THE JOURNAL OF OBSTETRICS AND GYNECOLOGY OF INDIA

The Journal of Obstetrics and Gynecology of India (November–December 2016) 66(6):466–470
DOI 10.1007/s13224-015-0713-x

ORIGINAL ARTICLE

Metabolic Syndrome: Can We Keep Check?

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Received: 26 April 2015 / Accepted: 18 May 2015 / Published online: 1 July 2015

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Abstract

Background Metabolic syndrome (MetS) is on the rise due to the epidemic increase of obesity. It increases the risk of atherosclerotic cardiovascular diseases and type II diabetes mellitus.

Aims To study the prevalence of MetS and its components in premenopausal and postmenopausal women.

Design Cross-sectional comparative study.

Material and Method Five hundred premenopausal women and 500 postmenopausal women in the age group 40–65 years, attending OPD of Obstetrics and Gynecology Department of Pt. J.N.M. Medical College, Raipur from September 2012 to August 2014 were analyzed and assessed for the MetS risk factors and evaluated according to the NCEP ATP III criteria.

Results The prevalence of MetS in postmenopausal women was 48.6 %, nearly 1.7 times the prevalence in premenopausal women (27.4 %). Except for central obesity and low HDL cholesterol, the frequency of hyperglycemia, high blood pressure, and hypertriglyceridemia were significantly higher in postmenopausal than in premenopausal women. All the five factors of NCEP ATP III criteria were present in 5 % of postmenopausal women in contrast to 0.4 % in premenopausal women.

Conclusion Prevention is better than cure. The need of the hour is to target premenopausal women who are at risk

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of developing MetS in their postmenopausal age. It will delay and prevent them from future morbidities.

Keywords MetS · Premenopausal · NCEP ATP III · CVD

Introduction

The metabolic syndrome (MetS) is the assemblage of risk factors such as central obesity, high blood pressure, hyperglycemia, hypertriglyceridemia, as well as low levels of high-density lipoprotein cholesterol. The postmenopausal period in life is found to be frequently associated with MetS, although some women suffer from it even in premenopausal age. The prevalence of the metabolic syndrome is increasing tremendously due to the epidemic increase of obesity around the world.

India has a large population which has already crossed the 1 billion mark with 71 million people over 60 years of age and the number of menopausal women about 43 million. The projected figures in 2026 have estimated that population of people over 60 years in India will be 1.4 billion and the menopausal population 103 million. Average age of menopause is 47.5 years in Indian women with an average life expectancy of 71 years [1].

It has been seen that MetS is on the rising trend especially in postmenopausal women [2]. Estrogen promotes gluteo-femoral fat. Loss of estrogen with menopause is associated with an increase in central fat. Cross-sectional and longitudinal studies have shown that the menopausal transition is associated with a preferential increase in abdominal adiposity independent of the effect of age and total body adiposity. The transition from pre- to postmenopause is associated with the emergence of many features of the metabolic syndrome, including increased central (intraabdominal) body fat; a shift toward a more atherogenic lipid profile, with increased low-density lipoprotein and triglycerides levels; reduced high-density lipoprotein, and small, dense low-density lipoprotein particles; and increased glucose and insulin levels. The emergence of these risk factors may be a direct result of ovarian failure or, alternatively, an indirect result of the metabolic consequences of central fat redistribution with estrogen deficiency [3]. A timely recognition and management of the components of MetS is important in the subset of women who are at high risk of CVD and Diabetes Mellitus type II.

A rising graph is seen in women of Asian origin. Epidemiologists in India and international agencies such as World Health Organization have been sounding an alarm on the rapidly rising burden of CVD for the past 15 years. It is estimated that by year 2020, CVD will be the largest cause of disability and death in India [4]. Studies in India estimate the prevalence of MetS to be 22.2 % in premenopausal women and 32.4 % in menopausal women [5].

Materials and Methods

This was a cross-sectional comparative study conducted in 1000 women in the age group 40–65 years, both included, attending as inpatients- and outpatients in the Department of Obstetrics and Gynecology of Pt. J. N. M. Medical College, Raipur during the period from December 2012 to August 2014. The objective of the study was explained and informed to women, and data of each woman were recorded in identical predesigned proforma after obtaining informed and written consent. Participants were categorized into two groups: Premenopausal age group and Menopausal age group.

Initially, a questionnaire was completed. It contained information regarding the physical activity, leisure time, addiction, menopausal status, consumption of relevant medication especially antidiabetic, antihypertensive, and hormone replacement therapy. A venous blood sample was collected from all the subjects in the morning after an overnight fast. The serum was used for estimating fasting blood glucose, triglyceride, HDL concentration, and postprandial blood glucose (taken 2 h after making them drink 75 gm. of glucose).

Other parameters were also recorded like Weight (digital scales were used), Height (in standing position using tape meter), Body mass index (BMI—calculated as weight in kilogram divided by height in meters squared), waist circumference(WC—measured at the point halfway between the lower border of ribs and the iliac crest in horizontal plane), hip circumference(HC—measured at the level of iliac crest), waist–hip ratio (WHR—calculated as ratio of WC:HC), and systolic and diastolic blood pressures (measured in sitting position from the right hand). Adult Treatment Panel III guideline of the National Cholesterol Education Program was used to categorize the subjects. The parameters are WC $>$ 88 cm, Systolic/Diastolic Blood Pressure $\geq$ 130/85 mm Hg, Triglyceride $>$ 150 mg/dl, HDL $<$ 50 mg/dl, and blood sugar fasting level $>$ 100 mg/dl. For MetS, one should fulfill any three of the above parameters.

Statistical Methods

The data were collected, and mean and SD were calculated. The results were reported as percentages and mean $\pm$ SD. The results were evaluated by means of independent student t test, Chi square tests, and Pearson χ^2 test. A p value of <0.05 was chosen to represent statistical significance.

Results

A total of 1000 women, 500 premenopausal and 500 postmenopausal, were examined for the risk factors of MetS. Among the premenopausal women, the age ranged from 40 to 55 years (mean 42.91 ± 5.79), while for postmenopausal women, the range was 40–65 years (mean 55.18 ± 6.48) ($p < 0.0001$). The baseline data as obtained are shown in Table 1.

The prevalence of MetS and metabolic risk factors are shown in Table 2. The overall prevalence of MetS in our study as per NCEP ATP III criteria is 38 %, while it was 50.7 % as per IDF criteria (WC ≥ 80 cm and any two of the following factors, that is, hypertension, hypertriglyceridemia, hyperglycemia, and low HDL-C level). Similarly, the prevalence rates were 48.6 and 56.8 % in postmenopausal women and 27.4 and 44.6 % in premenopausal women as per NCEP ATP III and IDF criteria, respectively. The prevalence of risk factors like central obesity, hypertriglyceridemia, hyperglycemia, and high systolic blood pressure were higher in postmenopausal women than in premenopausal women. However, the prevalence of low HDL cholesterol was lower in postmenopausal women than in premenopausal women, while the prevalence of diastolic blood pressure was similar in both groups (Table 3).

Discussion

The concept of MetS and its grave consequences has emerged for several decades, but only after the standardization of diagnostic criteria, it was possible to evaluate the prevalence of MetS in different regions. The prevalence of MetS varies a lot owing to differences in genetic profile, eating habits, levels of physical activity, age, gender, lifestyle, etc. The age of natural menopause calculated in our study is 46.7 ± 3.41 years which is comparable with the mean age found by other studies [11, 12]. A study in the USA, on the other hand, found that the median age at menopause in Europe ranged from 50.1 to 52.8 years, in North America from 50.5 to 51.4 years, in Latin America from 43.8 to 53 years, and in Asia from 42.1 to 49.5 years [13].

In our study group, as per NCEP ATP III criteria, it was found that overall prevalence of MetS was 38 % which is consistent with other studies done in different parts of India like Tamilnadu [14], Lucknow [15], and Hyderabad [16]. Studies done in different countries like Bangladesh [7] and Iran [17] are also in an agreement with our findings.

It was found that there is higher prevalence of MetS in postmenopausal group than in premenopausal group. In our study, 48.6 % of postmenopausal women had MetS compared to 27.4 % of premenopausal women. Similar data were observed in other studies (as shown in Table 1). When IDF criteria were used, the prevalence rates of MetS in the present study were 56.8 % in postmenopausal group and 44.6 % in premenopausal group, which is in line with the data observed by a study from Western India [6] (55 % in former, and 45 % in the latter group). The use of IDF criteria resulted in a higher prevalence rates than with NCEP criteria. Although Indians have lower average WC owing to the smaller body frames, they, however, carry excess morbidity risks even at lower BMI. Hence, newer guidelines for BMI cutoff values for Indians have been released jointly by ICMR, AIIMS, NIN, and others. As per these guidelines, BMI 18–22.9 kg/m^2 is acceptable, 23–24.9 kg/m^2 is overweight, and >25 kg/m^2 is considered as obese.

In our study, it was seen that there was higher prevalence of MetS in women who had crossed the menopausal transition phase. There is ongoing controversy regarding whether MetS worsens with age alone or as a result of climacteric transition. Being a cross-sectional study, it is difficult to find association between MetS with the increasing age or menopause as the latter two are interlinked. A cross-sectional study on Tunisian women in France, where women aged 45–54 years were studied, found that the menopause was independently associated with MetS [10]. In contrast, a study from Western India demonstrated that the significance between MetS and menopausal transition disappeared when adjusted for age [6].

In the present study, as per NCEP ATP III criteria, we found that all the metabolic risk factors were significantly

Table 1 Prevalence of metabolic syndrome in premenopausal and postmenopausal women [6–10]

Serial no.	Regions	Criteria	Pre-menopausal (%)	Post-menopausal (%)	Author	Year
1.	Western India	IDF	45	55	Pandey et al.	2010
2.	Bangladesh	NCEP	16.8	39.3	Jesmin et al.	2013
3.	France	NCEP	25.6	45.7	Ben Ali et al.	2014
4.	Brazil	NCEP	24	44.4	Neto et al.	2010
5.	Isfahan, Iran	NCEP	44.9	64.3	Heidari et al.	2010
6.	Chhattisgarh, India	NCEP	27.4	44.6	Singh et al.	2014

Table 2 Baseline data of premenopausal and postmenopausal women (NCEP ATP III)

Serial no.	Parameters	Total no. of premenopausal women	Total no. of postmenopausal women	*p* value
1.	Total no.	500	500	
2.	Age (years)	42.91 ± 5.79	55.18 ± 6.48	**<0.0001**
3.	WC (CM)	84.64 ± 11.09	84.94 ± 11.09	0.6689
4.	HC (CM)	94.64 ± 10.87	93.65 ± 11.65	0.1650
5.	WHR	0.88 ± 0.05	0.89 ± 0.05	**0.0016**
6.	BMI (Kg/m^2)	24.17 ± 4.47	24.66 ± 4.84	0.0966
7.	SBP (mmHg)	120.16 ± 13.59	124.00 ± 15.96	**<0.0001**
8.	DBP (mmHg)	79.87 ± 9.37	81.26 ± 11.33	**0.0348**
9.	FBS (mg/dl)	80.29 ± 25.31	84.58 ± 25.83	**0.0081**
10.	PPBS (mg/dl)	138.41 ± 49.58	153.04 ± 62.72	**<0.0001**
11.	TG (mg/dl)	134.58 ± 38.57	152.18 ± 51.14	**<0.0001**
12.	HDL (mg/dl)	36.41 ± 6.79	35.66 ± 6.99	0.0856

Bold indicate the significant values

Table 3 Prevalence of metabolic syndrome and its components (NCEP ATP III criteria)

S. no	Parameters	Premenopausal women	Postmenopausal women	Two tailed probability
1.	Total no.	500	500	
2.	Prevalence of MetS	27.4 % ($n = 137$)	48.6 % ($n = 243$)	0.0001
3.	WC (>88 cm)	33.2 % ($n = 166$)	45 % ($n = 225$)	0.0191
4.	WHR (>0.85)	72.2 % ($n = 361$)	80.8 % ($n = 404$)	0.0077
5.	BMI (>25 kg/m^2)	11.2 % ($n = 56$)	13.6 % ($n = 68$)	0.6900
6.	SBP (>130 mmHg)	33.2 % ($n = 166$)	40.4 % ($n = 202$)	0.1558
7.	DBP (>85 mmHg)	35.6 % ($n = 178$)	35 % ($n = 175$)	0.9062
8.	FBS (>100 mg/dl)	5.6 % ($n = 28$)	22.6 % ($n = 113$)	0.0429
9.	TG (>150 mg/dl)	28.2 % ($n = 141$)	44.6 % ($n = 223$)	0.0018
10.	HDL (<50 mg/dl)	92.4 % ($n = 462$)	90.8 % ($n = 454$)	0.3828

in the higher range in postmenopausal women in comparison with premenopausal women, except WC and low HDL cholesterol levels. It is commonly believed that there is weight gain with menopause and WC is significantly related to MetS [15], but most studies [6–8, 10] including ours did not find any significant differences in WC and BMI between premenopausal and postmenopausal women. Although there is no increase in weight, there is, however, a change in body fat distribution with menopause owing to preferential increase in abdominal adiposity. Low HDL cholesterol also had no significant difference between premenopausal and postmenopausal women. Some studies [6, 8] agreed with our conclusion and some [7, 16] differed. The transition from premenopausal to postmenopausal is associated with significant increase in systolic blood pressure, hypertriglyceridemia, and hyperglycemia. Similar results were obtained by studies where significant increase in blood pressure [6, 7, 9, 10, 16], hypertriglyceridemia [6, 7, 10], and hyperglycemia [6–8] were seen in postmenopausal women than in premenopausal women. When the average values of the components were evaluated according to the presence or the absence of MetS, the biggest variation occurred in the average of serum triglycerides (increase of 47.78) followed by fasting blood sugar (increase of 22.92). Similar trend was observed in study done by Mendes et al. [18]. In contrast, however, there was the smallest variation which was decrease in HDL in our study and blood pressure levels in their study. The number of components among with MetS was also analyzed. It was seen in our study that 46.8 % of women with MetS had three factors (most common being low HDL level followed by increased WC and increased triglyceride), 23.8 % had four (most common being low HDL then WC, increased triglyceride, and hypertension), and 5.4 % had all five MetS components (Table 4). On the other hand, the studies done in Brazil [11] and Tehran [19] found 73.2, 19.6, 7.1, and 15, 13.3, 1.8 % had three, four, and five criteria for MetS, respectively. Results of our study demonstrated that WC and low HDL cholesterol being more common but not significant still resulted in

Table 4 Number of risk factors common in premenopausal and postmenopausal women in study group (NCEP ATP III)

No. of risk factors	Premenopausal women	Postmenopausal women
5 factors	0.4 % ($n = 2$)	5 % ($n = 25$)
4 factors	4.2 % ($n = 21$)	19.6 % ($n = 98$)
3 factors	22.8 % ($n = 114$)	24 % ($n = 120$)
2 factors	47.6 % ($n = 238$)	29.4 % ($n = 147$)
1 factor	25 % ($n = 125$)	22 % ($n = 110$)

MetS more in postmenopausal women in comparison with premenopausal women owing to the significant increase in other risk factors of MetS.

These variations in the result may be due to different ethnic groups, differences in socioeconomic condition, genetic profile, eating habits, levels of physical activity, age, lifestyle, etc. The major limitation in our study was that, being a cross-sectional study, it was unable to elucidate a causal relationship.

Conclusion

Our study shows that an increased WHR, hypertension, hypertriglyceridemia, and hyperglycemia present in the postmenopausal women increase the risk of MetS, and therefore the associated sequelae of CVD and Diabetes Mellitus type II. For an accurate prediction of cardiovascular risk in the middle life, it is essential to identify the risk factors in the premenopausal women, who are likely to improve or delay the onset of MetS after menopause. Efforts should aim at prevention of body composition changes during premenopausal years through lifestyle changes, other interventions, screening, and education about healthy living.

Thus, timely recognition, diagnosis, and the management of the components of MetS in the premenopausal women reduce the risk of CVD and Diabetes Mellitus type II.

Compliance with ethical standards and conflict of interest This study was a cross sectional comparative study. Informed and written consent from all the participants was taken and all procedures followed were in accordance with ethical standard of the responsible Committee on human experiments (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008(5). Abha Singh and Neha Singh declared that they have no conflict of interest.

References

1. Unni J. Third consensus meeting of Indian menopause society (2008): a summary. J Mid-life Health. 2010;1:43–7.
2. Beigh SH, Jain S. Prevalence of metabolic syndrome and gender differences. Bioinformation. 2012;8(13):613–6.
3. Carr MC. The emergence of the metabolic syndrome with menopause. J Clin Endocrinol Metab. 2013;88(6):2404–11.
4. Ritu M, Manika M. Impact of intervention with Co-Enzyme Q10 on homocysteine levels of cardiac patients with established angiographic evidence. J Clin Trial Cardiol. 2014;1(2):1–6.
5. Shah D. The Annual conference of the British menopause society. J Midlife Health. 2010;1:48–50.
6. Pandey S, Srinivas M, Agashe S, et al. Menopause and metabolic syndrome: a study of 498 urban women from Western India. J Midlife Health. 2010;1(2):63–9.
7. Jesmin S, Islam AS, Akter S. Metabolic syndrome among pre- and post-menopausal rural women in Bangladesh; result from a population-based study. BMC Res Notes. 2013;6(1):157.
8. Ali SB, Belfki-Benali H, Aounallah-Skhiri H et al. Menopause and metabolic syndrome in Tunisian women. Bio Med Res Int, 2014, Article ID 457131, 7 pages, 2014.
9. de Figueiredo Neto JA, Figuerêdo ED, Barbosa JB, et al. Metabolic syndrome and menopause: cross-sectional study in gynecology clinic. Arq Bras Cardiol. 2010;95(3):339–45.
10. Heidari R, Sadeghi M, Talaei M, et al. Metabolic syndrome in menopausal transition: Isfahan healthy heart program, a population based study. Diabetol Metab Syndr. 2010;2:59.
11. Christian DS, Kathad MM, Bhavsar BS. A clinico-epidemiological study on health problems of postmenopausal women in rural area of Vadodara District, Gujarat. Natl J Med Res. 2012;2(4):478–80.
12. Madhukar S, Gaikwad V, Sudeepa D. A community based study on perceptions about menopausal symptoms and quality of life of postmenopausal women in Bangalore rural. Int J Health Sci Res. 2012;2(3):49–56.
13. Palacios S, Henderson VW, Siseles N, Tan D, Villaseca P. Age of menopause and impact of climacteric symptoms by geographical region. Climacteric. 2010;13:419–28.
14. Selvaraj I, Gopalakrishnan S, Logaraj M. Prevalence of metabolic syndrome among rural women in a primary health centre area in Tamil Nadu. Indian J Public Health. 2012;56(4):314–7.
15. Prakash A, Prakash J. Metabolic syndrome and its components: a hospital based study from north India. Indian J Med Spec. 2013;4(1):22–8.
16. Lavanya KM, Thomas V, Muralidhar NR. Metabolic syndrome (Ms) among adults in urban slums, a cross sectional study in Hyderabad, Andhra Pradesh, India. J Community Med Health Educ. 2012;2:192.
17. Marjani A, Moghasemi S. The metabolic syndrome among postmenopausal women in Gorgan. Int J Endocrinol, 2012, Article ID 953627: 2012: 6.
18. Mendes KG, Theodoro H, Rodrigues AD, et al. Menopausal status and metabolic syndrome in women in climacteric period treated at a clinic in Southern Brazil. Open J Endocr Metab Dis. 2013;3:31–41.
19. Jouyandeh Z, Nayebzadeh F, Qorbani M, et al. Metabolic syndrome and menopause. J Diabetes Metab Disord. 2013;12:1.