Advances in Bioresearch
Adv. Biores., Vol 13 (3) May 2022: 84-92
©2022 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.13.3.8492

Advances in Bioresearch

ORIGINAL ARTICLE

Gender differences in components of metabolic syndrome among the patients with coronary artery disease

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ABSTRACT

The metabolic syndrome (MetS) is a constellation of risk elements responsible for the progress of cardiovascular diseases (CVD) and type 2 diabetes (T2DM). It has been observed that the cardiovascular (CV) risk imposed by the MetS is relatively higher in women as compared to men. Several factors could be responsible for higher CV risk in women with MetS. The study was conducted to evaluate gender variations in relation to features of MetS and other CVD risk factors.This study was cross-sectional, observational assessment conducted at Holy Family Hospital, Bandra (West), Mumbai from 1st August, 2015 to 31st January, 2017.Clinical data was gathered by obtaining the required history and medical case records from patients having a history of acute coronary syndrome (ACS). Anthropometric indicators and blood pressure readings were taken and recorded and the laboratory investigative variables examined. The adjusted odds ratios and 95 percent confidence intervals for gender disparities among Indian patients with metabolic syndrome were calculated using multiple logistic regression models. Statistical analysis used: Study findings were entered in Microsoft Excel 2010 and data analysis was conducted using SPSS software version 15. An analysis was conducted to know the association of gender with that of the associated variables using PROC Logistic in SAS software. Out of the 100 patients recruited in this study 66 were males and 34 were females. The prevalence of the MetS in study population was 66%. Out of 34 female population, 28 (82.35%) patients has MetS. There was formal association between the gender with that of the MetS (P value-0.0191) and 95% odds ratio (0.113- 0.849) is < 0.05 and 1 is not included in 95% Odds CI. Age (P value-0.0063), 95% CI (-10.302 to -1.742), Weight (P-value-0.0005), 95% CI (3.921 to 13.475) and waist circumference (P-value-<.0001), 95% CI (3.379 to 8.023) has shown significant difference in the means as the P-value is <0.05 and 0 is not included in 95% CI Levels. Body mass index, waist circumference, and fasting blood sugar has shown significant difference in the means as the P-value is < 0.05. There exists a no formal association between the Gender with that of the ST-Elevation Myocardial Infarction (STEMI) and Non-STEMI as the P-value is > 0.05 and 1 is included in the 95% CI odds ratio. Female patients had a greater prevalence of MetS, indicating a higher cardiovascular risk in this group of patients.Gender-specific public health policies and treatment strategies to for the comprehensive management of cardiovascular disease.

Key words: Metabolic syndrome, cardiovascular risk, CAD, coronary artery disease, female, STEMI

Received 12.02.2022 Revised 16.04.2022 Accepted 16.05.2022

How to cite this article:
Balaji D, Gaurav Jain, Anju B, G. Jayalakshmi. Gender differences in components of metabolic syndrome among the patients with coronary artery disease . Adv. Biores. Vol 13 [3] May 2022.84-92

INTRODUCTION

Metabolic syndrome (MetS), commonly known as syndrome X or insulin resistance, is a serious global health concern. Metabolic syndrome is a pathologic illness defined by abdominal obesity, insulin resistance, hypertension, and hyperlipidemia, according to the World Health Organization (WHO) [1]. It's thought to be the outcome of social and environmental changes linked to urbanised living circumstances, high-calorie food consumption, and sedentary behaviour [2]. It is linked to the development and prognosis of cardiovascular illnesses and can lead to overt diabetes (CVD) [3]. Despite the fact that there are numerous definitions of MetS and unidentified aetiology, it is widely documented that MetS is significantly linked to an elevated risk of CVD [3].

The global prevalence of MetS is believed to be over one-quarter of the world's population, implying that more than one billion individuals are presently afflicted [1]. The prevalence of MetS was 24 percent, 29 percent, and 33 percent, respectively, after standardisation for age, sex, and urban-rural distribution [4].

In senior individuals, MetS is one of the most frequent metabolic disorders [5]. In India, the total prevalence of MetS syndrome in the older population was greater than 40% [6]. More study on the impact of metabolic syndrome in the elderly is required. MetS is a condition that occurs in conjunction with obesity and type 2 diabetes. According to NHNES statistics, the average BMI in the United States increased by 0.37 percent each year in both men and women from 1988 to 2010. In males and women, the waist circumference (WC) increased by 0.37 and 0.27 percent every year, respectively [1]. When compared to their Western counterparts, the frequency of the MetS is often higher among the urban population of various developing nations [2].

Breast cancer claimed the lives of about one in every 30 women, whereas cardiovascular disease claimed the lives of one in every 2.6 women [7]. The cause of this diabetes disparity between men and women is unknown; however, one explanation might be the higher frequency of MetS in women.

The gender distribution of the MetS in published epidemiological data from various regions of the world varies. While some research show that males have a greater incidence of MetS than women [9], others show the opposite [10]. Age dependency is a constant finding in the incidence of the metabolic syndrome; the prevalence of the MetS is frequently shown to rise with age [11]. According to numerous studies, the incidence of MetS among the elderly ranges from 20 to 60%, with females having a greater frequency than males. [3, 12, 13].Men and women with MetS had a 48 percent higher risk of CVD and a 60 percent higher risk of CVD death than those without MetS, according to Korean research. However, there are insufficient data on gender variations in MetS features and components in Indian population.

As a result, this study was carried out to assess gender variations in relation to MetS and other CVD risk variables. Its goal was to figure out the frequency of incidence, correlations, and gender distribution of the MetS components in people with diabetes. The findings would give critical gender-specific information on the management of MetS in the female population in order to avoid CVD.

MATERIAL AND METHODS

This study was cross-sectional, observational assessment conducted at Holy Family Hospital, Bandra (West), Mumbai from 1st August, 2015 to 31st January, 2017. Institutional ethical committee approval was obtained prior to the commencement of study. Written consent was obtained from all participants.

The inclusion criteria for the patient enrolment were: both male and female patients of 40 – 80 years of age, with acute coronary syndrome STEMI and NSTEMI, normal liver and renal function. The exclusion criteria with previous history of CVD, unstable angina, impaired renal function, cardiomyopathies, thyroid dysfunction, malignancy, acute infection and cardiogenic shock at admission were not included in the study.

The research only included patients who were eligible. The components of syndrome were all obtained from the detailed clinical histories. Details about the research participants' diabetes mellitus history, medication type, presence of comorbidities, smoking and drinking histories were obtained through interviews and medical records.

Clinical examination consisted of determining the body mass indices (BMI) and waist circumferences. Three or more measurements of BP were taken during enrolment, if values were BP ≥ 130/85 mmHg on an average and drug treatment for hypertension was considered significant. Waist circumference was recorded as recommended by the national health and nutritional survey. Peripheral venous blood samples were obtained after an overnight fast for lipid profile (high density lipoprotein cholesterol (HDL-C), total cholesterol, low density lipoprotein cholesterol (LDL-C) and triglycerides) and fasting plasma glucose evaluation.

The patients were diagnosed and classified at admission or later during their stay in the hospital, using the World Health Organization's criteria of ACS and the European Society of Cardiology's official guidelines [15, 16]. All participants with symptoms consistent with myocardial ischemia and elevated CK-MB or troponin I within 48 hours of admission were diagnosed with an ACS. When the electrocardiogram (ECG) at rest indicated ST-segment elevation in two contiguous leads (two millimetres in V1-V3, or one millimetre in the other leads) or new left bundle-branch block in addition to increased cardiac enzymes, the condition was classified as ACS with ST-segment elevation (STEMI).Patients with raised cardiac enzymes without the previously mentioned ECG abnormalities were classified as ACS without ST-segment elevation (NSTEMI).

The patient was diagnosed with unstable angina, which is defined as angina pectoris that has at least one of the following three features: (1) discomfort at rest (or with modest effort), (2) new-onset severe angina (within one month), and (3) a crescendo pattern. (3) NSTEMI and unstable angina have a similar appearance in general. The examination of myocardial damage biochemical indicators determines their therapy and diagnosis. Subjects with unstable angina were excluded from the research owing to the

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subjective and imprecise nature of the diagnosis, which varies depending on the treating physician and the patient's medical history.

Patients on lipid-lowering drug therapy such as statins, were considered to be as having dyslipidaemia.

Statistical analysis

Study findings were entered in Microsoft Excel 2010 and data analysis was conducted using SPSS software version 15. Qualitative data is presented with the help of frequency and percentage table. Association among various qualitative variables is done with the help of Chi Square test. P value < 0.05 is taken as level of significance. An analysis was conducted to know the association of gender with that of the associated variables using PROC Logistic in SAS software.

RESULTS

In this study a total of 100 patients with acute coronary syndrome were enrolled in the study, of which 34 were females and 66 were males. The mean age of female patients was 66.26 (±8.18) years and male patients was 60.24 (±11.10.18) years. The mean weight and BMI of female patients was 75.727 (±13.209) kg and 25.359 (±2.294) kg/m^2 respectively. The mean weight and BMI of female patients was 67.02 (±6.51) kg and 25.547 (±2.372) kg/m^2 respectively. The prevalence of metabolic syndrome among the participants was 66%, which was more prevalent in females 28 (82.35%) compared to 39 (59.09%) in males (57.6%). The clinical and laboratory parameters of the females and males with MetS is summarized in Table 5. The distribution of various components of metabolic syndrome between the female and male groups are depicted in Figure 1.

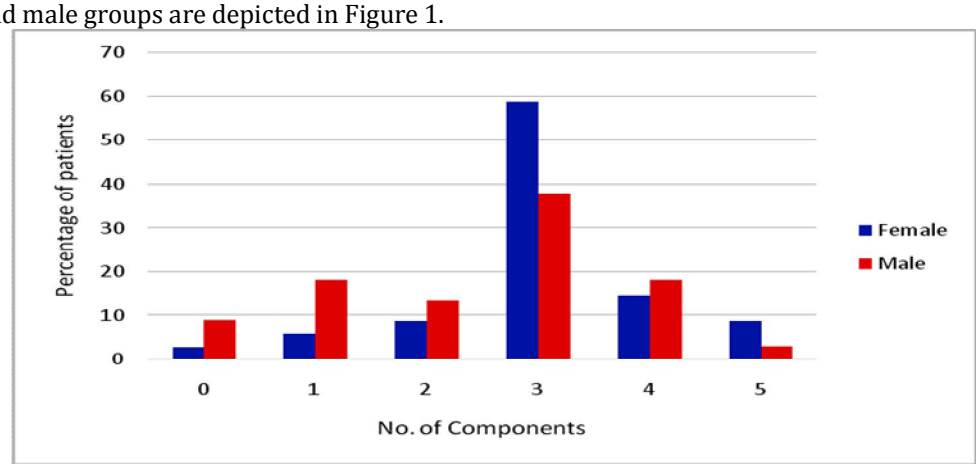

Figure 1: The distribution of various components of metabolic syndrome between the female and male groups

The frequency distribution of lipid parameters of female and male patients is summarized in Table 2. The STEMI was found in 22 (64.70%) females and 46 (69.69%) males whereas NSTEMI was observed in 12 (35.29%) females and 20 (30.30%) males (Figure 2).

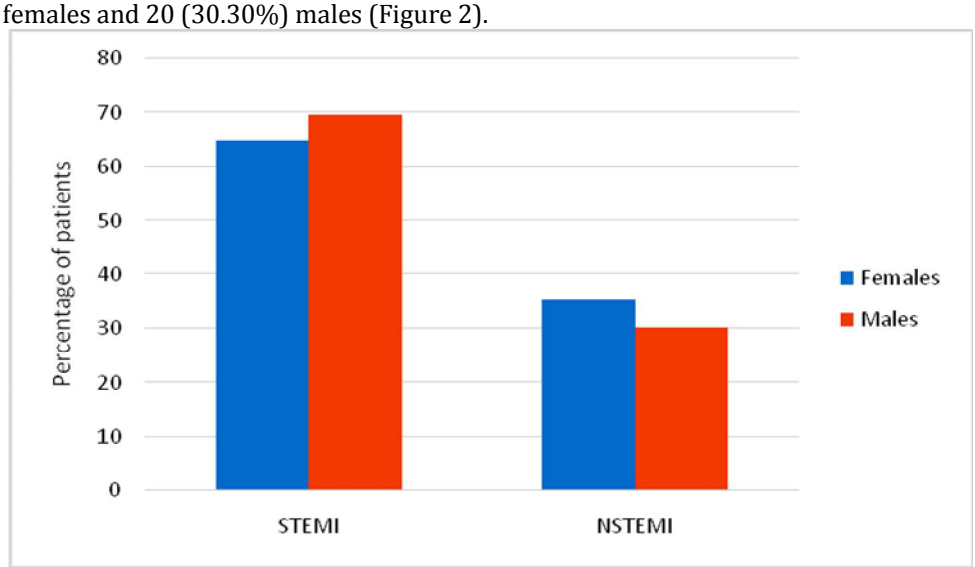

Figure 2: The percentage of STEMI and NSTEMI was observed female and male groups

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All the female patients and 59 (89.39%) males were above 45 years of age while 7 (11.86%) male were between 18 to 45 years of age. All patients enrolled in the study had height more than 1.5 m. The weight of patient was more than 60 kg in 30 (8 8.23%) females and 64 (96.96%) males. The BMI was high in 12 (35.29%) females and 24 (36.36%) females. The waist circumference was high in 33 (97.05%) females and 51 (77.27%) females. A summary of the frequency distribution of clinical parameters of the patients is presented in Table 1.

Table 1: Frequency distribution of demographic characteristic of female and male patients

Gender	Female N=34 (%)	Male N =66 (%)
Age		
>18-45 **Yrs.**	0 (0.00%)	7 (11.86%)
>45**Yrs.**	34 (100%)	59 (89.39%)
HEIGHT		
>1.5 **Meters**	34 (100.00%)	66 (100.00%)
WEIGHT		
<30**Kg**	0 (0.00%)	2 (3.03%)
30-60 **Kg**	4 (11.76%)	0 (0.00%)
>60 **Kg**	30 (88.23%)	64 (96.96%)
BMI		
Normal **(< 30 kg/m^2)**	22 (64.70%)	42 (63.63%)
High**(≥30 kg/m^2)**	12 (35.29%)	24 (36.36%)
WC		
High (>102 cm in males and > 88 cm in females)	33 (97.05%)	51 (77.27%)
Low (≤ 102 cm in males and ≤ 88 cm in females)	1 (2.94%)	15 (22.72%)

The lipid profile revealed higher abnormalities in males as compared to female population. The triglyceride levels were high in 13 (38.23%) females and 33 (50.00%) male patients. Low levels of HDL were observed in 3 (8.82%) females and 24 (36.36%) male patients. The frequency distribution of lipid parameters of female and male patients is summarized in Table 2.

Table 2: Frequency distribution of lipid parameters in female and male patients

Gender	Female N=34 (%)	Male N=66 (%)
TG		
Normal TG (<150 mg/dL)	21 (61.76%)	33 (50.00%)
High TG (≥ 150 mg/dL)	13 (38.23%)	33 (50.00%)
HDL (mg/dL)		
Low HDL (< 40 mg/dL in men and < 50 mg/dL women),	3 (8.82%)	24 (36.36%)
Normal HDL (≥40 mg/dL in men and ≥ 50 mg/dL women),	31 (91.17%)	42 (63.63%)
LDL(mg/dL)		
Normal LDL (<129 mg/dL)	31 (39.17%)	49 (74.24%)
High LDL (≥130 mg/dL)	3 (8.82%)	17 (25.75%)
VLDL (mg/dL)		
Normal VLDL (<30 mg/dL)	22 (64.70%)	41 (62.12%)
High VLDL(≥30 mg/dL)	12 (35.29%)	25 (37.87%)
CHOLESTEROL (mg/dL)		
Normal CHOLESTEROL (<200 mg/dL)	30 (88.23%)	47 (71.21%)
High CHOLESTEROL (≥200 mg/dL)	4 (11.76%)	19 (19%)

Table 3: Frequency distribution of fasting blood sugar and blood pressure in female and male patients

Fasting Blood Sugar		
Normal(< 100mg/dL)	6 (17.64%)	13 (19.69%)
High (≥100 mg/dL)	28 (82.35%)	53 (28.78%)
Blood pressure		
Normal(< 130/85 mm Hg)	9 (26.47%)	23 (34.84%)
High (≥130/85 mm Hg)	25 (73.52%)	43 (65.15%)

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The fasting blood sugar levels were high in 28 (82.34%) females and 53 (80.30%) males. The high blood pressure found in 25 (73.52%) females and 43 (65.150%) males (Table 3). Creatinine kinase were high in 1 (2.94%) females and 3 (4.54%) males. The CK MB was high in 1 (2.94%) females and 17 (25.75%). The troponin levels in females and males in depicted in Figure 3.

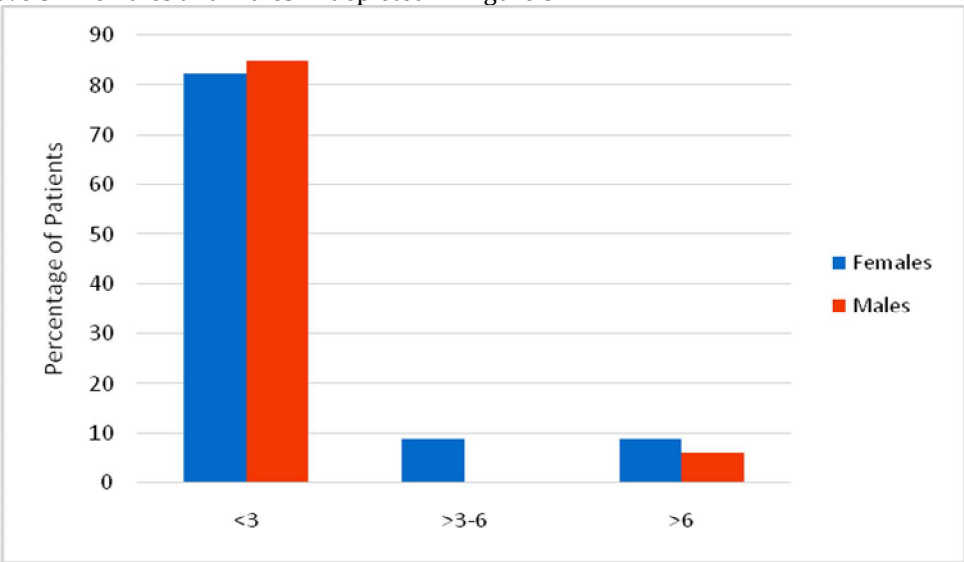

Figure 3: The troponin levels in female and male groups

An analysis has been conducted to know the association of gender with that of the associated variables using PROC Logistic in SAS software revealed that there is formal association between the gender with that of the MetS (as the P-value-0.0191) and 95% odds Ratio (0.1128- 0.8490) is < 0.05 and 1 is not included in 95% Odds CI.

ANOVA Analysis has been conducted to know the difference in the parameters based on the gender using PROC GLM in SAS software and the results are presented in Table 5.

Table 5: Difference in the clinical and laboratory parameters based on the gender

Parameter	Female*	Male*	P-value	95% CI Lower	95% CI Upper	Significance
Age (Yrs.)	66.265 (8.185)	60.242 (11.108)	0.0063	-10.302	-1.741	Significant
Height (m)	1.619 (0.025)	1.746 (0.038)	<.0001	0.1124	0.141	Significant
Weight (kg)	67.029 (6.516)	75.727 (13.209)	0.0005	3.921	13.474	Significant
BMI	25.359 (2.294)	25.547 (2.372)	0.7048	-0.794	1.170	Insignificant
WC (mg/dL)	90.147 (5.088)	95.848 (5.760)	<.0001	3.379	8.023	Significant
TG (mg/dL)	155.618 (60.349)	160.000 (46.942)	0.6897	-17.336	26.101	Insignificant
HDL (mg/dL)	55.441 (12.471)	46.273 (14.004)	0.0018	-14.826	-3.510	Significant
LDL(mg/dL)	125.971 (22.069)	129.818 (34.323)	0.5547	-9.032	16.728	Insignificant
VLDL (mg/dL)	32.559 (6.734)	35.242 (11.557)	0.2152	-1.585	6.952	Insignificant
Total Cholesterol (mg/dL)	197.382 (38.182)	210.712 (57.219)	0.2240	-8.286	34.945	Insignificant
FBS (mg/dL)	131.294 (29.764)	131.712 (30.810)	0.9483	-12.343	13.179	Insignificant
CK	116.647 (33.919)	111.333 (47.306)	0.5620	-23.437	12.810	Insignificant
CK MB	20.191 (12.394)	21.733 (18.148)	0.6577	-5.343	8.427	Insignificant
TROP I	1.767 (2.590)	1.580 (2.450)	0.7233	-1.233	0.859	Insignificant
Components	3.029 (1.058)	2.470 (1.315)	0.0342	-1.076	-0.042	Significant

*Quantitative data are displayed as mean values and standard deviation

Age (P-value-0.0063), 95% CI (-10.302 to -1.741), height (P-value-<.0001), 95% CI (0.112 to 0.141, weight (P-value-0.0005), 95% CI (3.921 to 13.474, waist circumference (P-value-<.0001), 95% CI (3.379

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to 8.023) and components of MetS (P-value-0.0342), 95% CI (-1.076 to -0.042) has shown significant difference in the means between females and males population as the P-value is <0.05 and 0 is not included in 95% CI Levels. Chi squared test has been conducted to know if there any association exists between the STEMI and NSTEMI with that of the gender using SAS software and the results are as follows: STEMI (P-value-0.6123), 95% CI (0.5216- 3.0176) and NSTEMI (P-value 0.6123), 95% CI (0.3314-1.9173) has shown insignificant difference in the means as the P-value is <0.05 and 0 is not included in 95% CI Levels.

DISCUSSION

Abdominal obesity, higher triglycerides, low high density alcohol, elevated blood pressure, and a history of diabetes mellitus or impaired fasting glucose level are all part of the MetS. (18) The MetS is significant in terms of the risk of developing type 2 diabetes mellitus (DM) and cardiovascular disease (CVD). Obesity, age, sedentary lifestyle, diabetes, coronary artery disease, and lipodystrophies are all risk factors for MetS. The metabolic syndrome is thought to affect the majority of people with type 2 diabetes or impaired glucose tolerance [20-22].

The prevalence of MetS is high in patients with CAD as compared to the general population, and increases with age in a sex-specific manner: in fact, while below 50 years it is slightly higher in men, it reverses after 50 years of age [23]. In this study the overall prevalence of metabolic syndrome among participants was slightly lower as compared to a previous report on the Mets, but the prevalence of MetS in female population higher (82.35%)similar to previous report [21].

The remarkable age-related rise in the prevalence of MetS among women is because of several factors, which may be categorised as sex- and gender-related factors. Sex-related factors involve genetical and biological pathways, are determined by hyperandrogenism, insulin-resistance. Also involve the rise in abdominal obesity and HDL-cholesterol decrease found in postmenopausal period. Gender-related factors involve female hypersensitivity to social and cultural behaviors, dietary habits and psychosocial elements. Generally, females are more prone than males to develop MetS in response to work stress and low socio-economic status [24].

Differential prevalence of MetS by sexe and gender may result in various related cardiovascular risk (CV) hazards. According to prospective studies, the CV risk in women with MetS is not only comparable, but also superior than the CV risk in males with MetS. When the existence of overt DM is taken into account, the disparity is mainly reduced. Despite having identical risks for CV events, the frequency of CV events in elderly women may be greater due to the higher prevalence of MetS than in males. Treatments for MetS, including as lifestyle changes and weight loss, may also affect men and women differently. Furthermore, non-pharmaceutical therapy measures aiming at lowering the prevalence of MetS appear to work better for men than for women, according to certain observational research data. (24) According to various meta-analyses, the CV risk given by the MetS is larger in women than it is in males. There are various reasons for a greater CV risk in women with MetS: the most significant changes may be attributed to central adiposity distribution, lipid profile, insulin resistance, and hormones, but abnormalities in platelet biology and biochemistry also play a role [25].

The role of age as a risk factor of MetS cannot be exaggerated as age dependency of the syndrome's prevalence is almost all populations the worldwide [26]. In this study the mean age of female patients was higher 66.26 (±8.18) years compared male subjects was 60.24 (±11.10.18) years. All the female patients and 59 (89.39%) males were above 45 years of age while 7 (11.86%) male were between 18 to 45 years of age.These findings are in concurrence with to those documented in a Finnish study on Mets, the prevalence of the MetS was found to increase with increasing age in women [27]. Similar trend was observed in a Seychelles'[28] population where the greatest prevalence of MetS using the ATP definition was highest at age 45-54 for men [21].

Although there are different definitions of the metabolic syndrome, the uniform pathophysiology of this syndrome is insulin resistance high blood sugar levels [29]. In this study the proportion of women with high fasting blood sugar (FSB)was more than men. Even though FBS is utilised to define MetS, clinical data reveal that the glucose level after a glucose load is more frequently elevated than FBS in women; the reverse pattern is observed in men [30]. Additionally, the post-glucose-load glucose level is predictive of CV mortality in women [31]. Thus, the use of FBS might lead to underestimation MetS women [8].

Animportant clinical feature of MetS is abdominal or central obesity. At present two major definitions for MetS are provided by the IDF and the revised NCEP. In this study 33% women and 51 % men had high waist circumference, whereas 35% women and 36 % men had high waist circumference which was found to be lower in comparison to study by Anthonia O Ogbera. Some researchers have report lower rates as well 25% of occurrence of central obesity in the MetS [21].

In this study as per this proposed criterion the fasting blood sugar levels were high in 82.34% females and 80.30% males [18].

The lipid profile revealed higher abnormalities in males as compared to female population. The triglyceride levels were high in 13 (38.23%) females and 33 (50.00%) male patients. Low levels of HDL were observed in 3 (8.82%) females and 24 (36.36%) male patients. Our results were in concurrence with earlier studies. (21),(32)The prevalence of elevated LDL in subjects with the Mets has been noted to increase the magnitude of the risk for developing CAD[33]. The majority of the study participant in this study showed normal VLDL, LDL and total cholesterol.

Gender differences were also reported in the prevalence of high blood pressure in the MetS. In this study proportion of women with the MetS who had elevated blood pressure was significantly higher than men. These findings were similar to reports have been documented in the published studies [32, 34].

The components of the MetS vary in their rates of occurrence. Every individual component of the MetShave been identified as risk factors for CVD and patient with ≥ 3 components is at particularly high risk. We found a comparable distribution of the components of the MetS in both sexes, but overall MetS higher in females as compared to males. Our study had a small proportionof type 2 DM patients with all the components of the MetS similar to study by [21].

Gender variations in cardiac troponin concentrations are not frequently recognised in clinical practise. This might lead to under-diagnosis of myocardial infarction in women, resulting in variations in patient management and prognosis [35]. Variations in the reference range and hence diagnostic threshold for myocardial infarction in men and women have been discovered using modern high-sensitivity cardiac troponin tests. The use of a common cardiac troponin threshold does not give identical risk stratification in men and women, necessitating lower thresholds for women to achieve comparable risk stratification [35]. The disparities in reference limits are most likely due to differences in CV pathophysiology or the frequency of sub-clinical disease in men and women.

Researchers discovered that peak troponin levels were lower in female hospital patients than in male [35]. It is not understood why there is a variation in the distribution of cardiac troponin concentrations in men and women [36]. Our study also revealed lower levels of Troponins and CK-MB females as compare to males.

Today, vast knowledge exists related to pathophysiological differences between genders in regards to the prevalence of MetS components as well as in the related CV risk. However lower representation of women in clinical studies and underutilization of guideline therapy, in women with CAD, essentiallylead to misinterpretation of epidemiological and clinical data. Therefore, efforts should be made to combat the so-called "Yentl syndrome" and to encourage gender-specific clinical trials [25]. The American Heart Association (AHA) published evidence-based guidelines for CVD prevention in women recommend lifestyle interventions [37].

CONCLUSION

This study has revealed high prevalence rate of MetS in both sexes with CAD, indicating a high disease burden of possible cardiovascular and diabetes complications. Women with suspected CAD are less likely to undergo investigation or receive treatment than men, and women consistently have poorer outcomes. Due consideration to gender specificities should be obligatory requirement of clinical and epidemiological research on MetS and CV disease, for enhanced insights and development of healthcare strategies.

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