

EFFECT OF PRE AND POST MENSTRUAL PHASES OF MENSTRUAL CYCLE ON SYMPATHETIC FUNCTION TESTS IN HEALTHY ADULT FEMALES

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Abstracts: Background: The menstrual cycle is characterized by fluctuations in several hormones, most notably the gonadal steroids, estrogen and progesterone.¹ Sympathetic function tests are the one of the autonomic function tests and it is easy, non invasive test to be carried out. They give us idea about role of gonadal hormone in sympathetic control of cardiovascular system during different phases of menstrual cycle. **Aim:** Aim of this study is to determine whether fluctuation of reproductive hormone during premenstrual and post menstrual phases affecting sympathetic function tests or not. **Objectives:** To do and compare sympathetic function tests in pre and post menstrual phase. **Methods:** Study was carried out in 50 adult healthy female having age group of 26-40 years. Sympathetic function tests were carried out by instrument Cardiac Autonomic Nervous System Analyzer (CANS) 504 in Department of Physiology, Government Medical Collage, Bhavnagar. Sympathetic function tests were done using standard protocol and statically analyzed. **Results:** Statically significant difference was seen between premenstrual phase and postmenstrual phase in all sympathetic function test parameters which includes supine systolic and diastolic blood pressure, blood pressure response to standing and systolic blood pressure response after sustained hand grip test. **Interpretation & conclusion:** According to this study sympathetic dominance is seen in premenstrual phase of menstrual cycle that may be due to increased level of progesterone and oestrogen in premenstrual phase.

Key Words: sympathetic function test, menstrual cycle, premenstrual phase, postmenstrual phase.

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Introduction:

Reproductive hormones have main effect on female reproductive organs like uterus and ovaries. Estrogen and progesterone is important for monthly cyclical changes occurring in uterus and ovaries together called menstrual cycle. Different hormonal environment during follicular and luteal phases may have implication for cardiac autonomic function. There is unquestionable evidence that oestrogen has both potent and long lasting effect on several vital organ systems, including the cardiovascular system, the autonomic nervous system and most recently, within the CNS itself.²

Experimental studies in animals have shown that estrogens act centrally to modulate the autonomic nervous system, increasing vagal and decreasing sympathetic activity², thus providing a cardiovascular protective function. Progesterone, on the other hand, appears to have an opposing effect, elevating central noradrenaline release.³ It is seen that cardiovascular mortality ratio is more

after menopause than before menopause. As Cardiovascular Autonomic Function Tests (CAFT) were easy and non-invasive tests to know the autonomic modulation during different phases of menstrual cycle, we planned to study sympathetic function tests (one of the Cardiovascular Autonomic Function Tests (CAFT)) during various phase of menstrual cycle.

Material and Methods:

Prior permission was taken from Institutional Review Board (IRB) of Government Medical College, Bhavnagar. This study was carried out in Autonomic Function Lab in Department of Physiology, Government Medical College, Bhavnagar. The study group comprised of 50 young healthy female participants having regular menstrual cycles and age between 26-40years. They were selected after employing the following criteria.

A detailed clinical history with special attention to the menstrual history (length of cycle, amount of

menstrual flow, and regularity of cycle) of each subject was taken. Relevant past history of any hormonal treatment, family history of diabetes, transplantation therapy and radiotherapy, personal history including smoking, alcoholism and occupation history was taken. A complete general physical examination as well as clinical examination was done. Height & weight of the subjects were recorded using standard methodologies. Subjects were instructed to visit the department during post menstrual phase (9-12th day) and premenstrual phase (19-22nd day) of menstrual cycle.

Selection criteria

○ Inclusion criteria:

1. Subjects should belong to the specified age range (26-40 years).
2. They should have regular menstrual cycles of 27 to 35 days as established by history, for at least the past 6 months.
3. Subject who gives written informed consent

○ Exclusion criteria:

1. Female subjects below 26 years and above 40 years.
2. Subjects having irregular menstrual cycle.
3. Subjects taking any medication or hormonal preparations that could alter the menstrual hormonal milieu.
4. Subjects having any physical illness like diabetes, hypertension, TB, cardiac arrhythmia or any other endocrinological disorders.
5. Smokers, alcoholics or those with history of substance abuse.
6. Athletes and those involved in excessive physical activity.
7. Subjects having any disorder which can interfere with the autonomic responses

After they were informed about the procedures and objectives of the study, a written consent was taken as per standard protocol from all participants. All participants were advised to avoid eating and drinking (tea, coffee and alcohol) at least six hours prior to test as these may affect the results.

Test preparation: After giving information about the procedure, each subject was advised to take rest for 15 minutes in a quiet room. After obtaining the clinical history and followed by physical examination; **Sympathetic Function Tests** were carried out. The subjects were instructed to attend the study in a relaxed condition and quiet mood. The room was darkened and without any acoustic disturbance.

List of Sympathetic function Tests and Instrument to be used

Sympathetic function tests under the scope of this study had been carried out with CANS (Cardiac Autonomic Nervous System Analyzer) – 504.

Sympathetic function test were Resting Systolic and Diastolic BP

Subject was asked to take rest for 15 minutes and then systolic and diastolic BP were measured in right brachial artery by instrument only in supine position.

Blood pressure response to standing

First of all, resting BP was recorded.

Then subject was asked to stand unaided, immediately next BP measurement was done.

BP response to sustained handgrip

The participant was asked to perform sustained handgrip for one minute. BP was recorded on non exercising arm immediately after one min of handgrip exercise.

Statistical Analysis: All data were represented as a Mean \pm SD and statistical analysis was done by using unpaired t-test. We were using graphpad instat statistical software (demo version) for data analysis.

Result: A total 50 healthy young female subjects having age between 26-40 years were recruited in this study.

Sympathetic function test exhibited statically significant difference between premenstrual and post menstrual phase. Table shows comparison of sympathetic function test during postmenstrual and premenstrual phase.

Table:1 showing comparison of Sympathetic function test during two phases of menstrual cycle

Sympathetic function test	Post - menstrual phase (FP) Mean± SD	Pre - menstrual phase (LP) Mean± SD	RESULT P value
Supine SBP	112.07± 6.10	116.63 ± 6.30	0.0061 (<0.05)
Supine DBP	75.12 ± 3.64	79.40 ± 4.34	0.0004 (<0.05)
SBP response to standing	105.60 ± 5.40	112.30 ± 5.47	<0.0001 (<0.05)
DBP response to Standing	74.46 ± 3.47	79.13 ± 5.11	0.0002 (<0.05)
SBP response after SHGT	117.2 ± 8.61	123.37 ± 8.55	0.007 (<0.05)
DBP response after SHGT	80.03 ± 9.36	85.13 ± 8.22	0.03

SD – Standard deviation, FP- follicular phase, LP- luteal phase, SBP-systolic blood pressure, DBP- diastolic blood pressure, SHGT- sustained handgrip test.

Discussion:

Data in Table 1 shows that during premenstrual phase, more resting systolic as well as diastolic blood pressure than postmenstrual phase showing sympathetic dominance in premenstrual phase. Also less fall in both systolic and diastolic blood pressure response to standing and after sustain handgrip test in premenstrual phase than post menstrual phase which is also statically significant except DBP response after SHGT. Jyoti Sahebrao Kale and Nilesh Tulsiram Katole⁴, Veena Mehta & A.S Chakrabarty⁵, Ashwini Nilekar & Vaishali Patil⁶ also have similar results.

In postmenstrual phase, estrogen level is more comparing to progesterone level. After ovulation progesterone level increases and reaches at its peak in midluteal phase. Estrogen is a key regulator of function of vascular smooth muscle cells, endothelial cells, fibroblasts and cardiomyocytes.⁷ Estrogen also causes upregulation of nitric oxide

synthase, vascular endothelial growth factor and also of atrial natriuretic factor which may in turn responsible for vasodilatation by nitric oxide (NO) release in vascular smooth muscle cell.⁷ NO stimulates the opening of calcium activated potassium channels which causes vasodilatation of vascular smooth muscles. Estradiol might also be associated with increase in acetyl choline concentration.⁸ Estrogen also causes down regulation of angiotensin converting enzymes, endothelin -1 and angiotensin receptor which may be responsible for less blood pressure both resting systolic as well as diastolic blood pressure in post menstrual phase.⁷

Progesterone level is increase in premenstrual phase. Progesterone in contrast to estrogen may increase cardiac excitability. Also progesterone has inhibitory effect on the cardiovascular baroreflex responses.⁹

In our study a statically significant difference seen in systolic and diastolic blood pressure after standing. In this test change in posture from supine to standing causes decrease in systolic pressure due to peripheral pulling of blood in dependent part which in turn causes decrease in Systolic BP. Less decrease in Systolic BP is seen in premenstrual phase that might be due to sympathetic dominance in premenstrual phase.

In isometric handgrip test, there is increased level of metabolites like lactic acid and adenosine that are detected by metabolite sensitive nerve ending within the skeletal muscle interstitium. These substances increase the discharge of group IV (metaboreceptor) afferent fibers, initiating potent reflex that increases sympathetic activity.¹⁰ This leads to vasoconstriction, which contributes to the rise in BP, it is shown that there is a marked influence of estrogen on the blood flow through the hand and forearm; especially on the venous tone, yet the effects of progesterone on peripheral blood flow are questionable.¹¹

Conclusion:

Our study shows that result of sympathetic function test parameters is increased in premenstrual phase than postmenstrual phase. This suggests that sympathetic activity is more in premenstrual phase than postmenstrual phase which may be one of the reasons for premenstrual stress symptoms. Also in postmenstrual phase, all

parameters has less value than premenstrual phase, suggest cardioprotective action of estrogen. Further investigations are required to know its biomechanism then it would be helpful to give hormone replacement therapy as cardioprotective drugs in menopausal women.

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