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ASSESSMENT OF CARDIAC AUTONOMIC MODULATION IN PRE AND POST MENOPAUSAL WOMEN

Physiology

KEYWORDS: Heart Rate Variability (HRV), Autonomic Nervous Systems (ANS)

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ABSTRACT

Natural menopause is characterized by gradual decrease in reproductive hormones i.e; Estrogen and Progesterone. However it is well known since long about the cardio protective effect of Estrogen because of which premenopausal women are more protected than age matched males. Cardiovascular system is mostly controlled by autonomic regulation through activity of sympathetic and parasympathetic pathways of Autonomic Nervous Systems (ANS). Analysis of HRV permits insight in this control mechanism. Materials and methods: A total of 60 healthy female volunteers participated in the study of which 30 were pre-menopausal women and 30 post menopausal women. ECG was recorded in Lead II for 5 min on Student Physio-pac. Cardiac Autonomic Nerve Function was determined using Heart Rate Variability (HRV) indices in the Frequency Domain. Data between study group was compared using students unpaired't' test. Conclusion: There was enhanced Sympathetic dominance indicating reduction in Cardiac Autonomic modulation in post menopausal women compared to that of pre-menopausal women.

INTRODUCTION

HRV is beat to beat variations in heart. HRV is a measure of the balance between sympathetic and parasympathetic mediators of heart rate. Sympathetic mediators appear to exert their influence over longer time periods and are reflected in the low frequency power (LFP) of the HRV spectrum [1] Vagal mediators exert their influence more quickly on the heart and principally affect the high frequency power (HFP) of the HRV spectrum Thus at any point in time the LFP: HFP ratio is a proxy for the sympathovagal balance.

Menopause is characterized by various physiological changes that occur in the reproductive organs and other systems of the body, one of them is modulation of autonomic activity.

Risk of Coronary Heart Disease in premenopausal women is less compared to males of same age. However the difference reduces in post menopausal state where the risk is equal.[2] Postmenopausal women with conjugated estrogen replacement therapy had significantly increased vagal and reduced sympathetic modulations of the heart rate. [3]

Analysis of the HRV response can be used to evaluate the adaptations of the autonomic nervous system. The aim of the present study was to compare Sympathovagal modulation between pre and postmenopausal women under resting conditions.

OBJECTIVES:

To compare Frequency domain indices of Heart Rate Variability (HRV) between pre and post menopausal women.

MATERIALS AND METHODS :

A total of 60 healthy female volunteers participated in the study of which 30 pre-menopausal women were of age group 20-45 years and 30 post menopausal women were of age group 45-55 years. Detailed history and preliminary medical examination was done to rule out any cardiovascular diseases, diabetes mellitus, and consumption of nicotine or alcohol.

Exclusion criteria for Pre-menopausal women were -

a) Oral contraceptive pills
b) Irregular menses

Exclusion criteria for Post-menopausal women were -

a) Hysterectomy
b) Post menopausal bleeding
c) Hormonal Replacement Therapy

Recordings were taken in the Department of Physiology, Grant Medical College, Mumbai. Pre-menopausal women were called on their 8th – 14th day of their menstrual cycle. All the subjects were asked to come to department in morning hours without any consumption of beverages containing caffeine or alcohol. Written informed consent was taken. The procedure was well explained to the subject. Baseline heart rate and blood pressure was noted. ECG was recorded in Lead II for 5 min on Student Physio-pac (Medicaid Company). Cardiac Autonomic Nerve Function was determined using Heart Rate Variability (HRV) indices in the Frequency Domain (Low Frequency (LF) cardiac sympathetic 0.04- 0.15 Hz; High Frequency (HF), cardiac parasympathetic 0.15-0.4 Hz).

Data between study groups was compared using students unpaired 't' test. Differences were considered statistically significant at $p < 0.05$.

HRV was analyzed by HRV software developed by the Department of applied Physics, University of Kupio, Finland. Protocols were followed as per guidelines of Task Force of European Journals4. HRV was analyzed by Fast Fourier Transformation (FFT).

Table No. 1 - showing comparison of height, weight, and BMI of subjects.

Parameter	Premenopausal Mean ± SD	Postmenopausal Mean ± SD	P value
Height (m)	1.56 ± 0.05	1.54 ± 0.04	>0.05
Weight (kg)	55.24 ± 6.12	54.06 ± 5.32	>0.05
BMI (kg/m2)	21.04 ±2.03	21.66 ± 1.34	>0.05

P >0.05 = non significant

Table No. 2 - showing distribution of HRV indices

Indices	Pre menopausal Mean ± SD	Post menopausal Mean ± SD	P value
HR	74.56 ± 5.34	76.87 ± 7.40	>0.05
Mean RR	0.767 ± 0.088	0.804 ± 0.147	>0.05
LF(n.u.)	45.25 ± 10.79*	58.3 ± 11.6*	<0.05
HF(n.u.)	26.93 ± 13.4*	19.03 ± 95.38*	<0.05
LF/HF Ratio	2.11 ± 1.01*	3.08 ± 0.5*	<0.05

*Post menopausal women had significantly -

a. lower HF
b. higher LF
c. higher LF/HF ratio

DISCUSSION

We found statistically significant difference in frequency domain indices between pre and postmenopausal women.

The findings of the present study are in accordance with Moodithaya et al(2009)[5] , Tanu et al(2012)[6], Yang et al(2013)[7] and Natrajan et al(2015)[8].

Moodithaya et al observed higher LF, lower HF and higher LF/HF ratio in post-menopausal women. She stated that both ageing and declined estrogen levels are associated with the autonomic alterations seen among postmenopausal women[5].

Mercuro et al. observed decreased HRV indices in women submitted to bilateral oophorectomy. However, when these patients were placed on therapy with 17ß-estradiol, all HRV indices returned to their pre-surgery levels[9]

In our study we have recorded HRV of premenopausal women during follicular phase so that we can compare the effect of estrogen between two groups as progesterone is at basal level.

Estrogen is known to exert its cardio protective effect by -

a) Modulation of vascular tone
b) Protection against vascular injury
c) Alteration of plasma conc. of lipoproteins

Estrogen enhances Cholinergic Muscarinic activity and modulates central and peripheral levels suppressing sympathetic tone[10]

Tanu et al concluded that difference in HRV could be due to declined estrogen level and increased body fat percentage .

In our study there was no significant difference between BMI of two groups.

Natrajan et al observed increased total power of HRV in premenopausal women which reflects parasympathetic activity.

Yang et al. concluded that sympathetic activity, as indicated by LF/HF ratio, was lower among postmenopausal women treated with estrogen only compared to postmenopausal women treated with combination of estrogen and progesterone.

Ribeiro et al[11], Brockbank et al[12] and Liu et al [13] have also shown changes in the autonomic control of HR following natural or surgical menopause .

Thus we can conclude that menopause can cause an imbalance of the autonomic nervous control of the cardiovascular system that shifts toward sympathetic hyperactivity. This could explain, in part, the increased incidence of cardiovascular diseases observed in postmenopausal women .

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