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Address of Correspondence

Editor-in-Chief, TMSS Medical College Journal, TMSS Medical College
Rangpur Road, Thengamara, Bogura, Bangladesh.
Phone: 051-61830, Fax : 051-61830
e-mail: editortmcjournal@gmail.com, Web: www.tmssmedicalcollege.com

Original Article

Cardiovascular Autonomic Response during Cold Pressor Test in Post-Menopausal Women

Begum MMN[1*], Sarkar CR[2], Yeasmin T[3], Parvin S[4], Benzir M[5]

1. Dr. Mst. Mostana Nazma Begum, Assistant professor, Department of Physiology, TMSS Medical College, Bogura.
2. Dr. Chandra Rani Sarkar, Professor, Department of Physiology, Rangpur Medical College, Rangpur.
3. Dr. Tania Yeasmin, Associate Professor, Department of Physiology, TMSS Medical College, Bogura.
4. Dr. Suraiya Parvin, Assistant professor, Department of Physiology, Prime Medical College, Rangpur.
5. Dr. Maskura Benzir, Assistant professor, Department of Physiology, TMSS Medical College, Bogura.

***Corresponding Author**

Abstract

Background: Variation in autonomic nervous system functions is seen in postmenopausal women. Autonomic nervous system control is a major determinant in various cardiovascular diseases. In premenopausal and postmenopausal women the risk of cardiovascular diseases gradually increases and alteration in autonomic nervous functions. **Objectives:** To assess the cardiovascular response to cold pressor test in postmenopausal women. **Materials and Methods:** This cross sectional analytical study was conducted from July 2019 to June 2020 in the Department of Physiology, Rangpur Medical College, Rangpur. After obtaining permission, a total 120 subjects who meet the inclusion and exclusion criteria were enrolled in the study after briefing them objectives of the study. Among them 40 were reproductive women (Group-A), 40 were premenopausal women (Group-B) and 40 were postmenopausal women (Group-C). The blood pressure responses could be used as a tool for cold pressor test which is indicator of sympathetic activation and thus of cardiac status. The subjects were selected from different areas of Rangpur district. For statistical analysis one-way ANOVA (post-Hoc) test was performed by computer based software SPSS-23.0 version for windows. **Results:** Resting systolic blood pressure and resting diastolic pressure were significantly higher in group C ($p<0.001$). Systolic blood pressure in response to cold pressor test was significantly higher in group C ($p< 0.001$). Diastolic blood pressure in response to cold pressor test was significantly higher in group C ($p< 0.001$). **Conclusion:** The study concluded that the changes in systolic and diastolic blood pressure after cold pressor test increased in Postmenopausal women and thus indicating increased sympathetic activity.

Key words: Postmenopausal women, Cold pressor test, Sympathetic Nervous System.

Introduction

The normal reproductive years of the female are characterized by monthly rhythmical changes in the rates of secretion of the female hormones and corresponding physical changes in the ovaries and other sexual organs. The age of reproductive period is about 13 to 46 years[1]. Menopause is defined as the permanent cessation of menses for 1 year and physiologically correlated with the decline in estrogen secretion resulting from the loss of follicular function.[2] It is a normal aging phenomenon, involves gradual transition of woman from reproductive to non-reproductive phase of life.[3] The menopause usually occurs between the ages of 45 and 52 years.[2] Joshi PK et al studied upon 60 premenopausal women of age 25 to 45 years and 60 postmenopausal women of age 46 to 60 years. They demonstrated systolic and diastolic pressure change in cold pressor test in postmenopausal women was significantly higher compared to premenopausal women.[4] Postmenopausal women have higher risk of cardiovascular disease, anxiety and depression. Hence health management is important for postmenopausal women.[5] Hormonal changes are associated with menopause.[6] Changes in the hormone levels is responsible for autonomic system variations seen in pre- and post-menopausal women.[7] According to the survey conducted by the Korean Society of Menopause, of 707 women who underwent natural menopause, 89% answered that experienced

menopausal symptoms or have symptoms currently.[8] The effect of menopause on cardiovascular disease (CVD) in women has been studied by kannel et al. It has been found that autonomic dysfunction is an important factor for the evaluation of risk of cardiovascular events in CVD patients.[9] Data from the Framingham study shows a two-fold age-adjusted increase in risk for coronary heart diseases in post-menopausal compared with pre-menopausal women.[10] The high incidence of ischemic heart disease after menopause suggested a close association between ovarian hormone levels and cardiovascular system.[11] In women, both pre and postmenopausal hormonal changes contribute to modifications of the autonomic control of the heart.[12] Vongpatanasin W. has studied the increase of sympathetic tone and blood pressure in menopause. Lee et al. have found a relationship between postmenopausal symptoms and changes in cardiovascular autonomic functions in women. For example, hot flashes and sleep disorders are strongly associated with increased sympathetic tone.[9]

Materials and Methods

A Cross-sectional analytical study was conducted in the Department of Physiology, Rangpur Medical College Hospital, Rangpur, Bangladesh from june 2019 to July 2020. A total number of 120 apperently healthy women ware available within the study period. Among them 40 reproductive women, 40 premenopausal and 40 postmenopausal women. All the study individuals were apparently healthy women and their age ranged from 20 to 55 years. Samples of Reproductive, premenopausal and postmenopausal women were collected from housewives at different areas in Rangpur city matched with age and socioeconomic condition.

Inclusion criteria

a) Age group of 20 to 55 years.
b) Healthy women individual of- Reproductive women (20-35 years), Premenopausal women (40-45 years) and Postmenopausal women (45-55 years).

Exclusion criteria

a) History of diabetes mellitus, hypertension, chronic renal failure, cardiac complication, obstructive lung diseases, liver diseases.
b) Tobacco users.
c) Psychiatric disorders (depression)
d) Any Neurological disorder
e) Previous history of head injury.
f) History of taking neurotoxic drug, Tranquilizers (barbiturates), Antidepressants (tricyclic antidepresant).
g) After exercise, meal and trained athletes.
e) Overweight and obese women.
h) Pregnancy and lactating mother.

Reproductive women, premenopausal and postmenopausal women in different areas of Rangpur city, who fulfill the inclusion criteria, were included by numbering. After selection of all subjects, the objectives and the procedure of the study were explained clearly to them and their informed written consent were taken. Detailed medical and family history were taken and thorough clinical examinations were done. All information were recorded in a preformed questionnaire. Each of those workers were briefly explained about the procedure in detailed encouraged to obtain maximum efficient performance. From the previous night up to the examination, they should not undergo any physical or mental stress and not to take any sedatives or any drugs affecting central nervous system. Then the autonomic nerve function assessed by Cold Pressor Test using sphygmomanometer. Blood glucose, serum creatinine level and serum alanine amino transferase were measured to exclude diabetes mellitus, chronic renal failure and liver diseases respectively. Autonomic nerve function test was conducted in a comfortable environment in the department of physiology laboratory from 9.00 am to 2.30pm.

Statistical Analysis Method: All data were recorded systematically in a preformed history sheet and all statistical analysis was done by computer using the software SPSS-23.0 version for windows. Comparison of reproductive, premenopausal and postmenopausal women were done by one-way ANOVA (post–Hoc) tests. In the interpretation of results, < 0.05 level of probability (p) were accepted as significance.

Results

Table-I: Mean ± SD of age, height, and weight and body mass index of the study subjects of different groups.

Parameters	Mean ± SD			P-value
	Group A (n= 40)	Group B (n= 40)	Group C (n= 40)	
Age- Year	27.600±3.934	42.175±1.662	51.425±2.600	0.001***
Height-m²	1.564±0.021	1.546±0.024	1.524±0.069	0.146^{NS}
Weight-kg	56.550±3.993	58.450±2.960	57.450±4.320	0.453^{NS}
BMI-kg/m2	23.657±1.805	24.460±1.406	24.330±1.567	0.920^{NS}

Table-I showing Mean ± SD of age were 27.600±3.934, 42.175±1.662, 51.425±2.600 years in group A, B and C respectively. Mean ± SD of height were 1.564±0.021, 1.546±0.024, 1.524±0.069 m in group A, B and C respectively. Mean ± SD of weight were 56.550±3.993, 58.450±2.960, 57.450±4.320 kg in group A, B and C respectively. Mean ± SD of body mass index were 23.657±1.805, 24.460±1.406, 24.330±1.567 kg/m 2 in group A, B and C respectively. Mean age had significant differences ($p<0.001$) but height, weight, and BMI almost similar and statistically no significant differences ($p>0.05$) in different groups

Table-II: Mean ± SD resting systolic blood pressure and diastolic blood pressure of study subjects in group A, B and C.

Variable	Mean ± SD			P-value
	Group A (n=40)	Group B (n= 40)	Group C (n= 40)	
Resting systolic blood pressure (mm of Hg)	120.875±7.602	122.7500±3.387	130.000±3.922	0.000***
Resting diastolic blood pressure (mm of Hg)	76.500±9.837	80.000±2.773	^{8}4.275±7.404	0.004**

Table-II Showing mean ± SD of resting systolic blood pressure were 120.875±7.602, 122.7500±3.387, 130.000±3.922 mm of Hg in group A, B and C respectively. The mean ± SD of resting diastolic blood pressure were 76.500±9.837, 80.000±2.773, 84.275±7. 404 mm of Hg in group A, B and C respectively. In this study mean resting blood pressure were compared between group A and B, group A and C, group B and C. The mean systolic blood pressures were significantly ($p < 0.001$) higher in group C than A and also significantly ($p < 0.001$) higher in group C than B. Again the mean value non significantly ($p>0.05$) higher in group B than A. The mean diastolic blood pressures were significantly ($p<0.001$) higher in group C than A and also significantly ($p<0.01$) higher in group C than B. Again the mean value non significantly ($p>0.05$) higher in group B than A (Table-II).

Table-III: Mean ± SD systolic blood pressure and diastolic blood pressure of study subjects in group A, B and C after cold pressor test.

Variable	Mean ± SD			P-value
	Group A (n= 40)	Group B (n= 40)	Group C (n= 40)	
Systolic blood pressure (mm of Hg)	14.175±1.692 (12-13)	14.575±0.747 (14-18)	15.975±2.081 (18-19)	0.000***
Diastolic blood pressure (mm of Hg)	12.225±1.073 (11-12)	12.325±0.474 (12-13)	13.175±1.217 (11-16)	0.000***

Table-III Showing mean ± SD of systolic blood pressure of cold pressor test were 14.175±1.692, 14.575±0.747, 15.975±2.081 in group A, B and C. In this study mean values of cold pressor test were compared between group A and B, group A and C, group B and C. In systolic blood pressure changes, the mean values were significantly ($p< 0.001$) higher in group C than group A. also significantly ($p<0.01$) higher in group C than B. Again the mean value non significantly ($p > 0.05$) higher in group B than A. The mean ± SD of diastolic blood pressure of cold pressor test were 12.225±1.073, 12.325±0.474, 13.175±1.217 in group A, B and C respectively. In this study mean values of cold pressor test compared between group A and B, group A and C, group B and C. In diastolic blood pressure changes, the mean values were significantly ($p< 0.001$) higher in group C than group A. also significantly ($p<0.01$) higher in group C than B. Again the mean value non significantly ($p > 0.05$) higher in group B than A (Table-III).

Discussion

The present study was carried out to observe the changes in cardiovascular autonomic functions in apparently healthy premenopausal and postmenopausal women. Height, weight and BMI were calculated to exclude the overweight and obesity and cardiovascular reflexes test was performed to evaluate the changes in autonomic functions. cold pressor test was studied in reproductive, premenopausal and postmenopausal women for comparison. Moreover, scoring of autonomic nerve dysfunction was assessed in order to detect its degree of involvement. In the present study, the findings of the parameter in apparently healthy control group were within normal ranges and also similar to those reported by the various investigators from different countries. Random blood sugar, serum creatinine, SGPT & PEFR levels were estimated in subjects of all groups of the present study for exclusion of diabetes mellitus, kidney diseases, liver diseases & pulmonary diseases as these diseases are well known to affect cardiac autonomic nerve function parameters. In this study, both the values were within the normal range in all the study subjects. Therefore, all the subjects were non diabetic, they did not suffer from chronic renal failure, chronic liver diseases or pulmonary diseases. In this study, resting blood pressure was measured in all healthy reproductive, premenopausal and postmenopausal women to find out their basal status. In premenopausal women mean values of systolic and diastolic blood pressures were non-significantly ($p>0.05$), higher. These findings are in agreement with those reported by Shivwani et al[13]. In postmenopausal women mean values of systolic blood pressures and diastolic blood pressures were significantly ($p<0.001$) higher. These findings are in agreement with those reported by Nahar L A D et al[14] and Shivwani et al[13]. In this study, cold pressor test was measured in all healthy reproductive, premenopausal and postmenopausal women to find out their sympathetic nerve function status. In premenopausal women non-significantly ($p>0.05$) higher systolic and diastolic blood pressure was found in cold pressor tests when compared to reproductive women. These findings are in agreement with those reported by Joshi PK et al[4] and Srivastava RD et al[15] In postmenopausal women significantly ($p<0.001$) higher systolic and diastolic blood pressure was found in cold pressor tests, when compared to reproductive and premenopausal women. These findings are in

agreement with those reported by Joshi PK et al[4] and Srivastava RD et al[15]

Conclusion

In this study, impairment in autonomic nerve function was observed in postmenopausal women. Increased sympathetic nerve function was observed by increased resting blood pressure, increased diastolic pressure response to increase blood pressure response to cold stimulus.

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