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Original Research

Assessment of alteration in heart rate variability among young eumenorrheic women

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ABSTRACT

Background: The risk of coronary heart disease is much lower in the premenopausal women compared to age matched men. The present study assessed the effect of cyclical alteration in female sex hormones on cardiac autonomic activity by HRV. **Materials & Methods:** The present study was conducted on 56 eumenorrheic women volunteers with regular menstrual cycle aging between 20-30 years with normal BMI. Last menstrual period (LMP) and menstrual history were collected. After 10 minutes rest ECG analysis was done. Recordings were done in the morning during proliferative phase (6th -7 th day) and premenstrual phase (24th - 25th day). **Results:** Low frequency (LF) in proliferative phase was 84.12 and in premenstrual phase was 87.35, high frequency (HF) was 15.6 in proliferative phase and in premenstrual phase was 12.3, LF/HF ratio was 5.4 and 6.8 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05). Total power found to be 4487 $ms^2$and 3452 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05). **Conclusion:** Cardioprotective role of female sex hormones in premenopausal women was more pronounced in the proliferative phase of menstrual cycle.

Key words: Cardiac autonomic, Premenopausal, Sex hormones.

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INTRODUCTION

Epidemiological studies showed that the risk of coronary heart disease is much lower in the premenopausal women compared to age matched men. This suggests that the female sex hormones in the premenopausal women contribute to their cardio protective role compared to postmenopausal women. Cyclical alteration in female sex hormones along the menstrual cycle affect the cardiac autonomic reactivity through hypothalamo-pituitary adrenal activity and sympatho-adrenomedullary system.

Heart rate variability (HRV) represents one of the most promising such markers. The apparently easy derivation of this measure has popularized its use. As many commercial devices now provide automated measurement of HRV, the cardiologist has been

provided with a seemingly simple tool for both research and clinical studies. However, the significance and meaning of the many different measures of HRV are more complex than generally appreciated and there is a potential for incorrect conclusions and for excessive or unfounded extrapolation.

Power spectral analysis is a sensitive index to assess the autonomic activity in the normal menstruating females during different phases of menstrual cycle. Vagal innervation influence the HF component in correspondence with sinus rhythm. The LF component varies with oscillations in blood pressure, influenced by both the divisions of Autonomic Nervous System. The present study assessed the effect of cyclical alteration in female sex hormones on cardiac autonomic activity by HRV.

MATERIALS & METHODS

The present study was conducted in the department of Physiology. It comprised of 56 eumenorrheic women volunteers with regular menstrual cycle aging between 20-30 years with normal BMI. The study protocol was approved from institutional ethical committee.

Data such as age, sex and socioeconomic status was recorded. Last menstrual period (LMP) and menstrual history were collected. After 10 minutes rest ECG analysis was done. Recordings were done in the morning during proliferative phase (6th -7th day) and premenstrual phase (24th - 25th day). The subjects were advised to avoid caffeine at least 2 hours before the test and recording was done at least 2 hours after the meal. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I HRV (Frequency domain) in both the phases of menstrual cycle

Frequency domain parameters	Proliferative phase	Premenstrual phase	P value
LF nu	84.12	87.35	0.01
HF nu	15.6	12.3	0.02
LF/HF	5.4	6.8	0.03

Table I, graph I shows that low frequency (LF) in proliferative phase was 84.12 and in premenstrual phase was 87.35, high frequency (HF) was 15.6 in proliferative phase and in premenstrual phase was 12.3, LF/HF ratio was 5.4 and 6.8 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05).

Graph I HRV (Frequency domain) in both the phases of menstrual cycle

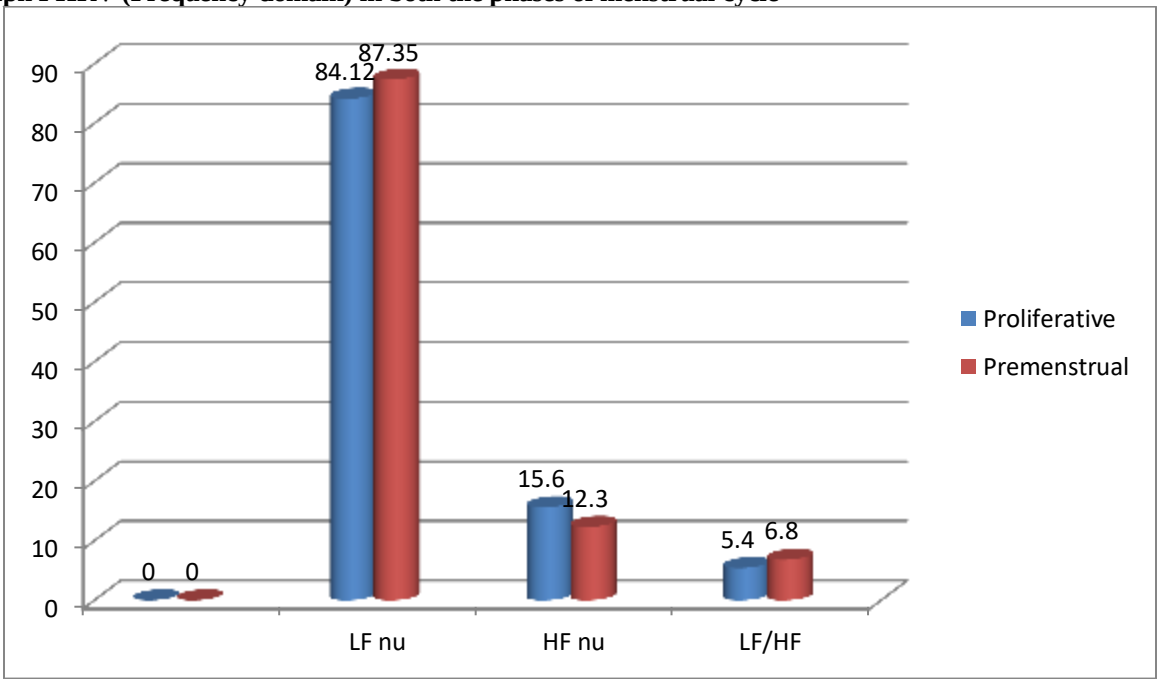
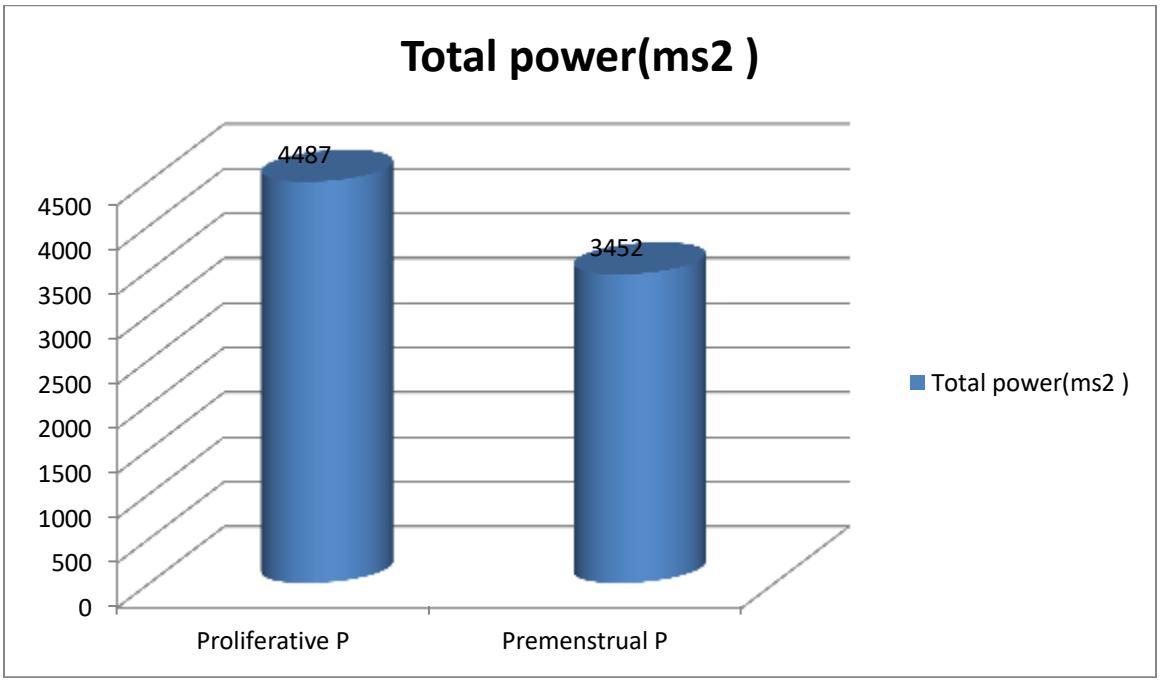


Table II Total power in both phase

Frequency domain parameters	Proliferative phase	Premenstrual phase	P value
Total power(ms^2)	4487	3452	0.001

Table II, graph II shows that total power found to be 4487 $ms^2$and 3452 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05).

Graph II Total power in both phase



DISCUSSION

Variations in heart rate may be evaluated by a number of methods. Perhaps the simplest to perform are the time domain measures. With these methods either the heart rate at any point in time or the intervals between successive normal complexes are determined. In a continuous electrocardiographic (ECG) record, each QRS complex is detected, and the so-called normal-to-normal (NN) intervals (that is all intervals between adjacent QRS complexes resulting from sinus node depolarizations), or the instantaneous heart rate is determined. Simple time–domain variables that can be calculated include the mean NN interval, the mean heart rate, the difference between the longest and shortest NN interval, the difference between night and day heart rate, etc. Other time–domain measurements that can be used are variations in instantaneous heart rate secondary to respiration, tilt, Valsalva manoeuvre, or secondary to phenylephrine infusion. These differences can be described as either differences in heart rate or cycle length. The present study assessed the effect of cyclical alteration in female sex hormones on cardiac autonomic activity by HRV.

In present study it was found that low frequency (LF) in proliferative phase was 84.12 and in premenstrual phase was 87.35, high frequency (HF) was 15.6 in proliferative phase and in premenstrual phase was 12.3, LF/HF ratio was 5.4 and 6.8 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05). Leicht et al[6] found that the sympathetic activity was higher during ovulatory and luteal phase compared to the menstrual phase. Increased vagal tone during proliferative phase could be one of the reasons for decreased sympathetic activity. In contrast Dekker et al[7] reported increased sympathetic activity in the premenstrual phase might be due to associated increase in LH, FSH and progesterone. Weisman et al reported sudden increase in the level of estrogen in women treated with ovulation induction for in-vitro fertilization showed increase in the vagal activity.

We found that total power found to be 4487 $ms^2$and 3452 in proliferative phase and premenstrual phase respectively. The difference was significant (P< 0.05). Rosana et al[8] reported that women with regular menstrual cycle and paroxysmal supraventricular

tachycardia showed greater incidence of arrhythmia during luteal phase compared to follicular phase. Thus cardiovagal modulation has antiarrhythmic effect in proliferative phase which is consistent with our finding of increased paraympathetic function during the proliferative phase.

Rainbow et al[9] found that short term HRV (5 minutes) was recorded in fifty young female volunteers aged between 20-30 years within normal range of BMI and regular menstrual cycle in supine posture after 10 minutes rest. The sympathetic parameters like (low frequency domain) LF nu, LF/HF ratio was significantly increased in the premenstrual phase. The parasympathetic parameters like (high frequency domain) HF nu, TP (total power) were significantly increased in the proliferative phase of the menstrual cycle.

Estrogen was known to modulate the neurotransmitter release presynaptically by secreting NO. Thus in this study vagal dominance in the proliferative phase be due to endogenous estrogen and increased sympathetic activity (as shown by increased LFnu, LF/HF ratio in premenstrual phase) might be due to increase in the progesterone, opposing the effect of estrogen. Hence HRV can be used to find the autonomic imbalance in the normal menstruating female subjects. With short term HRV, frequency domain parameters were found to be the better gauge of cardiac autonomic activity compared to time domain parameters which are better with long term HRV measured for 24 hours.[10]

CONCLUSION

Authors found that cardioprotective role of female sex hormones in premenopausal women was more pronounced in the proliferative phase of menstrual cycle.

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