Journal of Psychiatric and Mental Health Nursing, 2015, **22**, 15–19

Metabolic syndrome in mental health and addiction treatment: a quantitative study

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Keywords: Metabolic syndrome, addiction, dual diagnosis, mental health, schizophrenia

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Accepted for publication: 15 June 2014

doi: 10.1111/jpm.12166

Accessible summary

- Patients with mental illnesses have been found to shorter life expectancy due to an increased risk of heart disease.
- Some medication used to treat mental illnesses have been linked to weight gain and other physical change that make patients susceptible to heart disease.
- In order to reduce this risk it is important that health professionals regularly measure and monitor signs of these physical changes.
- This research has found that measuring both waist circumference and blood pressure of patients is a safe and reliable way to way to monitor patients.

Abstract

To identify if combined blood pressure and waist circumference measurements are reliable predictor of metabolic syndrome, a descriptive correlational design was used to examine the sensitivity and specificity of screening techniques used to detect metabolic syndrome. Data were collected regarding waist circumference, body mass index, blood pressure, fasting blood glucose, triglycerides and high-density lipoproteins. Blood pressure and waist circumference measurements demonstrated high significance, sensitivity and specificity as screening instruments for metabolic syndrome. Combined waist circumference and blood pressure measurements may be clinically useful for a quick and reliable detection of metabolic syndrome in patients with addiction and comorbid mental health problems.

Introduction

Patients with psychiatric disorders have a reduced life expectancy of between 15 and 20 years (Laursen 2011). An increased risk of cardiovascular disease is the main cause of this excess mortality (Hansen *et al*. 2001). When compared to the general population, patients with schizophrenia or bipolar disorder, who are treated with antipsychotic medication, have been found to have a two to three times increased rate of obesity (Tirupati & Chua 2007). Treatment with second generation antipsychotics (SGAs) has also been linked to an increased risk of weight gain, developing diabetes mellitus type II (Lindenmayer *et al*. 2003, Tirupati & Chua 2007) and an increased risk of developing dyslipidaemia (Olfson *et al*. 2006). These metabolic abnormalities are part of a cluster of risk factors that are collectively known as the metabolic syndrome. Metabolic syndrome gives rise to increased cardiovascular morbidity and mortality (Brown 1997, Cohn *et al*. 2004).

Patients with schizophrenia have a fourfold risk of developing metabolic syndrome (Meyer *et al.* 2005). They are also more likely to smoke, they have a poorer diet, and they are less physically active (de Hert *et al.* 2009). Patients with metabolic syndrome have been found to have increased psychotic and depressive symptoms (Dixon *et al.* 1999), as well as lowered compliance with treatment (Weiden *et al.* 2004). Despite these increased risks, patients with a severe mental illness are less likely than the general population to access primary health care, and their general health-care needs are seldom addressed within psychiatric services (de Hert *et al.* 2009).

Effective screening of patients for metabolic syndrome is important in reducing the high morbidity and mortality rate of this patient group. There are currently several diagnostic definitions of metabolic syndrome, for example the Adult Treatment Panel III (National Cholesterol Education Program 2002) and the International Diabetes Federation (2006). The following metabolic abnormalities are common to all definitions; raised blood pressure, abdominal obesity, raised fasting blood glucose, raised fasting triglycerides and lowered high-density lipoprotein (HDL). These criteria and the prevalence of metabolic syndrome differ across racial and ethnic groups, and there is a danger that different definitions might under diagnose metabolic syndrome in some groups (Prussian *et al.* 2007).

Straker *et al.* (2005) claimed that 100% of all cases of metabolic syndrome could correctly be identified by screening for abdominal obesity and raised fasting blood glucose levels only. Straker's study also reported that abdominal obesity and raised blood pressure correctly identified 96.2% of all cases. The researchers suggest that this could be an acceptable screening method in situations where it is difficult to measure fasting blood glucose levels. Tirupati & Chua (2007) reported that a body mass index (BMI) >25 kg/m^2 was 76.3% accurate in predicting the presence of metabolic syndrome (sensitivity) and 80% accurate in predicting the absence of metabolic syndrome (specificity).

Bouman Geestelijke Gezondheidszorg (GGZ) is a provider of mental health services that specializes in addiction treatment in Rotterdam, Netherlands. The organisation is currently developing a new protocol for the systematic screening of patients who are at risk of developing metabolic syndrome. Within the organisation, it is unclear how many patients being treated with SGAs have, or are at risk of, developing metabolic syndrome. The aim of this study was to identify if combined blood pressure and waist circumference measurement is a reliable predictor of metabolic syndrome for this patient group.

Method

Research design

A descriptive correlational design was used to examine the sensitivity and specificity of screening techniques used to detect metabolic syndrome.

Research population

Between January and April 2012, 57 adult patients (18 years and older) were selected from inpatient and outpatient treatment settings within Bouman GGZ. All selected patients were being treated with one or more of the following SGAs; clozapine, olanzapine, quetiapine, risperidone and aripiprazole, and were being treated for psychiatric and addiction disorders.

Procedures

Patients were recruited from a wide variety of treatment settings within Bouman GGZ that were spread across the Rotterdam area. Data were collected regarding waist circumference, BMI and blood pressure of all participating patients. Fasting blood samples were taken and sent to independent laboratories for analysis of blood glucose, HDL and triglycerides levels. The investigator (MF) then made diagnostic predictions of the presence or absence of metabolic syndrome based on waist circumference and blood pressure measurements alone.

Data were also collected on gender, diagnosis, antipsychotic medication as well as treatment with a combination of antipsychotics (atypical plus atypical or atypical plus classic). In order to gather these data, the medical records of all participating patients were reviewed. A second diagnosis of metabolic syndrome was then independently made using all the collected data according to diagnostic criteria as defined by the Adult Treatment Panel III and included:

- Central (abdominal) obesity; waist circumference ≥102 cm in males and >88 cm in females
- Raised fasting plasma glucose ≥5.6 mmol/L or history of diabetes mellitus II
- Raised fasting triglycerides ≥1.7 mmol/L or history of dyslipidaemia
- Lowered HDL <1.03 mmol/L males, <1.29 females or history of dyslipidaemia
- Raised blood pressure ≥130/85 mm Hg or history of hypertension

Data analysis and methodological quality

The results of the predictive diagnosis and the diagnosis complying with all the criteria of the Adult Treatment

Panel III (ATPII) were analysed to test the sensitivity (ability to correctly identify a true case of metabolic syndrome) and specificity (ability to correctly identify when metabolic syndrome isn't present) of the combination of waist circumference and blood pressure measurements as a screening instrument for metabolic syndrome. Sensitivity, specificity, likelihood ratios (an index demonstrating the relationship between sensitivity and specificity) and positive predictive value (probability that result is correct) were calculated. Receiver operator characteristic curves were plotted to establish appropriate cut-off points for sensitivity and specificity. Bivariate analyses were carried out to assess the relationship between individual variables and metabolic syndrome. A linear regression analysis was carried out to calculate the predictive values of the multiple independent variables on the dependent variable metabolic syndrome. In order to be able to conduct a logistic regression analysis, the outcomes of the metabolic screening were converted into dichotomized variables: 0 = no metabolic syndrome, 1 = metabolic syndrome. Significance was set at 0.05.

Electronic blood pressure monitors were used, and research staff received an update on correct measuring of waist circumference. To enhance internal validity, it was decided not to include any data that were not complete and any blood data analysis that were not reported as fasting.

Ethical responsibility

The research proposal was presented to and approved by the research and ethics commission of Bouman GGZ. Patients were informed of the research programme. No written consent was requested because interventions carried out during the research may be considered as standard good practice in the treatment of patients taking SGAs. Data were anonymized and electronic patient database numbers were used to record and catalogue data. Abnormal test results were reported to case coordinators and prescribing clinicians with advice for further interventions.

Results

Fifty-seven patients were identified to take part in the study. Twenty-five patients were being treated in community treatment settings, and 32 were being treated in a inpatient clinical setting. Sixteen patients (28%) were eventually excluded due to discharge from treatment ($n = 3$), no show ($n = 5$), insufficient data ($n = 5$) and refusal to take part ($n = 3$). Of the excluded patients, 75% were being treated in a community treatment setting. The final study group consisted of 41 patients of which 56.1% were male and 70% were inpatients (see Table 1).

Table 1
Characteristics of study group, $n = 41$

	No metabolic syndrome ($n = 19$[46.3%])		Metabolic syndrome ($n = 22$[53.7%])	
	n	%	*n*	%
Gender				
Male	11	57.9	12	54.5
Female	8	42.1	10	45.5
Primary diagnosis				
Schizophrenia spectrum disorders	9	47.4	5	22.7
Mood disorders	6	31.6	10	45,5
Other	4	21.0	7	31,8
Medication				
Olanzapine	4	21.1	3	13,6
Quetiapine	10	52.6	13	59,1
Risperidone	3	15.8	4	18,2
Aripiprazol	2	10.5	2	9,1
Combination therapy				
Single atypical	17	89.5	15	68,2
Atypical + atypical	2	10.5	2	9,1
Atypical + typical	0	0	5	22,7

The mean age of the group was 42.66, range 23–56, standard deviation 8.005. Patients with a primary diagnosis of mood disorder made up 39% of the study group, schizophrenia spectrum disorder 34% and 27% other. Thirty-two patients (78%) were being treated with a single atypical antipsychotic medication. The most frequently used antipsychotic was quetiapine (56%), with olanzapine and risperidone used in 17% of the cases and aripiprazol in 10%. Twenty-two patients (53.7%) met the criteria for metabolic syndrome (see Table 1). Metabolic syndrome was not significantly associated with diagnosis, gender or antipsychotic medication. Seven of the nine (77.7%) patients being treated with a combination of antipsychotic medications (atypical +atypical or atypical + typical) tested positive for metabolic syndrome. A significant association was also found between central obesity and metabolic syndrome ($r = 0.431$, $P = 0.005$), one third of all patients with central obesity tested positive for metabolic syndrome. Furthermore, a significant relationship was found between gender and central obesity $r = 0.314$ $P = 0.046$, 88% of females had central obesity compared with 64% of men.

All the individual criteria of metabolic syndrome were significantly associated with metabolic syndrome. In a linear regression analysis, waist circumference in combination with blood pressure as a predictor of metabolic syndrome was found to have a high significance as was BMI and blood pressure (see Table 2).

Table 2
A lineal regression analysis of the predictive values of screening instruments for metabolic syndrome

	R^2	F	$P = 0.001$
Predictive diagnosis; Central obesity, raised systolic/diastolic blood pressure or existing treatment for hypertension	0.395	5.887	0.001
Body mass index, raised systolic/diastolic blood pressure or existing treatment for hypertension	0.380	5.509	0.001

Table 3
Sensitivity, specificity, positive predictive value and likelihood ratios of the different criteria of metabolic syndrome

	Sensitivity	Specificity	PPV	+LR
High blood pressure (≥130/85 mmHg) or history of hypertension	88%	73%	73%	3.4
Raised fasting blood glucose (≥5.6 mmol/L) or a history of diabetes mellitus	75%	60%	55%	1.9
Raised fasting triglycerides (≥1.7 mmol/L 4)	84%	72%	73%	3.1
Lowered high-density lipoprotein (m. <1.03 mmol/L , f. <1.29 mmol/L)	88%	71%	68%	3.0
Central obesity (m. ≥102 cm, f. >88 cm)	66%	81%	91%	3.6
Body mass index (BMI)	63%	72%	86%	2.3
High blood pressure and central obesity	93%	69%	64%	3.0
High blood pressure and BMI	63%	87%	95%	5.1

PPV, positive predictive value.
+LR, positive likelihood ratio.

The sensitivity, specificity, positive predictive value and likelihood ratios are presented in Table 3. High blood pressure correctly identified 17 out of the 22 cases of metabolic syndrome and had a sensitivity value of 88%. Central obesity had a sensitivity of just 66%, but a high positive predictive value meaning that 91% of the positive result will have metabolic syndrome. Combining blood pressure and central obesity as a measuring instrument creates a high sensitivity (93%) but a lower positive predictive value (64%). Combining blood pressure and BMI resulted in a likelihood ratio of 5.1, a sensitivity of 63%, a specificity of 87% and a positive predictive value of 95%.

Discussion

Major findings

To the best of the author's knowledge, this is the first study so far that has researched metabolic syndrome in a population group that has both addiction and comorbid psychiatric disorders. The findings reveal a high prevalence of metabolic syndrome (53.7%) among the study population. In a study group of 35 outpatients with schizophrenia, Heiskanen *et al.* (2003) reported a prevalence rate of metabolic syndrome of 37%. Straker *et al.* (2005) reported a prevalence rate of metabolic syndrome of 29% in a group of 89 psychiatric inpatients treated with at least one second-generation antipsychotic. Similar to these two studies, we also found that metabolic syndrome was not associated with any specific antipsychotic. Polypharmacy was found to be significantly associated with metabolic syndrome. However, more research on a larger scale is needed to validate the results.

In the study group, a significant association was found between central obesity and metabolic syndrome. Gender was also associated with central obesity with 88% of the females in the study having central obesity. Central obesity alone, however, was not associated with metabolic syndrome. Cerit *et al.* (2008) also reported that females were significantly more likely to have central obesity and Tirupati & Chua (2007) observed the same rate of 88% of females in their study had central obesity.

As expected, all the individual diagnostic criteria for metabolic syndrome were significantly associated with the disorder. Blood pressure measurements alone had a high sensitivity of 88%. Combined blood pressure and central obesity was found to a significant association with metabolic syndrome and had a sensitivity of 93%. This is similar to that reported by Straker *et al.* (2005) of 96%. Specificity, that is the ability of combined blood pressure and waist circumference measurements to correctly identify non-cases, was however lower at 69%, which can result in a high number of false positive diagnostic results.

Strengths and limitations

Inpatients were recruited for this research from a variety of different wards including acute admission and longer stay psychiatric wards. The length of treatment with atypical antipsychotic medication is also not considered within this study but may be a vital confounder.

The large attrition rate is one of the limitations of this study and may have compromised the external validity. Furthermore, the attrition rate was at its highest amongst patients being treated in community settings, which may indicate self-selection. Patients who were not concerned about their weight and general health may have chosen not to take part in the study. Alternatively, treatment in a clinical setting may be associated with abnormalities in metabolic functioning. The number of subjects in this study also limits its generalizability. Further research with a

larger study population is needed to determine if waist circumference and blood pressure measurements alone are reliable diagnostic predictors in clinical and community settings.

The cross-sectional nature of the design can also have limitations on the results. Blood pressure for example was measured only once in this study. To diagnose hypertension the National Institute for Health and Clinical Excellence in the UK recommends taking several measurements of blood pressure that should be confirmed by ambulatory blood pressure monitoring (NICE 2011). Finally, results may have been modified by variables that were not controlled for, such as length of time on medication, dose of medication, side effects of medication and interactions with other medications.

Conclusion

This study has clearly demonstrated that combined waist circumference and blood pressure measurements may be clinically useful as a quick reliable and non-intrusive method to identify patients with metabolic syndrome that are unwilling or unable to provide fasting blood samples. Providing a fast, easy and acceptable method of initially screening patients would significantly increase our knowledge of the prevalence of metabolic syndrome among this patient group as well as inform and improve treatment. Patients who test positive could be referred for the full diagnostic test. By identifying patients with risk factors for metabolic syndrome, clinicians will be able to effectively target interventions to reduce or manage these risks factors.

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