was such that the middle of the arm placed on the table approximately coincided with the level of the heart. The subject was asked to keep the other forearm on the side hand rest of the chair. The BP cuff was tied just tight (neither too tight nor loose) on the arm approximately 2 cm above the cubital fossa. It was ensured that the BP cuff was at the level of the heart. After five-minute rest in the sitting posture, the cuff was inflated and then deflated to record the systolic and diastolic blood pressures (SBP, DBP). For each parameter, the mean of the four recordings was considered.

Recording of autonomic function tests

A battery of non-invasive autonomic function tests were performed in each subject. These tests were designed to evaluate both sympathetic and parasympathetic divisions of autonomic nervous system.

Parasympathetic function tests

Deep breathing Test (DBT)

The subject was explained that the breathing should be smooth, slow and deep at the rate of six cycles per minute with each inspiratory and expiratory phase to be completed in 5 seconds. Hand signal was given to maintain the rate and timing of the breathing, while the ECG was recorded continuously. The results were recorded as expiration to inspiration ratio (E:I), which is the ratio of the longest R-R interval during expiration to the shortest R-R interval during inspiration.

Lying to Standing Test (L: S)

In this test, heart rate (HR) and response to standing was assessed. The resting ECG was recorded in

supine position for 30 seconds. The subject was then asked to attain standing posture immediately without any help. The ECG was continuously recorded during the procedure and for one minute after standing. 30:15 ratio (ratio of maximum RR interval at 30th beat to minimum RR interval at 15th beat following standing) was calculated.

Valsalva Maneuver

After demonstrating the procedure to the subject, she was asked to perform Valsalva maneuver in sitting posture for 15 seconds by blowing against closed glottis through a mouth piece attached to manometer and maintained an expiratory pressure of 40mm of Hg for 15 seconds. A small air leak in the system was useful to prevent the closure of glottis during the maneuver. At the end of 15 seconds the pressure was released. Care was taken to prevent deep breathing before and after the maneuver. ECG was recorded for 15 seconds before the maneuver to get the baseline value, and then during the maneuver (Strain period, 15 sec) and for fifteen seconds after release of pressure. The Valsalva ratio was calculated as the ratio of longest R-R interval after maneuver to shortest R-R interval during maneuver.

Sympathetic Function Tests

Isometric Handgrip Test (HGT)

The baseline BP was recorded. The subject was then asked to press handgrip dynamometer at 30% of maximum voluntary contraction for 2 minutes. The blood pressure was recorded simultaneously from non-exercising arm at 1st and 2nd minute followed by releasing of grip and recording of the blood pressure in the 4th minute. Highest increase in diastolic blood pressure on performing isometric exercise was taken as test response.

Orthostatic Hypotension test (OHT)

The test was conducted after 10 minutes of supine rest. After recording the blood pressure of the subject in supine position, she was asked to stand immediately within 3-4 sec. and to remain motionless. Blood pressure was recorded immediately and then at 30 second intervals for 2 minutes or till BP returns back to normal. Difference between readings of systolic blood pressure in lying position and standing position were calculated. Highest fall in systolic blood pressure was taken as response to test.

Statistical analysis of data

All the results were expressed in mean±S.D. and compared with the control group. The data was analyzed by using paired and unpaired student't' test. The P values less than 0.05 was considered statistically significant. Pearson's coefficient of correlation was used to determine the correlation between number of symptoms and autonomic function test in PMS group.

Results

Table I shows that the physical parameters between the cases and control group during both the phases of the cycle were comparable. Table III shows the autonomic activity between control and PMS groups during follicular phase and luteal phase. It exhibits an increase in both - parasympathetic and sympathetic activity in PMS group as compared to

TABLE I: Biophysical profile of control and PMS groups during follicular and leuteal phases.

Physical Parameters	*PMS GROUP (n=24) Mean±SD*		*CONTROL (n=21) Mean±SD*	
	Follicular	*Leuteal*	*Follicular*	*Leuteal*
Age (yr)	23.58±4.5	23.58±4.5	22.76±3.53	22.76±3.53
Height (cm)	158.4±5.36	158.4±5.36	155.6±5.19	155.6±5.19
Weight (kg)	55.15±6.77	56.12±5.77	51.05±9.97	52.04±8.97
BMI	21.96±2.71	22.67±2.89	21±3.19	22.12±3.15

Data expressed are mean±SD.

TABLE II : Frequency of symptoms as they appear in cases.

	Symptoms	*No. of times they appear in cases*
1.	Lower abdominal pain	20
2.	Headache	18
3.	Swollen extremities	21
4.	Bloating of abdomen	22
5.	Heaviness in breast	17
6.	Acne face	21
7.	Greasiness of scalp and hair	20
8.	Frequency of micturition	7
9.	Appetite	5
10.	Irritability	20
11.	Fatigue (mood)	18
12.	Mood swings	18
13.	Confusion	13
14.	Lack of sleep	12
15.	Depression/social withdrawal	18

The above table gives an idea regarding the most common symptoms amongst the PMS cases.

control ones during follicular phase, though it is statistically insignificant. Parasympathetic activity is significantly (P<0.05) reduced but the sympathetic activity is markedly increased (P<0.001) in PMS group during luteal phase.

Table IV shows the correlation between number of symptoms and autonomic activity in PMS group. It shows a significant positive correlation (P<0.01-0.001) between the number of symptoms and parasympathetic activity during the follicular phase while during leuteal phase the same correlation between them became insignificant (P>0.05). The sympathetic activity also exhibited a positive correlation but a reversal of significance in the two phases ie insignificant (P>0.05) during follicular phase but significant (<0.001) during leuteal phase.

Discussion

Premenstrual syndrome includes a wide variety of symptoms prior to menstruation and attributed to psycho physiological alterations in susceptible young ladies. The exact cause of such symptoms is still elusive. The present work demonstrated that basal autonomic activity is insignificantly higher in PMS group than the control group during the follicular phase (Table II). Though similar observations were found by Doreen et al (9), most of the studies did not comment on the status of autonomic activity during follicular phase in PMS and control subjects. The cause of this increased autonomic activity cannot be ascertained though it might be due to

TABLE III : Follicular phase, luteal phase of different study group subjects.

Autonomic activity	*Parameters*	*Follicular Phase*			*Leuteal Phase*		
		Control (n=21)	*PMS cases (n=24)*	*P value*	*Control (n=21)*	*PMS cases (n=24)*	*P value*
Parasympathetic test	DBT	1.41±0.19	1.46±0.22	0.39	1.37±0.14	1.31±0.26	0.3
	LS RATIO	1.36±0.18	1.42±0.22	0.34	1.34±0.19	1.18±0.20	0.01
	VALSALVA	1.34±0.15	1.39±0.18	0.33	1.33±0.18	1.20±0.17	0.01
Sympathetic test	OHT	5.04±2.15	6.08±2.24	0.12	6.00±2.09	10.58±1.61	1.97
	HGT	17.33±2.39	17.50±4.38	1.95	12.75±3.52	16.85±3.5	0.0001

Data expressed as mean±SD

TABLE IV : Co-efficient of correlation between number of symptoms and autonomic activity (n=24) in PMS group.

	Parameters	*Follicular phase*		*Leuteal phase*	
		r value	*P value*	*r value*	*P value*
Parasympathetic function tests	DBT	0.80	<0.001*	0.47	<0.01*
	LS RATIO	0.47	<0.01*	0.22	>0.15
	VALSALVA	0.56	<0.001*	0.14	>0.23
Sympathetic function tests	OHT	0.16	>0.2	0.52	<0.001*
	HGT	0.35	>0.1	0.45	<0.001*

*Statistically significant.

lesser stress during this phase of the cycle.

During leuteal phase there was a significant decline in parasympathetic activity and increase in sympathetic activity in PMS group as compared to control group (Table III). The literature seems to have controversial views in this phase with some workers observing no change in autonomic activity during this phase (10, 11) while many researchers pointed an significant decrease in parasympathetic activity (5, 12, 13) or increased sympathetic/ autonomic activity (14).

Our findings also in line with other workers and points an increased autonomic activity exhibited by a significant increase in sympathetic but decrease in parasympathetic activity in PMS group. It appears that altered sympatho-vagal response is responsible for the pre menstrual symptomatology. This may be due to shift of the autonomic balance in favor of sympathetic system.

We also tried to look for any correlation between the numbers of symptoms with autonomic activity in PMS group (Table IV). The parasympathetic activity exhibited significant positive correlation with increasing symptoms during follicular phase but became insignificant during leuteal phase. The sympathetic activity expressed an insignificant positive correlation during follicular but highly significant correlation with number of symptoms during leuteal phase of the cycle. There is possibility that the altered autonomic imbalance during the latter part of the cycle might be responsible for the causation of symptoms in susceptible individuals. As the parasympathetic activity is decreased, it may also be responsible for shifting of autonomic balance in favour of sympathetic activity and these ladies are unable to cope up with stressful situations. However, a definite etiopathological cause remains elusive and needs to be explored.

Limitations of the Study

This work was done in a small sample size due to difficulty in recruiting subjects as the PMS cases are usually under reported. Moreover, we were not having the facilities of HRV analysis in our laboratory, which could be a better choice to measure the autonomic balance.

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