

Original Research Article

Assessment of occurrence of metabolic syndrome among post-menopausal women

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ABSTRACT

Background: Metabolic syndrome is described by the clustering of several risk factors for cardiovascular disease such as hypertension, dyslipidemia, obesity, Insulin resistance, and high fasting plasma glucose. Objective of this study was to determine the frequency and evaluate the components of metabolic syndrome in post-menopausal women.

Methods: This Descriptive study was conducted in OPD as well as IPD of Department of Medicine, Sri Siddhartha Medical college Hospital and Research Centre, Tumkur After obtaining written informed consent. Period of study was 24 months. Purposive sampling was used.

Results: Mean age of post-menopausal women was 54.19 ± 8.454 years. Mean age of menopause was 45.41 ± 2.428 . Majority of patients between were between 45-50 years (33.7%). There were high number of women (34.6%) whose postmenopausal duration ranged between 6-10 years. In our study 10(9.6%) postmenopausal women had type 2 DM and 15(14.4%) postmenopausal women had HTN. Metabolic syndrome was present in 65(62.5%) postmenopausal women and absent in 39(37.5%) postmenopausal women. Waist circumference >80 cm (68.3) was the most prevalent component of metabolic syndrome followed by HDL <50 mg/dl (53.8%), BP $>130/80$ mmHg (51%) triglycerides >150 mg/dl (44.2%)/ and FBS >100 mg/dl (39.4%). There was statistical significance observed between the components of metabolic syndrome and metabolic syndrome in postmenopausal women.

Conclusions: The prevalence of metabolic syndrome was high in our study. The components of metabolic syndrome such as waist circumference, FBS, blood pressure, triglycerides were significantly raised and HDL levels were significantly reduced in post-menopausal women with metabolic syndrome.

Keywords: Components of metabolic syndrome, Metabolic syndrome, Postmenopausal women, Waist circumference

INTRODUCTION

In 2001, The Third Report of National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (ATP III) emphasized the importance of the metabolic syndrome and provided a working definition of this syndrome for the first time.¹ Menopause is a normal physiological process that occurs

in women at an average age of 50 years.² The menopausal state may be a potential risk factor for the development of metabolic syndrome as its prevalence has been reported to increase after the attainment of menopause.³

The menopausal state has been noted to be an independent risk factor for the occurrence of metabolic syndrome, and the risk for metabolic syndrome is said to further increase up to 14 years post menopause.⁴ As the

average life expectancy of women extends 20-30 years after menopause, the medical impact of changes leading to metabolic syndrome in postmenopausal women are significant.⁵

The declining level of estrogen and alteration of its ratio with testosterone has been implicated as a causal factor for the emergence of metabolic syndrome at menopausal transition.⁶ Alterations in lipid metabolism with estrogen deficiency are thought to be a substantial component of Cardiovascular disease risk in postmenopausal women.⁷ But there are also direct effects of estrogen deficiency on body fat distribution (central obesity), insulin action, the arterial wall, and fibrinolysis that may influence cardiovascular risk. These factors contribute to an increased prevalence of the Metabolic Syndrome in postmenopausal women compared with premenopausal women.⁸

Metabolic Syndrome has been demonstrated as a common precursor to the development of type 2 diabetes and cardiovascular disease (CVD) as well as a risk factor for all-cause mortality. Individuals with Metabolic Syndrome are associated with approximately five and two-fold increased risk for type 2 diabetes and Cardiovascular disease respectively. More effort should be given to promoting a healthy lifestyle with increased physical activity and reduced obesity.⁹ Individuals with metabolic syndrome should be identified early so that their cardiovascular risk factors can be reduced.¹⁰

Accumulation of excess abdominal fat with transition through the menopause plays a central role in connecting the metabolic syndrome with the metabolic alterations of menopause. Therefore, to prevent cardiovascular diseases there is a need to evaluate the occurrence of metabolic syndrome and its components from the time of the menopause. Hence the present study was designed to determine the frequency and evaluate the components of metabolic syndrome in post-menopausal women.

METHODS

This Descriptive study was conducted in Outpatients as well as inpatients of Department of Medicine, Sri Siddhartha Medical college Hospital and Research Centre, Tumkur After obtaining written informed consent. Period of study was 24 months. Purposive sampling was used.

Sample size using the following formula for calculation of sample size for prevalence studies using confidence level of 95% and precision of 10%

$$N = Z^2 P (1-P) / d^2$$

Where;

N is the sample size,

Z is the statistic for level of confidence (1.96).

P expected prevalence (56.6%) based on Indian study by Pandey S et al.¹¹

d is the precision (10%),

$$n = [1.96^2 \times 0.566(1-0.566)] / (0.12)^2 \approx 94$$

Taking into consideration 10% non-response rate, the sample size will be 104.

Inclusion criteria

Postmenopausal women visiting medicine department (both outpatient and inpatient) who were willing to give consent to participate in the study.

Exclusion criteria

Surgical menopause, Patients on hormone replacement therapy, K/C/O Diabetes and Hypertension before the onset of menopause, Patient on lipid lowering medication, K/C/O Ischemic heart disease and patients who were not willing to give consent to participate in the study.

Post-menopausal women who had at least 1-year history of cessation of menses were included. Written informed consent was obtained from all the patients before their enrolment into the study.

The data on socio-demographic details & history was collected using a pre-tested proforma through personal interview. This was followed by thorough clinical examination, anthropometry and other investigations as mentioned below.

- Body height- Body height in centimeters was measured.
- Body weight- Body weight was measured in Kilogram(kg) with a standard portable scale.
- Waist circumference (WC) in centimeter.
- Body Mass Index (BMI)- BMI was calculated as body weight in kilogram divided by the square of body height in meters.
- Lipid profile- Venous blood samples were taken after an overnight fast for lipid profile.
- Fasting blood sugar-Venous blood samples were taken after an overnight fast for fasting blood sugar.
- Blood pressure- Systolic and diastolic blood pressure was measured resting in sitting position in the right hand.

Post-Menopausal women were considered to have metabolic syndrome if they have any three or more of the following according to the modified ATP III Criteria.⁹

- Abdominal obesity: waist circumference >80cm

- Hypertriglyceridemia: serum triglycerides level >150 mg/dl
- Low HDL-cholesterol: <50 mg/dl
- High blood pressure: SBP >130 mm Hg and /or DBP >85 mm hg or on treatment for hypertension.
- High fasting glucose: serum glucose level >100 mg/dl or on treatment for diabetes.

Statistical analysis

Data was entered in excel sheet and statistical analysis was carried out using SPSS (version 20). To analyze the association between categorical data, chi-square test was used and to test the difference in the continuous measurement sample t test was used. p value less than 0.05 was considered statistically significant.

RESULTS

In this study among 104 postmenopausal women, maximum number of study group were between the age of 46-50 years (33.7%) and minimum number of study group were between the age of 41-45 years (9.6%). There were high number of women (34.6%) whose postmenopausal duration ranged between 6-10 years and less number of women (16.3%) with duration less than 2 years. In our study 10 (9.6%) postmenopausal women had type 2 DM and 15 (14.4%) postmenopausal women had HTN. Metabolic syndrome was present in 65 (62.5%) postmenopausal women and absent in 39 (37.5%) postmenopausal women.

Waist circumference >80 cm (68.3) was the most prevalent component of metabolic syndrome followed by HDL <50 mg/dl (53.8%), BP>130/80 mmHg (51%)

triglycerides >150 mg/dl (44.2%) \ and FBS>100mg/dl (39.4%). There was high statistical association found between the age and risk of metabolic syndrome. Maximum prevalence of metabolic syndrome was found between 56-60 years and minimum prevalence was between 41-45 years.

In our study the mean age of postmenopausal women with metabolic syndrome was 55.4±7.27 years and without metabolic syndrome was 52.28±9.94 years. There was no significant difference found (p=0.074) in terms of age between the two groups. The mean age of menopause was 45.43±2.3 years in postmenopausal women with metabolic syndrome and 45.38±2.65 years without metabolic syndrome. There was no significant difference found (p=0.926) between the two groups in terms of age of menopause.

The mean height in post-menopausal women with metabolic syndrome was 154.25±5.81 cm and without metabolic syndrome was 154.95±4.61 cm. There was no significant difference found (p=0.522) between the two groups in terms of height. The mean weight of postmenopausal women with metabolic syndrome was 61.23±8.55 kg and without metabolic syndrome was 52.49±5.63 kg. There was significant difference observed (p<0.001) between the two groups in terms of weight. The mean BMI of post-menopausal women with metabolic syndrome was 25.68±2.67 kg/m 2and without metabolic syndrome was 21.82±1.81 kg/m. There was significant difference observed (p<0.001) between the two groups in terms of BMI. Postmenopausal women with metabolic syndrome weighed more than the postmenopausal women without metabolic syndrome Table 1.

Table 1: Comparison of age, age of menopause, height, weight and BMI of study group with and without metabolic syndrome.

Parameters	Women with metabolic syndrome (65) (Mean±SD)	Women without metabolic syndrome (39) (Mean±SD)	Mean difference	p-value
Age	55.34±7.27	52.28±9.94	-3.06	0.074
Age of menopause	45.43±2.3	45.38±2.65	-0.05	0.926
Height	154.25±5.81	154.95±4.61	0.70	0.522
Weight	61.23±8.55	52.49±5.63	-8.74	<0.001
BMI	25.68±2.67	21.82±1.81	-3.86	<0.001

There was statistical significance observed between the components of metabolic syndrome and metabolic syndrome in postmenopausal women (waist circumference >80 cm p<0.001, FBS >100 mg/dl p <0.001, BP >130/85 p = 0.025, triglycerides > 150 mg/dl p<0.001, HDL <50 mg/dl p=0.002)

Postmenopausal women with abdominal obesity (waist circumference >80cm) had 7.91 times (OR-7.91) more

risk of developing metabolic syndrome than with postmenopausal women with waist circumference <80 cm. Postmenopausal women with FBS >100 mg/dl had 11.56 times (OR-11.56) more risk of developing metabolic syndrome than with postmenopausal women with FBS<100 mg/dl.

Similarly postmenopausal women with postmenopausal women with BP>130/85 mm Hg, Triglyceride>150

mg/dl, HDL <50 mg/dl had 2.679 (OR- 2.679), 6.86 (OR-6.86), 3.91 (OR-3.91) times more risk of developing metabolic syndrome than with postmenopausal women

with BP <130/85 mmhg, Triglycerides <150 mg/dl and HDL >50 mg/dl respectively Table 2.

Table 2: Components of metabolic syndrome.

Components of metabolic syndrome	Metabolic syndrome		Total	OR	95% CI	p-value
	Absent	Present				
Waist circumference						
<80 cm	23 (59.0%)	10 (15.4%)	33 (31.7%)	7.91	3.13-19.99	<0.001
>80 cm	16 (41.0%)	55 (84.6%)	71 (68.3%)			
FBS or Diabetic on medication						
<100 mg/dl	35 (89.7%)	28 (43.1%)	63 (60.6%)	11.56	3.68-36.34	<0.001
>100 mg/dl	4 (10.3%)	37 (56.9%)	41 (39.4%)			
BP or hypertension on Rx						
<130/85	25 (64.1%)	26 (40.0%)	51 (49.0%)	2.679	1.18-6.09	0.025
>130/85	14 (35.9%)	39 (60.0%)	53 (51.0%)			
Triglycerides						
<150 mg/dl	32 (82.1%)	26 (40.0%)	58 (55.8%)	6.86	2.64-17.85	<0.001
>150 mg/dl	7 (17.9%)	39 (60.0%)	46 (44.2%)			
HDL						
>50 mg/dl	26 (66.7%)	22 (33.8%)	48 (46.2%)	3.91	1.69-9.06	0.002
<50 mg/dl	13 (33.3%)	43 (66.2%)	56 (53.8%)			
Total	39 (100.0%)	65 (100.0%)	104 (100.0%)			

Table 3: Biochemical profile.

Laboratory parameters	Women without metabolic syndrome (39) (Mean±SD)	Women with metabolic syndrome (65) (Mean±SD)	Mean difference	p-value
FBS (mg/dl)	91.13±10	112.18±30.94	-21.06	<0.006
Triglycerides	133.92±11.96	168.85±74.05	-34.93	0.008
HDL	53.36±11.96	47.8±9.49	5.38	0.013

Table 4: Waist circumference and blood pressure measurement.

Clinical parameters	Women without metabolic syndrome (39) (Mean±SD)	Women with metabolic syndrome (65) (Mean±SD)	Mean difference	p-value
Waist circumference	79.69±7.08	89.22±8.04	-9.52	>0.001
SBP	123.59±16.21	131.28±16.91	-8.29	0.016
DBP	79.54±9.67	84.8±11.21	-5.26	0.017

The mean FBS in postmenopausal women with metabolic syndrome was 112.18±30.94 mg/dl and without metabolic syndrome was 91.13±10 mg/dl. Postmenopausal women with metabolic syndrome had significantly high FBS (p<0.001) when compared to women without metabolic syndrome.

The mean triglyceride level in postmenopausal women with metabolic syndrome was 168.85±74.05 mg/dl and without metabolic syndrome was 133.24±39.26 mg/dl.

Postmenopausal women with metabolic syndrome had significantly high triglyceride levels (p=0.008) when compared to women without metabolic syndrome.

The mean HDL level in postmenopausal women with metabolic syndrome was 47.98±9.49 mg/dl and without metabolic syndrome was 53.36±11.96 mg/dl. Postmenopausal women with metabolic syndrome had significantly low HDL (p=0.013) when compared to women without metabolic syndrome Table 3. The waist circumference of postmenopausal women with metabolic syndrome measured greater than the women without metabolic syndrome (p<0.001).

Postmenopausal women with metabolic syndrome had significantly high systolic blood pressure (p=0.016) and diastolic blood pressure (p=0.017) when compared to women without metabolic syndrome Table 4.

DISCUSSION

The prevalence of metabolic syndrome in our study was 62.5% using modified ATP III criteria. Our findings were consistent with studies conducted by Pandey S et al, Sharma Set al, Heidari R et al, where postmenopausal women were found to be at higher risk of MS than premenopausal women.¹¹⁻¹³

In this study the prevalence of abdominal obesity waist circumference >80 cm), hyperglycemia (FBS >100mg/dl), hypertension (BP >130/85 mmHg), hypertriglyceridemia (Triglyceride >150 mg/dl) and low HDL (HDL <50 mg/dl) in post-menopausal women were 68.3% (71), 39.4% (41), 51% (53), 44.2% (46), 53.8% (56) respectively. In this study abnormal waist circumference was the most prevalent component (68.3%) and abnormal FBS (39.4%) was the least prevalent component of metabolic syndrome in post-menopausal women.

In a study conducted by Jeyasheela K et al, dyslipidemia was observed in nearly 83% of study subjects followed by abnormal FBS (59.7%) and hypertension (50.6%).¹⁴ In a study conducted by Sharma et al the component of MS which was most prevalent among the subjects having MS (both pre and postmenopausal) was abnormal waist circumference (94%), followed by hypertension (71.4%) low HDL, (55.14%), abnormal triglyceride (40%) and diabetes (35.71%). In a study conducted by Jouyandeh et al in Tehran, the percentage of fasting blood sugar >110 mg/dl, high density lipoprotein <50 mg/dl, Triglycerides 150 mg/dl, waist circumference 88 cm, and systolic blood pressure 2130 mmHg/diastolic blood pressure 285 mmHg in postmenopausal women were 29.1%, 35.6%, 35, 6% 64.3% 47.9% respectively which can be compared to our results.

The waist circumference of women with metabolic syndrome measured greater than women without metabolic syndrome ($p < 0.001$) in present study. There was a strong correlation between waist circumference and metabolic syndrome.

Misra et al described that the cardiovascular risk seems to occur at lower waist circumference level in Asian Indians when compared to Caucasians.¹⁵ The mean waist circumference of postmenopausal women in our study was 84.45 ± 7.56 cm and the mean waist circumference of postmenopausal women with and without metabolic syndrome was 89.22 ± 8.04 cm and 79.69 ± 7.08 cm respectively. In a study conducted by Jayasheela k et al the mean waist circumference of women with and without metabolic syndrome was 95.63 ± 9.32 cm and 86.35 ± 13.95 cm respectively.¹⁴ The mean waist circumference of post-menopausal women in studies conducted by Sapkota et al and Pandoy S et al was 94.3 ± 10.1 cm and 89.43 ± 10.91 cm respectively.^{11,16}

In this study waist circumference was the most prevalent component of metabolic syndrome. 71 (68.3%) of 104

patients had waist circumference >80 cm suggestive of high prevalence of abdominal obesity among postmenopausal women. The prevalence of abdominal obesity in a study conducted by Jouyandeh et al was 64.3% which can be compared to our results, contrary to our results, the prevalence of abdominal obesity in a study conducted by Marjani et al was 29%.^{17,18}

The mean FBS in women with and without metabolic syndrome in our study was 112.18 ± 30.94 mg/dl and 91.13 ± 10 mg/dl respectively. In study conducted by Jeyasheola K et al the mean FBS in women with and without MS was 102.44 ± 33.93 mg/dl and 129.48 ± 56.35 mg/dl respectively.¹⁴ In this study patients with metabolic syndrome had elevated fasting blood glucose when compared to women without metabolic syndrome ($p = 0.00$).

The prevalence of abnormal FBS in studies conducted by Jesmin S et al, Kim et al and Marjani et al was 49.64%, 26% and 17% respectively.^{19,20}

There was association between hypertension and risk of metabolic syndrome in postmenopausal women (SBP $p = 0.016$, DBP $p = 0.017$) 2.679 times risk of developing metabolic syndrome.

In a study conducted by Jayasheela K et al, postmenopausal women with metabolic syndrome had significantly higher systolic blood pressure ($p = 0.002$) when compared to women without metabolic syndrome.¹⁴ However, there was no difference in diastolic blood pressure between two groups. In a cross-sectional study conducted by Jouyandeh et al described the elevation of both systolic and diastolic blood pressure.¹⁷ Marjani et al, also showed a significantly high diastolic blood pressure among postmenopausal women.¹⁸ There was a high prevalence of hypertension in our study and the study conducted by Jayasheela K et al, Jouyandeh et al and Marjani et al.^{14,17,18} This could be explained by the decline in estrogen levels in menopause.

In this study the prevalence of hypertriglyceridemia was 44.2% and the prevalence of low HDL in postmenopausal women was 53.8%. There was significant association between dyslipidemia and metabolic syndrome. In a study conducted by Jeyasheela K et al, there was no significant association between dyslipidemia and metabolic syndrome, but there was significant association between dyslipidemia and metabolic syndrome in a study conducted by Marjani al.^{14,18}

In a study conducted by Sapkota et al, a significantly higher level of triglycerides were observed in postmenopausal women than pre-menopausal women.¹⁶ HDL-C was also found to be significantly lower in postmenopausal group. In a study conducted by Pandey S et al, postmenopausal women had higher level of triglycerides compared to premenopausal women however they did not differ in terms of HDL levels.¹¹

CONCLUSION

The prevalence of metabolic syndrome was high in our study. The components of metabolic syndrome such as waist circumference, FBS, blood pressure, triglycerides were significantly raised and HDL levels were significantly reduced in post-menopausal women with metabolic syndrome. Such a high prevalence of metabolic syndrome in postmenopausal women is an alarming sign.

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