Original article:

Association between cardiovascular risk with baroreceptor sensitivity in normal and high BMI postmenopausal women

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Abstract:

Introduction: The world health organization defines menopause as permanent stoppage of menstruation that occurs due to decreased level of female sex hormones mainly estrogen and progesterone in the blood and this can be confirmed after twelve months of amenorrhea. The postmenopause describes years that follows the menopause. Throughout the world, the commonness of being overweight was found to be 38% and India ranks third. According to National Institutes of Health, weight more than normal is considered one of the preventable causes of death. Baroreflex sensitivity (BRS) is a sensitive indicator of cardiac autonomic function and a measure of cardiovascular (CV) risk including morbidity and mortality. There are conflicting reports available on activity of autonomic nervous system in postmenopausal obese women. There is no report available on baroreflex sensitivity in postmenopausal obese women.

Materials and methods: The study was conducted on 104 postmenopausal women grouped them into 2 with group 1 having normal BMI (18.50- 24.99) and group 2 having high BMI >25.00 based on Asian's classification for BMI. Subjects were evenly matched for age and menopausal duration. Anthrometric indices were calculated. The continuous beat to beat blood pressure variability is measured using a noninvasive continuous hemodynamic monitor Finapres.

Result: Basal Heart rate (BHR) (p= 0.009) and total peripheral resisitance (TPR) was increased (p<0.000) in high BMI postmenopausal women highlighting increased sympathetic activity. This was supported by significant rise in Diastolic blood pressure (DBP) (p<0.000) and Cardiac output (CO) (p<0.000) in high BMI postmenopausal women when compared to controls.

Conclusion: BRS was reduced in high BMI postmenopausal women. Reduced BRS is known cardiovascular risk factors. So, high BMI postmenopausal women were more prone for CV risk when compared to normal BMI postmenopausal women.

Keywords: BMI, postmenopausal women, BRS.

Introduction:

Menopause also known as climacteric, indicates to the period in the life of a woman when she does not get any more menstrual period and becomes capable of producing offspring [1]. The postmenopause describes years that follows the menopause. During menopause women suffer a lot symptomatically. Symptoms associated with menopausal transition are vasomotor symptoms like night sweats, hot flashes and flushes, psychological and mental disturbances, sexual dysfunctions, somatic symptoms and weight gain [2].Throughout the world, the commonness of being overweight was found to be 38% (2.1 billion of world population) and India ranks third [3].According to National Institutes of Health, weight more than normal is considered one of the preventable

causes of death [4], especially on the large scale accounting for 300,000 deaths per year in the united states [5]. Cardiovascular disease is increasing throughout the world and is the most common leading cause of death in women after 65years [6]. Autonomic imbalance has been linked to assess the cardiovascular disease risk factors [7]. Analysis of continuous blood pressure variability as recorded by Finapress is noninvasive and useful tool to assess cardiac autonomic activity and sympathovagal balance [8,9,10]. Baroreflex sensitivity (BRS) is a sensitive indicator of cardiac autonomic function and a measure of cardiovascular (CV) risk including morbidity and mortality [11]. In India the women on an average live for 65 years, whereas it is much more in case of women in developed countries, which is about 80 years. This shows the poor health status of women in India, emphasizing the requirement of special health care for them especially in the postmenopausal phase [12].

Aim and objectives:

To study the association between cardiovascular risk with Baroreflex sensitivity in normal and high BMI postmenopausal women.

Materials and methods:

After obtaining the approval from the JIPMER Scientific Advisory Committee (JSAC) and the Institutional Ethics Committee for human studies, the study was conducted on 104 postmenopausal women grouped them into 2 with group 1 having normal BMI (18.50- 24.99) and group 2 having high BMI >25.00 based on Asian's classification for BMI.

Inclusion criteria:

Postmenopausal women of age group 45-60 years, who were normotensives, without any gross systemic disease and non-smoker and who could abstain from caffeine, caffeine-containing beverages, drugs, and alcohol were taken during the study period.

Exclusion criteria:

Postmenopausal women of less than 45 and above 60 yrs, Tachycardia , Cardiac arrhythmias, Hypertension, Diabetes, Ischemic heart disease, Retinopathy , Neuropathy, Any chronic disease or associated factors that may affect the autonomic reflexes, Neurological disease, Psychiatric diseases, Chronic alcoholics, Women receiving hormone replacement therapy and taking any medication that have been reported to affect BRS (like for instance autonomic blockers).

 Subjects were evenly matched for age and menopausal duration. The physical and physiological parameters were recorded using weighting machine, height strands. BMI was calculated using Quetlet index that uses body weight and height of the individual. Circumferences were measured using non- elastic steel tape (CESCORF, Brazil, South America). Waist circumference was measured (WC) which lies between lower costal border and top of the iliac crest , hip circumference at the level of greatest posterior protuberance of the buttocks. The continuous beat to beat blood pressure variability is measured using a noninvasive continuous hemodynamic monitor Finapres (Finometer version1.22a, Finapres Medical Systems BV, Amsterdam, The Netherlands). The subjects were made comfortable in supine posture for 10 minutes in quiet room with ambient temperature of 25 C. Based on the finger size, cuff was selected and tied tightly around middle phalanx of the middle finger. Brachial cuff was tied around the midarm above the cubital fossa for return to flow calibrations. In Finapres for level correction two sensors are used, which usually shift the finger pressure in upward direction to approach the nearest brachial artery pressure, one placed at the level of heart and the other at the level of finger. Later 5

minutes of initial recording of return to flow calibration was done and physiocal was carried out for level correction following which 10 minutes of reconstructed finger arterial pressure was recorded.

Results:

Comparison of normal BMI and high BMI postmenopausal women:

Anthropometric indices:

All the anthropometric indices such as weight, BMI, waist circumference and hip circumference, were significantly high (Table-1) in high BMI postmenopausal women when compared to normal BMI postmenopausal women.

Blood pressure variability parameters:

Among the BPV parameters, BHR, SBP, DBP, RPP, SV, CO, LVET and TPR were significantly high (Table- 2) and the BRS was reduced significantly in high BMI postmenopausal women compared to normal BMI.

Table 1: Age and Anthropometric indices in normal and high BMI postmenopausal women

Parameters	Normal BMI (n=50)	High BMI (n=54)	P value
Age	51.68± 4.96	50.46±5.05	0.219
Weight (Kg)	52.44± 7.29	67.17±8.469	<0.000
Height (cm)	153.56± 6.23	151.98±6.00	0.190
BMI	22.16±2.08	29.06±3.18	<0.000
Waist circumference(cm)	81.19±7.91	87.94±9.35	<0.000

The values are expressed as Mean±SD; Statistical analysis was done by student unpaired t-test. The P value <0.05 was statistically considered significant.

BMI: body mass index.

*Mann-Whitney test was performed

Table 2: Comparison of Blood pressure variability parameters among normal and high BMI postmenopausal women

Parameters	Normal BMI (n=50)	High BMI (n=54)	P value
BHR (per min)	75.72± 10.13	79.85± 4.84	0.009
SBP (mmHg)	116.37± 7.18	121.41± 9.07	<0.002
DBP (mmHg)	67.90± 7.40	76.60± 6.83	<0.000
MAP	84.1± 7.84	91.5± 9.48	<0.000
RPP (mmHg/min)	88.11± 14.02	96.94±12.31	<0.000
SV (ml)	74.16± 20.18	85.90± 10.67	<0.000
CO (L/min)	5.61± 1.70	6.85± 1.00	<0.000
TPR (mmHg.min/L)	0.70± 0.27	1.22± 0.55	<0.000
LVET (ms)	255.43± 22.88	306.18± 16.37	0.000
BRS (ms/mmHg)	11.82± 4.33	9.44± 3.83	0.003

The values are expressed as Mean±SD; Statistical analysis was done by student unpaired t-test. The p value <0.05 was statistically considered significant. BPV: blood pressure variability; BHR: basal heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; RPP: Rate pressure product; SV: stroke volume; CO: cardiac output; LVET; left ventricular ejection time; TPR: total peripheral resistance; BRS: Baroreceptor sensitivity.

Discussion:

Finapres stands for FINger Arterial PRESsure, the instrument used to record the BP variability. An inflatable finger cuff tied around the finger is used obtain arterial waveform at the finger level. The diameter of the arterial wall is altered during each cardiac cycle as well as due to fluctuation in the physiological hemodynamics. The fluctuation in the arterial volume is perceived by the sensor made of infrared rays in the finger cuff, and is calculated by the plethysmograph attached to it; thereby a counter pressure is applied by a pressure-servo-controller system [13]. As a result, the arterial diameter is kept constant throughout the cardiac cycle by clamping the artery, irrespective of the change in the volume [14]. Thus Finapres provides parameters that assess the

functional abnormalities. However, it does not provide information regarding valvular and vascular dimensions and cardiac chambers. Among all the parameter, BRS is considered as one of the important tool to assess the CV functions and dysfunctions and also used to detect various clinical disorders [15]. BRS is defined as the change in interbeat interval (IBI) in milliseconds per unit change in blood pressure. Decreased baroreflex sensitivity is reported as an index of CV risk [16].Several studies have denoted that BRS is the broadcaster of the CV risk [17,18,19]. White WB, 1999 stated that increased rate pressure product was an established risk of cardiovascular disease [20]. The tone of the vasculature in the systemic circulation tells about the total peripheral resistance (TPR) [21]. In the present study, TPR was increased in high BMI postmenopausal women highlighting increased sympathetic activity in these subjects. This was supported by significant rise in DBP in high BMI postmenopausal women because TPR is directly proportional to diastolic blood pressure. If TPR is more, then the pressure generated by the ventricles to eject the blood out of the arteries also goes up which can be appreciated by rise in DBP [22].Cardiac output (CO) was increased in high BMI postmenopausal women when compared to controls. CO is the amount of blood pumped out of each ventricle per minute and it is measured as the product of heart rate (HR) and the stroke volume (SV). So, increase in any of these parameters will increase the CO. In high BMI postmenopausal women the heart rate was found to be increased when compared to controls and this could be due to the vagal withdrawal influencing the rise in HR. SV is the amount of blood pumped by each ventricle per beat. Increase in sympathetic activity increases SV as the ventricles are richly innervated by sympathetic fibbers, and sympathetic activity increases the force of contraction of cardiac muscle. This rise in CO is further confirmed by rise in the SBP in the high BMI postmenopausal women because CO and SBP are linearly related to each other. Rise in both CO and SBP in the present study depicts the rise in sympathetic activity in the high BMI postmenopausal women compared to controls. In the present study BRS was found to be reduced in high BMI postmenopausal women. Baroreceptors sense the fluctuation in the blood pressure based on the stretch produced on the vessel wall. Reduced sensing power of the baroreceptor could be due to persistent rise in CO and SBP in high BMI postmenopausal women when compared to controls. Also, rise in the body fat could be a factor which desensitizes the baroreceptors as fat gets deposited in the vessel wall, and makes it stiffer and less pliable. Several studies have denoted that BRS is the broadcaster of the CV risk [17,18,19]. So, postmenopausal women with reduced BRS are more prone to CV risks.

Conclusion:

BRS was reduced in high BMI postmenopausal women when compared to controls. Autonomic dysfunction in the form of heightened sympathetic activity associated with reduced parasympathetic activity was found in high BMI postmenopausal women. Thus, we concluded that postmenopausal women with high BMI were more prone for cardiovascular diseases when compared to normal BMI postmenopausal women.

Conflict of Interest:

The author declare no conflict of interest

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