Research Paper
Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

A Study of Autonomic Functions and Obesity in Postmenopausal Women

Medical Science

KEYWORDS : Autonomic functions, obesity and postmenopausal women

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ABSTRACT

There are over 60 million postmenopausal women above 55 years in India. Obesity, physical inactivity, and altered estrogen metabolism play an integrated role in contributing to the disease risk profile of postmenopausal women. A study was undertaken to test the whether there is indeed an alteration in autonomic functions in obese postmenopausal women. . Subjects were divided into two groups of 55 Non-Obese and 45 Obese. The two groups were well matched for age and menopausal duration. The physical as well as physiological parameters like valsalva ratio, heart rate variation with deep breath test, heart rate response to postural change (30:15 R-R interval ratio), orthostatic tolerance test, and isometric handgrip test were recorded. valsalva ratio, deep breath test, and 30:15 R-R interval ratios and isometric handgrip test were significantly decreased and orthostatic tolerance values were significantly increased in Obese subjects. Findings show decreased sympathovagal activity with obesity in postmenopausal women.

Introduction

Menopause is associated with reduced physical activity and energy expenditure, an accelerated loss of fat free mass, alteration of adipose tissue metabolism, and fat oxidation. This deregulation of energy metabolism could induce an increase in total adiposity and a redistribution of fat in the abdominal region in postmenopausal women. The distribution of adipose tissue in different anatomic depots also has substantial implication for morbidity. Specifically, intra-abdominal and abdominal subcutaneous fat has more significance than subcutaneous fat in the buttocks and lower extremities. Many of the complications of obesity, such as insulin resistance, diabetes, hypertension, hyperlipidemia, and hyperandrogenism in women, are linked more strongly to intra-abdominal or upper body fat than to overall adiposity. Increased body fat percentage causes marked sympathetic activation and vagal inhibition leading to autonomic dysfunction.

The altered sympatho-vagal activity has an additional adverse effect on health. As life expectancy increases, women in general experience a longer life after menopause. 60 million women in India are above the age of 55 years. Hence, there is a need to understand the effect of obesity and autonomic function in post menopausal women. Early detection of subclinical autonomic dysfunction therefore will improve the quality of life by proper medication and lifestyle modification.

Materials and Methods

A total of 100 post menopausal women without any gross systemic disease who were evenly matched for age and menopausal duration were selected. The physical and physiological parameters were recorded using weighing machine, height stands, 4 channel physiograph polyrite-D, timer, handgrip dynamometer, and sphygmomanometer.

Methods

Inclusion criteria

Only those subjects who were normotensive, without any gross systemic disease and non-smoker and who could abstain from caffeine-containing beverages, drugs, hormone replacement therapy, and alcohol during the study were taken.

Exclusion criteria

Tachycardia, cardiac arrhythmias, presence of hypertension, diabetes, ischemic heart disease, retinopathy, nephropathy and the presence of a chronic disease or associated factors that may affect the autonomic reflexes were excluded.

Anthropometry

a. Body weight:
b. Height:
c. Body mass index:
d. Waist/hip ratio: WHR < 0.9.

Determination of resting heart rate (RHR)

Apparatus: Polyrite-D.
Tests for autonomic function

Tests for parasympathetic functions

1. Heart rate response to postural change (30:15 ratio)
2. Heart rate variation during deep breathing
3. Heart rate response to valsalva maneuver (VR)

Tests for sympathetic functions

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

The subjects were made to rest for 15 min in the supine position. The resting time given to subjects in between two tests was 5 to 10 min.

Heart rate response to postural change (30:15 ratio)

After a complete rest of 15 min in the supine position, the ECG recording was started. The subject was instructed to stand erect from the supine position as quickly as possible (within 3 s) with continuous ECG recording for at least 30 s.The ratio of the longest RR around 30th beat after standing to the shortest RR interval around 15th beat after standing were calculated for result of 30:15 ratio. Normal ≥1.04, Abnormal ≤1.00

Heart rate variation during deep breathing

The subject was instructed to take deep inspiration over 5 s and followed by expiration over next 5 s completing six respiratory cycles in 1 min (six cycles were repeated in 1 min in this test). The inspiratory and expiratory timing were synchronized by looking at the observer's finger moving rhythmically up and down with the timer. The mean of the minimum RR intervals in the six inspiratory cycles was calculated and heart rate determined. Also the mean of the maximum RR interval in the six expiratory cycles of the same tracing were calculated for heart rate during expiration. The difference of the heart rate between the maximum in the inspiratory cycle and the minimum in the expiratory cycles was calculated and was used as result of the test

Normal ≥15 beats/min

Heart rate response to valsalva maneuver
The subject was instructed to exhale forcefully through the mouth piece of a modified mercurial sphygmomanometer and to maintain pressure in the manometer up to 40 mmHg for 15 s. ECG recording were taken during the maneuver and continued for about 30 s after the performance. The ratio of the longest RR interval after blowing to the shortest RR interval during blowing was calculated: Normal ≥1.21, Abnormal ≤1.1

Orthostatic tolerance test
Apparatus: mercurial sphygmomanometer, stethoscope.

Basal blood pressure was recorded. Then the patient was asked to stand up and the blood pressure was recorded immediately.

The difference of the systolic blood pressures between the one recorded during lying supine and in erect posture was calculated. The fall in systolic pressure was used as the result of the OTT.

Normal: 10 mmHg or less, Borderline: 11-29, Abnormal: 30 mmHg or more.

Blood pressure response to sustained isometric handgrip

Apparatus: mercurial sphygmomanometer, stethoscope and handgrip dynamometer.

The subject was asked to perform maximum grip of the handgrip dynamometer with his dominant hand and the maximum capacity was noted down. After 5 min in the sitting position, the subject was asked to hold his grip with 30% of the maximum capacity for 5 min and the blood pressure was recorded just after release of the grip.

Calculation: The rise in diastolic blood pressure was calculated and taken as the result of IHG test.

Normal: 16 mmHg or more, Borderline: 11-15 mm, Abnormal: 10 mmHg or less All the mean values of all parameters of both groups were arranged in tabular form and spastically analyzed using Student's t-test and Pearson's correlation coefficient test (P value <0.05 * significant, P value <0.01** highly significant). No significant changes in resting pulse rate and casual blood pressure were found between the two groups.

Results
Results showed significant differences in BMI, Waist/Hip Ratio, VR, Deep breath test, 30:15 R-R ratios, OTT & IHG Tests between the two groups. Markers of obesity were negatively correlated with autonomic function tests.

Name of parameters	Non-obese subjects mean±S.D	Obese subjects mean±S.D	P Value
BMI	19.98±2.3	27.55±1.9	<0.01
Waist /hip ratio	0.83±0.29	0.973±0.053	<0.01
Valsava ratio	1.24±0.126	1.15±0.083	<0.01
30:15R-R interval ratio	1.06±0.057	1.03±0.033	<0.05
Deep breath test	14.86±7.6	10.2±8.63	<0.05
OTT	26.22±8.91	33.81±5.86	<0.01
IHG test	11±4.57	8.9±3.39	<0.05

Table :1.The average values of BMI, waist/hip ratio, valsalva ratio,30:15 R-R interval ratio, deep breath test, OTT, IHJ test, p value < 0.05 is significant p value<0.01 is highly significant

parameters	rvalue	p value
Valsalva ratio	-0.23	<0.01
IHG	-0.28	<0.01
OTT	+0.31	<0.01
DBD	-0.13	<0.01
30:15 RR ratio	-0.13	<0.01

Table no: 2. BMI is positively correlated with OTT and negatively correlated with all other autonomic function tests. P value <0.01 highly significant

parameters	rvalue	P value
Valsalva ratio	-0.22	<0.01
IHG	-0.321	<0.01
OTT	+0.35	<0.01
DBD	-0.20	<0.01
30:15 RR ratio	-0.22	<0.01

Table 3. shows correlation of waist/hip ratio and autonomic function tests, p value <0.01 highly significant

Discussion
Women with the metabolic syndrome (central obesity, insulin resistance, and dyslipidemia) are known to be at especially high risk for cardiovascular disease (CVD). The prevalence of the metabolic syndrome increases with menopause and may partially explain the apparent acceleration in CVD after menopause. The values of BMI for the Asian population have been reset as their body composition is different from that of the western world. Recent comparative studies have shown that Indians have a higher percentage of body fat for a given BMI compared with the white Caucasians and African-Americans but have a lower muscle mass. Body composition of Indians is partly responsible for their higher insulin resistance. In the present study, subjects with BMI greater than 25 were categorized into Obese and those with BMI less than 25 as Non-Obese. WHRs > 0.9 in women and > 1 in men are considered abnormal. Many of the important complications of obesity, insulin resistance, diabetes, hypertension, hyperlipidemia, and hyperandrogenism in women are linked strongly to intra-abdominal or upper body fat than to overall adiposity. WHR has been found to be more predictive than BMI in most studies. An increase in body fat percentage with menopause has been reported by many workers. Heart rate variation is reported to be reduced in obese individuals. Human obesity is characterized by marked sympathetic activation. A 10% increase in body weight above an individual's usual weight is accompanied with a decrease in parasympathetic activity. This effect of increased weight is one mechanism for cardiac alterations such as arrhythmias that accompany obesity. Leptin is an anorexigenic hormone that influences the feeding and satiety centers in hypothalamus. At one time it was assumed that adipocytes are the sole site of leptin production and release. Evidence from studies in experimental animals and human now indicates that leptin is also derived from non-adipose sites, one of these being the brain. Leptin and the sympathoadrenal system appear to be intimately linked. It has been suggested that there may be a two-way interaction between leptin and sympathetic nervous system, perhaps constituting a regulatory feedback loop, with leptin acting within the hypothalamus to cause activation of the central sympathetic outflow and stimulation of adrenal medullary release of epinephrine, and conversely, with the sympathetic nervous system inhibiting leptin release from white adipose tissue.

In this study, obese subjects had significantly lower autonomic functions as compared to non-obese subjects. Similar results were reported by Tetsuya Kimura et al. Epidemiological data shows that women below 50 years rarely develop CVD, but the incidence is equal in men and women around 70 years of age. Menopause may result in endothelial dysfunction and increase body weight and type II diabetes that causes increase sympathetic activation.

Decreased baroreflex sensitivity also appears with increasing body mass. Obese humans have decreased responsiveness to sympathetic stimulation and down regulatedβ receptors in white adipose tissue. Gaining weight combines regularly with metabolic changes revealing adaptation processes towards "resistance" of feedback loops involved especially in organ systems ensuring supply and utilization of energy. Thus, this study implies that the altered sympatho-vagal activity has an additional adverse effect on health and ultimately on the quality of life in obese PMW

Dietary modifications, exercise, and yoga may improve autonomic functions in PMW by reducing body fat and weight. Further studies with larger samples of population and using MRI or bioelectric impedance analyzer for measuring body fat percentage may prove useful.

Conclusion:
valsalva ratio, deep breath test, and 30:15 R-R interval ratios and isometric handgrip test were significantly decreased and orthostatic tolerance values were significantly increased in Obese subjects. Findings show decreased sympathovagal activity with obesity in postmenopausal women.

REFERENCE

1. Carr MC. The emergence of metabolic syndrome with menopause. J Clin Endocrinol Metab 2003;88:2404-11. | | 2. Fu CH, Yang CC, Lin CL, Kuo TB. Alteration of cardiovascular autonomic functions by vegetarian diets in postmenopausal women is related to LDL cholesterol levels. Chin J Physiol 2008;51:100-5. | | 3. Pellizzer AM, Straznicky NE, Lim S, Kamen PW, Krum H. Reduced dietary fat intake increases parasympathetic activity in healthy premenopausal women. Clin Exp Pharmacol Physiol 1999;26:656-60. | | 4. Phehlman ET, Toth MJ, Gardner AW. Changes in energy balance and body composition at Menopause: A controlled longitudinal study. Ann Intern Med 1995;123:673-5. | | 5. Kirschner MA, Samojilk E, Drejka M, Sjmal E, Schneider G, Ertel N. Androgen-estrogen metab in women with upper body versus lower body obesity. J Clin Endo Metab 1990;70:473-9. | | |