Original Article

Prevalence and Correlates of Metabolic Syndrome in Severe Mental Illness: A Cross-Sectional Survey of Inpatients at a Tertiary Care Institute

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Abstract

Background: People with severe mental illness (SMI) die prematurely. They also have disproportionately high burden of diabetes, dyslipidemia, and obesity, which is further compounded by unhealthy lifestyle such as sedentary behavior and substance use. Consequently, there is a high prevalence of metabolic syndrome (MetS) in this population. MetS has been reported in 10%–50% of SMI patients, but its risk factors have been poorly studied. **Aims:** The aim of the study is to assess the prevalence and correlates of MetS in SMI. **Methodology:** A cross-sectional study at a tertiary care psychiatry hospital was conducted. A total of 304 consecutive inpatients with SMI were administered the WHO-STEPS-2 questionnaire, Brief Psychiatric Rating Scale, and World Health Organization Disability Assessment Schedule (WHODAS); and biochemical measures such as lipid and blood sugar levels were measured. Summary statistics (means and proportions) were described, followed by univariate and multivariate analyses to examine the associations between variables. **Results:** 25.7% of SMI patients had diabetes mellitus and 43.09% had elevated cholesterol; 23.4% (95% confidence interval 18.6–28.1) had MetS and it was associated with age ($P < 0.01$), female gender ($P < 0.001$), being married ($P < 0.01$), weight ($P < 0.001$), body mass index ($P < 0.001$), waist and hip circumference ($P < 0.001$), and duration of psychiatric illness ($P < 0.001$). On multivariate analyses, only age ($P = 0.002$), female gender ($P < 0.001$), body weight ($P < 0.001$), abnormal waist to hip ratio (W: H ratio) ($P = 0.02$), and lower use of alcohol ($P = 0.01$) were significantly associated with MetS. **Conclusion:** Patients with SMI have a high burden of cardiometabolic risk factors. Monitoring of traditional risk factors such as W: H ratio is an important and cheap option to screen for risk of MetS.

Keywords: Cardiometabolic risk factors, metabolic syndrome, severe mental illness

Introduction

People with schizophrenia and other severe mental illness (SMI) die prematurely, often one or two decades early, compared to the general population.[1-5] Causes of such premature mortality included lifestyle factors such as unhealthy diet, smoking, alcohol use, and sedentary lifestyle; physical illnesses that are diagnosed late and are not adequately treated; and high risk of suicide and accidents.[6] This is further compounded by the high burden of diabetes, hypertension, obesity, and dyslipidemia in SMI,[7] which is described as the metabolic syndrome (MetS). Prevalence of MetS often reaches up to 50% in SMI.[8-11]

Meta-analysis by Vancampfort *et al*. shows life expectancy of patients with major psychiatric disorders reduced by 7–24 years. About 60% of the excess mortality observed in psychiatric patients is due to physical comorbidities, predominantly cardiovascular diseases (CVDs).[12] The risk of related comorbidities of diabetes, stroke, and obesity is significantly increased in a multitude of psychiatric conditions, including depression,[13] schizophrenia,[14] bipolar disorder (BD),[15] and anxiety disorder.[16] Factors predisposing people with SMI to CVDs include antipsychotic medication and unhealthy lifestyles,[17] as well as their

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reduced likelihood to receive standard levels of medical care.[8-21]

There is limited literature on MetS in the Indian setting with studies reporting a prevalence of 11.6%–47% in SMI.[22-25] We therefore aimed to (a) estimate the prevalence of MetS in SMI using WHO-STEPS-2 questionnaire and (b) determine the sociodemographic and illness attributes of MetS using semi-structured questionnaire, Brief Psychiatric Rating Scale (BPRS) and WHODASS-2.

Methodology

This was a cross-sectional study conducted at a tertiary care psychiatry hospital in a western state of India in patients with SMI (schizophrenia, schizoaffective disorder, delusional disorder, bipolar affective disorder, and psychosis not otherwise specified [NOS]). All consecutive admissions over 6 months were recruited. All adult (>18 years) patients of either gender were included. Pregnant patients were excluded as per the WHO-STEPS protocol.

Measurement

WHO-STEPS-2[26] is a set of standardized questions and protocols used by the WHO to collect information on risk factors for noncommunicable disorders. It includes questions on sociodemographic variables and behavioral risk factors, i.e., tobacco use, alcohol use, diet, and related factors using a questionnaire (STEP 1); obtaining clinical measurements using standardized protocols and weight, height, waist circumference, and blood pressure using instruments (STEP 2); acquiring biochemical measurements such as serum total cholesterol, high-density lipoprotein (HDL), cholesterol, blood glucose, and triglycerides (TGs) using fasting blood samples (STEP 3). The Alcohol Use Disorder Identification Test (AUDIT), a screening tool developed by the WHO, was used to assess for alcohol use disorders.[27] Severity of SMI was measured using BPRS.[28] Disability was measured using the WHO Disability Assessment Scale (WHODAS-2).[29] A semistructured questionnaire was used to gather the information regarding patient's alcohol use behavior and psychiatric illness details such as diagnosis, duration of illness, and use of medications. Diagnosis of SMI was made by experienced clinicians using the International Classification of Diseases, 10th ed.ition.[30]

Procedure

Height was measured with a stadiometer and weight was recorded with a calibrated analog weighing scale. The same instruments were used for all the patients. These measurements were done at admission by the nursing staff trained as per the study protocol. Fasting blood samples were collected at 8 am the day following the admission. All biochemical analyses were carried out with auto-analyzer using Coral kits to measure the serum cholesterol, HDL, TG, and blood sugar levels. Rigorous standardization was conducted and regularly checked. Low-density lipoprotein (LDL) cholesterol was calculated using the Friedewald formula (LDL = total cholesterol − HDL − TG/5).[31]

Waist and hip circumference were measured according to the WHO guidelines.[32] Waist to hip (W: H) ratio was considered abnormal if >0.9 for males and 0.85 for females.[33] The International Diabetes Federation criteria[34] were applied to ascertain MetS [Table 1].

Analyses

Analyses were done using STATA12 (Statacorp.2011. statastatistical software:Release 12.College Station,TX:StataCorp LP). Summary statistics were calculated for all the descriptive data. *t*-test was used for continuous data and Chi-square test for proportions, as appropriate. Univariate analyses were conducted for the association between variables. Significant associations with $P < 0.1$ were further modeled using multivariate analyses.

Ethical considerations

Ethical approval was obtained from the local ethical committee. Written informed consent was obtained from the patients. Confidentiality was maintained and all data were kept in a secure manner. Privacy was ascertained during interviews. Those identified with high risk for MetS were counseled with healthy lifestyles advice and medical referral where needed. Appropriate help was offered for substance use behavior.

Results

A total of 304 participants with 183 (60.2%) males were included in the study [Table 2]. The mean age of the sample was 39.6 (standard deviation [SD] 11. 4) years. 62.5% were Hindu and mean years of education was 7.7 (SD 3.4); 7.84 in males and 7.46 in females. Males were more educated with higher proportions of high school education compared to females.

44.4% of men and 18.1% of women were gainfully employed, mostly in unskilled manual work. An additional 45.5% of women identified themselves as homemakers. Most males (57.9%) were unmarried, while more females (47.9%) were married. A higher proportion of females were postmarital (separated/divorced/widow) compared to males. A reliable information of their socioeconomic status could not be ascertained as most could not give information regarding their or family's earnings and asset ownership.

Table 1: Criteria for metabolic syndrome

	IDF (waist plus 2 criteria required)
Waist (cm)	
Male	≥94
Female	≥80
BP (mm Hg)	≥130/85
HDL (mg/dl)	
Male	<40
Female	<50
Triglycerides (mg/dl)	≥150
Glucose (mg/dl)	≥100

IDF: International Diabetes Federation, HDL: High-density lipoprotein, BP: Blood pressure

Table 2: Sample description with biochemical and illness characteristics

	Male (n=183; 60.2%)	Female (n=121; 39.8%)	Total (n=304)
Sociodemographic data			
Age (years), mean (SD)	38.5 (11.6)	41.1 (10.9)	39.6 (11.4)
Religion (%)	64.4	59.5	62.5
Hindu Christian	30.6	39.7	34.2
Muslim	4.9	0.8	3.3
Education (years), mean (SD)	7.8 (3.3)	7.5 (3.4)	7.7 (3.4)
Employed (%)***	45.9	19	64.9
Marital status (%)***			
Never married	58.5	33.9	48.7
Married	36.6	47.9	41.2
Postmarital	4.9	18.2	10.2
Physical and biochemical measures			
Waist (cm), mean (SD)*	86.2 (9.8)	82.9 (11.2)	84.9 (11.3)
Abnormal waist (%)***	20.7	61.2	36.8
Hip (cm)	85.9 (8.3)	84.8 (11.8)	85.5 (9.8)
BMI (kg/m^2), mean (SD)	22.1 (4.5)	21.7 (4.5)	21.9 (4.5)
BMI category (%) *			
Underweight	14.2	27.3	19.4
Normal	65.6	52.9	60.5
Overweight	15.6	14.9	15.5
Obese	4.4	4.9	4.6
SBP (mmHg), mean (SD)	116.7 (13.2)	114.6 (13.9)	115.9 (13.5)
DBP (mmHg), mean (SD)	73.2 (6.3)	73.4 (7.3)	73.3 (6.7)
Hypertension (%)	32.2	22.3	28.3
FBSL (mg/dl), mean (SD)	97.3 (33.1)	102.3 (48.3)	99.5 (39.8)
DM (%)	25.1	26.5	25.7
Cholesterol (mg/dl), mean (SD)	182.7 (40.6)	191.9 (41.5)	186.4 (41.1)
HDL (mg/dl), mean (SD)	32.2 (7.4)	33.5 (8.7)	32.7 (7.9)
Abnormal HDL (%)*	84.2	92.6	87.5
LDL (mg/dl), mean (SD)	125.3 (36.1)	131.2 (41.6)	127.7 (38.4)
TG (mg/dl), mean (SD)	126.1 (61.9)	135.5 (62.8)	129.9 (62.3)
Abnormal TG (%)*	22.4	34.7	27.3
Psychiatric illness characteristics			
Duration of illness (years)*, mean (SD)	11.5 (9.1)	14.2 (9.8)	12.6 (9.4)
Age at onset (years), mean (SD)	26.7 (8.4)	27.9 (9.2)	27.2 (8.7)
BPRS, mean (SD)	36.1 (8.6)	37.4 (8.4)	36.6 (8.5)
WHODAS, mean (SD)	17.5 (6.3)	19.0 (7.3)	18.1 (6.7)
Treatment in last month (%)	35.5	33.0	34.5

*P<0.05, **P<0.01, ***P<0.001. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SD: Standard deviation, BMI: Body mass index, FBSL: Fasting blood sugar levels, DM: Diabetes mellitus, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride, BPRS: Brief Psychiatric Rating Scale, WHODAS: World Health Organization Disability Assessment Schedule

The prevalence of MetS in our sample was 23.4% (95% confidence interval [CI] 18.6–28.1) [Table 2]. Compared to males, females had significantly (P < 0.05) higher proportions of abnormal waist measures (male 20.7%, female 61.2%), HDL (male 84.2%, female 92.6%), and TG levels (male 22.4%, female 34.7%) and longer duration of psychiatric illness (male 11.5 years, female 14.2 years). On univariate analyses, MetS was significantly associated with age - t = 3.1443 (P = 0.002), female gender - χ^2 = 21.49 (P < 0.001), being married - χ^2 = 27.3597 (P < 0.01), weight - t = 5.95 (P < 0.001), body mass index (BMI) - t = 6.62 (P < 0.001), hip circumference - t = 7.94 (P < 0.001), abnormal W: H ratio - t = 3.16 (P < 0.001), duration of illness - t = 3.42 (P = 0.007), and lower alcohol use - t = −2.72 (P = 0.007).

On multivariate regression analyses, only age - z = 3.14 (P = 0.002), female gender - z = 5.46 (P < 0.001), body weight - z = 6.29 (P < 0.001), abnormal W: H ratio - z = 2.37 (P = 0.02), and lower use of alcohol - z = −2.45 (P = 0.01) were significantly associated with MetS.

Discussion

This cross-sectional survey evaluated MetS and its risk factors in patients with SMI. Behavioral factors such as substance use and biochemical parameters were evaluated and correlated with illness characteristics. A total of 304 patients (60% males) were evaluated; most had a schizophrenia

Table 3: Metabolic syndrome and its correlates

	MetS	
	Present	Absent
Prevalence, *n* (%)	71 (23.4)	233 (76.6)
Mean (years) age (SD)	43.2 (10.4)**	38.4 (11.4)
Married (%)	54.9**	36.9
Female (%)	63.4***	32.6
Current tobacco use (%)	11.3	21.5
Current alcohol use (%)	2.8	14.6**
Mean AUDIT score (SD)	0.2 (1.1)	2.4 (6.7)**
Mean weekly activity (min) (SD)	56.9 (185.3)	121.2 (362.9)
Mean weight (kg) (SD)	63.3 (11.9)***	54.2 (11.0)
Mean BMI (kg/m^2) (SD)	24.8 (4.2)***	21.1 (4.2)
Overweight (%) ≥25 kg/m^2	30.9***	10.7
Obese (%) ≥30 kg/m^2	12.7***	2.1
Mean hip circumference (cm) (SD)	92.9 (9.3)***	83.3 (8.8)
Mean waist: hip (SD)	1.0 (0.1)***	0.98 (0.1)
Abnormal waist: hip (%)	100**	90.6
On medication in the past month (%)	38.0	33.5
Mean duration of illness (years) (SD)	15.8*** (9.3)	11.5 (9.2)
Mean age at onset (years) (SD)	27.3 (9.5)	27.2 (8.7)
Mean BPRS (SD)	34.9 (8.9)	37.1 (8.3)
Mean WHODAS (SD)	18.3 (7.4)	18.1 (6.5)

*P<0.05, **P<0.01, ***P<0.001. SD: Standard deviation, MetS: Metabolic syndrome, AUDIT: Alcohol use disorder identification test, BPRS: Brief Psychiatric Rating Scale, WHODAS: World Health Organization Disability Assessment Schedule, BMI: Body mass index

spectrum diagnosis (schizophrenia 61.4%, schizoaffective 5.9%, bipolar 25.33%, psychosis NOS 6.25%, delusional disorder 0.66%). Only a third of the patients were receiving any kind of medications and all were admitted in acute exacerbations.

As cited in table 3 MetS was present in 23.4% (95% CI: 18.6–28.1) of the study sample. Other Indian studies have reported MetS in 37.8% of SMI,[35,36] 46% of clozapine receiving patients,[24] and 18.2% in first episode schizophrenia.[37] Meta analyses by Mitchell *et al*. report an overall MetS prevalence in schizophrenia of 32.5% across countries, treatment settings, and MetS criteria.[14] The pooled MetS prevalence from meta-analysis by Vancampfort *et al*. was 33.4% (95% CI: 30.8%–36.0%) in people with schizophrenia and 34.6% (95% CI: 29.3%–40.0%) in those with related psychotic disorders. Similar pooled MetS prevalence was observed in patients with BD (31.7%, 95% CI: 27.3%–36.3%) and major depressive disorder (31.3%, 95% CI: 27.3%–35.5%).[12] The prevalence of MetS in our acutely ill, mostly not on treatment sample, seems to be reasonably placed between that seen in the first episode schizophrenia and those on clozapine. It is well established that MetS is directly related to type and duration of psychotropic medications used.[12] MetS risk is significantly higher with clozapine, followed by olanzapine and significantly lower with aripiprazole.[12] Those with acute illness are likely to be exposed to fewer and shorter durations of psychotropic medications, hence having lower prevalence of MetS. On the other hand, those needing the use of clozapine for the management of their psychosis are possibly under longer periods of treatment and exposed to multiple medications, hence more likely to have MetS.

The effect of illness duration and the role of antipsychotics are well established.[14,38] In our study too, MetS was associated with duration of illness; however, no association could be established with the (low) medication use levels.

Increasing age, weight gain, BMI (overweight and obese category), and higher hip measures with abnormal W: H ratios were significantly associated with MetS. These are known risk factors involved in visceral adiposity, insulin resistance, and other hormonal changes.[39,40] Waist size is attributed a sensitivity of 79.4% and specificity of 78.8% in predicting high rates of MetS.[14] Easily measured waist circumference is thus a simple and useful tool for identifying patients who are susceptible to the MetS.[14,41-45] Weight gain is known in SMI due to the use of psychotropic medications as well as the sedentary lifestyle, accentuated by negative symptoms.[46-49] Several of the second-generation antipsychotics have been associated with weight gain/obesity, dyslipidemia, and insulin resistance/diabetes mellitus.[17] Prevalence of MetS was significantly more in females a finding that is reported in other Indian studies too.[24,36] Female patients were especially prone to have adverse lipid profile and abdominal obesity in our study, thus putting them at higher cardiometabolic risk. Those married were more likely to have MetS than those never married. Marriage probably suggests an improved social support leading to more chances of being under treatment, hence exposure to psychotropic medication; however, more studies are needed.

Interestingly, those using alcohol had significantly lower rates of MetS. The mean AUDIT score was 2.4 representing casual drinking behavior. Slight and moderate alcohol consumption has been found in epidemiologic studies to be associated with low cardiovascular risk, possibly through beneficial alterations in HDL cholesterol and blood pressure.[50-52] However, this finding needs to be interpreted with caution. Those with MetS also had lower BPRS scores. Whether the low symptom scores on BPRS are mediated through the use of antipsychotics could not be confirmed.

High prevalence of cardiometabolic risk factors is well known in SMI compared to the general population and has complex etiopathogenesis.[17,53] Though most of the patients were not under-treatment at the time of admission, yet they exhibited adverse cardiometabolic profile. Thus, besides psychotropic medication, other risk factors are also significant contributors to MetS in SMI. Adequate monitoring and management of all risk factors is a must to prevent the high burden of premature mortality and medical morbidity in our patients. Lifestyle management such as increased physical activity are known to promote weight loss, visceral adipose tissue loss, improve insulin sensitivity, increase HDL levels, and lower TG levels.

Conclusion

This cross-sectional study of MetS and its risk factors adds to the scarce literature in the Indian setting. A quarter of the sample had MetS with females more at risk, and it correlated significantly with anthropometric indices. Monitoring of these anthropometric indices such as waist and hip measures is an important and cheap option to screen cardiometabolic risk in our patients. This study underscores the need for lifestyle management as a cornerstone in the overall treatment of SMI. More prospective cohort studies are needed to understand the complex relations between the various risk factors and ultimate effect on mortality and morbidity.

Limitations

The primary limitation of this study is that it does not allow us to make conclusions about temporality of associations, due to the cross-sectional nature of the study design. Role of medication, an important risk factor, could not be assessed as most were not receiving any treatment. Role of socioeconomic status could not be assessed as most patients could not provide relevant information. However, the strengths of this study include its relatively large sample size, use of a standardized questionnaire (WHO-STEPS), and objective measures for various correlates, i.e., biochemical evaluations, which yield a reliable assessment of the risk factors.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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