

A comparative study of cardiovascular autonomic functions in healthy urban postmenopausal women

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Abstract

Background and Objectives: Menopause marks the period of many changes in women. The risk of cardiovascular disease increases after menopause. The autonomic nervous system responsible for control of many visceral functions is under the influence of female reproductive hormones. Hormonal changes after menopause bring alteration in these functions. This study was aimed to assess the physiological changes in the cardiovascular autonomic functions in healthy urban postmenopausal women.

Material and Methods: 72 healthy women were chosen for the study. They were divided into 2 groups of 36 each, control group (premenopausal) and Study group (postmenopausal).

The parasympathetic function tests included the Heart rate response to postural change (30:15 ratio) heart rate variation during deep breathing (I-E difference), Heart rate response to valsalva maneuver (VR) and the sympathetic function tests like the blood pressure response to the Isometric handgrip (IHG) and the Blood pressure response to standing (BPS) were done in the control and study subjects.

Results: By the student 't' test, we found the significant difference in mean of the heart rate response to deep breathing, the 30:15 ratio, the valsalva ratio and the IHG test, between premenopausal and postmenopausal women, with a 'p' value <0.05.

Conclusion: Autonomic function tests between premenopausal and postmenopausal women showed significant changes. The parasympathetic activity was reduced, sympathetic activity was increased in postmenopausal women.

Keywords: Menopause, Cardiovascular autonomic functions.

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leading to increased cardiovascular risk which is more common in urban population.⁵ Many of the complications of such as insulin resistance, diabetes, hypertension, hyperlipidemia, hyperandrogenism and autonomic dysfunction are seen in postmenopausal women.⁶

Hence, the present study was undertaken to know more about cardiovascular autonomic functions in healthy urban postmenopausal women.

Introduction

In the reproductive life of a woman menopausal period has an important role. Many physical, mental and physiological changes occur during this period.¹ Life expectancy is increasing whereas age at menopause decreasing in Indian women.^{2,3} As a result significant number of post-menopausal women are part of the elderly female population in our country. They often suffer from various menopause related complications including autonomic nerve dysfunctions.²

It is well known that autonomic nervous system maintains homeostasis in our body. Alteration in autonomic nerve function may lead to hypertension, cardiac arrhythmia or sudden cardiac death.^{4,5}

Menopause is also associated with reduced physical activity and decreased energy expenditure

Materials and Methods

72 Apparently healthy women residing in Vijaypur city of North Karnataka of the age 40-60 years were randomly selected for the study. They were divided into premenopausal (control)(n=36) and postmenopausal (study)(n=36) groups depending upon attainment of menopause.

Institutional ethical clearance was taken. Informed consent was obtained from all the participants.

Exclusion criteria

Subjects with history of surgical menopause, alcohol intake, clinical signs of structural cardiovascular diseases, Diabetes Mellitus and Hypertension were excluded from the study.

Anthropometrical parameters

- Body weight(in kg):** A digital weighing scale was used to measure body weight with an accuracy of ± 100 g. Subjects were weighed without their shoes.
- Height(in cms):** Standing body height was measured without shoes to the nearest 0.5 cm with the use of height stand with shoulders in relaxed position and arms hanging freely.

Tests for cardiovascular autonomic function

The tests were recorded using Physiopac, sphygmomanometer and handgrip dynamometer, Tests reflecting cardiac parasympathetic functions

- Heart rate response to postural change (30:15 ratio)
- Heart rate variation during deep breathing(I-E difference)
- Heart rate response to valsalva maneuver (VR)

Tests reflecting sympathetic functions

- Blood pressure response to postural change (orthostatic tolerance test (OTT))
- Blood pressure response to sustained isometric handgrip (IHG)

Statistical Analysis

The results are expressed as mean \pm standard deviation. Comparison of cardiovascular autonomic function tests and Body Mass Index between premenopausal and postmenopausal women is done using unpaired Student's 't' test.

Results

The Table 1 shows the mean, standard deviation and p-value of anthropometric parameters age, height and weight of premenopausal and postmenopausal women. There was no significant statistical difference between mean age and weight of postmenopausal women and premenopausal women.

Table 1: Anthropometric parameters in control and study groups

| Parameters | Control Group | Study Group | Level of significance |
|--------------|-------------------|-------------------|-----------------------|
| Age (Years) | 42.95 \pm 1.82 | 46.35 \pm 5.97 | 0.07 |
| Height (cms) | 157.94 \pm 5.97 | 153.88 \pm 5.23 | 0.003** |
| Weight (Kg) | 62.22 \pm 8.87 | 62.72 \pm 9.21 | 0.81 |

*p <0.05: Significant, **p <0.01: Highly significant, ***p <0.001: Very highly significant

We found statistically significant lower mean values of three parasympathetic function tests and significant higher values of one sympathetic function test in study group compared to control group.(Table 2) This suggested that there was increased sympathetic activity and decreased parasympathetic activity in postmenopausal women (study) compared to premenopausal women (control).

Table 2: Autonomic function parameters in Study and Control Groups

| Autonomic function parameters | Control Group | Study Group | Level of significance |
|---|------------------|------------------|-----------------------|
| Valsalva Ratio | 1.71 \pm 0.43 | 1.20 \pm 0.14 | 0.001*** |
| HR variation to deep breathing (bpm) (Maximum-Minimum) | 31.61 \pm 5.96 | 14.98 \pm 6.30 | 0.0005*** |
| Immediate HR response to standing (30:15) | 1.23 \pm 0.19 | 1.05 \pm 0.06 | 0.0004*** |
| BP response to Standing (Fall in SBP)(mmHg) | 7.77 \pm 2.73 | 8.83 \pm 2.76 | 0.10 |
| BP response to sustained Hand grip (mmHg) (Increase in DBP) | 18.08 \pm 3.54 | 22.55 \pm 5.37 | 0.0001*** |

*p <0.05: Significant, **p <0.01: Highly significant, ***p <0.001: Very highly significant

Discussion

In our study we found significantly increased sympathetic activity and decreased parasympathetic activity in postmenopausal women compared to premenopausal women. Which is similar to the study done by Shikha G, Nilima S, Om PT, Neerja G in 2011 in which they compared cardiac autonomic functions among postmenopausal women with and without hormone replacement therapy, and premenopausal women suggesting the role of estrogen in maintaining the cardiovascular autonomic functions.⁷

Similar results were obtained in a study done by Shailaja S, Sandhya T in which they compared cardiac autonomic activity between pre and post-menopausal women using heart rate variability.⁸

Mercurio G et al found a role of endogenous estrogen in the modulation of autonomic nervous system in their study, they observed autonomic changes before and after oophorectomy in premenopausal women which indicates that estrogen has a role in increasing vagal function and reducing sympathetic action.⁹

Our study is in accordance with study done by Weitz G, Elam M, Born J, Fehm HL, Dodt C in 2001 in which they found decreased parasympathetic activity and increased sympathetic activity in postmenopausal women and the effect of conjugated hormone replacement therapy in reversing this sympathetic hyperactivity and vagal deficit.¹⁰

Naher LAD, Begum N, Begum S, Ferdousi S, Ali T, Sultana M, Ali ML found two parasympathetic functions tests lower in postmenopausal women compared to premenopausal women.¹¹

The possible explanation could be the decline in level of estrogen from premenopausal to postmenopausal status which favors the shifting of autonomic balance towards the sympathetic dominance. This is due to the decreased level of estrogen in postmenopausal women which produces an unfavorable alteration in cardiac autonomic functions.

There are several mechanisms through which reproductive hormonal status may influence cardiovascular autonomic reactivity. These include altering receptor sensitivity, density or neurotransmitter availability. The role of estrogen on cardiac autonomic modulation action can be explained by its effect on enhancing the cholinergic muscarinic activity in central nervous system and such modulation at central and peripheral levels tends to suppress sympathetic but elevate parasympathetic tone.⁸

There is also age related parasympathetic dysfunction which starts after sixth decade.¹²

In our study we have tried to reduce the confounding factor age by taking the control as well as study group of same age i.e. there is no significant difference in the mean age of the control and study group.

Hormonal replacement therapy is yet controversial. Hence role of phytoestrogens as a dietary component and role of Yoga in reversing the sympathovagal balance in postmenopausal women is the further of scope of the study.

Conclusion

We found increase in sympathetic activity and decrease in parasympathetic activity in healthy urban postmenopausal women.

In India compared to western countries very less awareness is present regarding menopause and its related complications. Establishment of menopausal clinics and the assessment of Cardiovascular Autonomic functions as a part of regular investigation

can be helpful to reduce morbidity and related mortality in postmenopausal women.

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