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Diagnostic value of a simplified screening test for metabolic syndrome in a Dutch patient cohort with schizophrenia spectrum disorders

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Abstract

Objective: The aim of this study was to establish the specificity and sensitivity of a simplified screening test based on diastolic blood pressure and waist circumference for predicting metabolic syndrome.

Method: Demographic, anthropometric (waist circumference and systolic and diastolic blood pressure) and laboratory (triglyceride, high-density lipoprotein and fasting glucose) data were collected from a large cohort of Dutch patients with a schizophrenia spectrum disorder in order to determine whether patients fulfilled the Western criteria of the International Diabetes Federation (IDF) for metabolic syndrome. The sensitivity, specificity, likelihood ratio of a positive or negative test outcome and positive and negative predictive values of the simplified test (only waist circumference and diastolic blood pressure) were calculated.

Results: Of 252 recruited patients, 55% met the IDF criteria for metabolic syndrome. The sensitivity and the specificity of the simplified test were 65% and 85%, respectively. The likelihood ratios of positive and negative test outcomes were 4.35 and 0.41, respectively, and the positive and negative predictive values were 87% and 67%, respectively.

Conclusion: This simplified screening test did not have diagnostic validity for metabolic syndrome in a Dutch cohort of patients with schizophrenia spectrum disorder.

Keywords: metabolic syndrome, screening, diagnostic, schizophrenia

Cardiovascular mortality is a major public-health concern and is partly responsible for the mortality gap between schizophrenia patients and the general population.[1] A Swedish study demonstrated that cardiovascular disease was responsible for the 50% increase in mortality due to natural causes as seen in patients with schizophrenia.[2] Metabolic syndrome, which comprises both obesity and abnormalities in glucose metabolism, lipid metabolism and blood pressure, is strongly correlated with increased rates of cardiovascular morbidity and mortality.[3,4] The prevalence of metabolic syndrome is two- to fourfold higher in patients with schizophrenia than in the general population.[5,6] This high prevalence is related to the disease itself, with a possible genetic link between schizophrenia and diabetes, and other associated behavioural factors, such as antipsychotic agents, poor diet, smoking and physical inactivity.[7,8] Despite its high prevalence, metabolic syndrome often goes undetected and untreated.[9]

Simplified screening methods may facilitate the detection of metabolic syndrome and increase the likelihood that adequate interventions are initiated. A simplified

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Table 1. Diagnostic criteria for metabolic syndrome according to the International Diabetes Federation 2005

Metabolic syndrome	*Abdominal obesity and two or more of the four other criteria*
Waist circumference (abdominal obesity)	Men ⩾94 cm Women ⩾80 cm
1. Fasting triglycerides	⩾1.7 mmol/L or treatment for high triglycerides
2. High-density lipoprotein (HDL)	Men ⩽1.03 mmol/L Women ⩽1.29 or treatment for low HDL
3. Blood pressure	⩾130/85 mmHg
4. Fasting glucose	⩾5.6 mmol/L or treatment for diabetes

non-invasive screening test, based on anthropometric data, could be useful because it is low in cost, can be performed in the consulting room and is acceptable to patients. In their study of Taiwanese patients, Lin et al.[10] found that a model based on only two variables – diastolic blood pressure and waist circumference – had 86% sensitivity and 83% specificity for detecting metabolic syndrome, defined according to the International Diabetes Federation (IDF) criteria[11] (see Table 1).

Aim of the study

The aim of this study was to replicate the findings of Lin et al.[10] by establishing the specificity and sensitivity of a simplified screening test for predicting metabolic syndrome in a Dutch cohort of patients with schizophrenia, based on diastolic blood pressure (⩾85 mmHg) and waist circumference (⩾94 cm for men and ⩾80 cm for women) and using the IDF criteria for metabolic syndrome.

Methods

We recruited patients who were being treated for schizophrenia spectrum disorders, such as schizophrenia, psychosis not otherwise specified and schizoaffective disorders, at our inpatient and outpatient mental-health facility in Gouda, the Netherlands, from January 2007 to December 2011. The catchment area is a mixed urban/rural region, and the large majority of patients are Dutch natives. Data collection was performed according to a metabolic screening protocol based on the consensus meeting in 2002 in New York City.[12]

Information on demographics and medication was obtained at the first screening visit or, for the large majority of patients, later in the course of the illness. Anthropometric measurements (waist circumference and blood pressure) and laboratory measurements (triglycerides, high-density lipoprotein and fasting glucose) were taken to determine if patients fulfilled the IDF criteria. Age indicates the patient's age at the date of this assessment.

A patient can also meet the IDF criteria if he or she uses medication for abnormal metabolic values, such as antihypertensive medication, lipid-lowering medication and antidiabetic medication. However, as we had insufficient information about the use of these medications, patients who met these criteria were not recognised as such. Lin et al.[10] adapted the IDF criteria for the Chinese population, using a waist circumference for men of ⩾90 cm (instead of ⩾94 cm). We used the original criterion of a waist circumference ⩾94 cm.

All patients fasted overnight, and blood was collected the following morning at 10 a.m. using an indwelling catheter. Serum glucose, triglycerides and cholesterol were measured at a local laboratory with Hitachi autoanalyzers (Hitachi Modular PPE, Tokyo, Japan). Blood pressure was measured once the patient was seated using the Korotkoff method. Waist circumference was measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest according to the World Health Organization expert consultation.[13] Data were collected by a nurse practitioner, physicians and psychiatrists.

All patients consented to metabolic screening. The researchers had access to anonymised data. All analyses were performed using IBM SPSS Statistics for Windows v19.0 (IBM Corp., Armonk, NY). Chi-square analyses were used to generate test characteristics, including sensitivity, specificity, likelihood ratios for positive and negative test outcomes and positive and negative predictive values.

Results

We recruited 252 patients, 228 of whom used antipsychotic medication. Table 2 summarises the demographic and clinical characteristics of patients with or without metabolic syndrome. Men were over-represented in both groups (63%), as well as in the total population of patients with psychotic disorders. The metabolic syndrome group was significantly older than the non-metabolic syndrome group ($p<0.05$).

Table 2. Demographic and clinical characteristics of 252 patients with schizophrenia spectrum disorders in Gouda, the Netherlands, in relation to presence of metabolic syndrome (criteria of International Diabetes Federation)

	Non-MetS (n=113)		*MetS* (n=139)	
Characteristics	***Male* (n=75)**	***Female* (n=38)**	***Male* (n=84)**	***Female* (n=55)**
Age (years)	Mean 37.3	Mean 41.1	Mean 43.4	Mean 47.7
Weight (kg)	76.7	72.3	98.7	83.9
Waist circumference (cm)	92.4	89.3	110.6	102.5
Fasting triglycerides (mmol/L)	1.3	1.0	2.3	2.2
High-density lipoproteins (mmol/L)	1.3	1.6	1.0	1.2
Systolic blood pressure (mmHg)	132.5	127.9	140.6	135.5
Diastolic blood pressure (mmHg)	79.2	79.6	89.1	87.4
Fasting glucose (mmol/L)	5.3	5.1	6.0	6.2
Antipsychotic medication, *n* (%)				
None	7	4	7	6
Olanzapine	18	7	19	7
Clozapine	14	1	21	12
Risperidon	8	3	9	8
Aripiprazol	0	1	1	1
Quetiapine	4	5	7	6
First-generation antipsychotics	24	17	20	15

MetS: metabolic syndrome.

Table 3. Diagnostic validity of a simplified screening test for metabolic syndrome, including waist circumference and diastolic blood pressure, for a sample of 252 patients with a schizophrenia spectrum disorder in Gouda, the Netherlands

	Prevalence	*Sensitivity*	*Specificity*	*LRP*	*LRN*	*PPV*	*NPV*
MetS	55%	65%	85%	4.35	0.41	84%	67%
MetS[a]	60%	63%	90%	6.37	0.41	90%	62%

[a]Patients using only atypical antipsychotics.

LRP: likelihood ratio of a positive test; LRN: likelihood ratio of a negative test; PPV: positive predictive value; NPV: negative predictive value.

Table 3 summarises the diagnostic validity of the simplified screening test, using the IDF criteria as the gold standard. The overall prevalence of metabolic syndrome in our study population was 55%. Sensitivity and specificity were 65% and 85%, respectively.

Discussion

We were unable to replicate the finding of Lin et al.[10] that an abnormal waist circumference and increased diastolic blood pressure can identify metabolic syndrome in patients with schizophrenia spectrum disorders. The low sensitivity and likelihood ratios imply that the short screening test may lead to a substantial number of false-negative results in our population.

The high specificity of the simplified test means that a positive test result is very likely indicative of metabolic syndrome.

Strengths of the study were the large sample size and inclusion from a large Dutch region, with data collection according to a generally used metabolic screening

protocol, so results can be generalised to ambulatory patients with schizophrenia. We also largely replicated Lin's methods. However, some limitations have to be mentioned. The real proportion of patients with metabolic syndrome was probably higher than we determined, given the lack of information on patients using medication for abnormal metabolic values.

A possible explanation for the discrepant findings is the difference in definition of abnormal waist circumference, a major component of the IDF criteria.[14] In order to make these criteria more sensitive for detecting metabolic syndrome in the Taiwanese population, Lin et al.[10] adapted them to require a smaller waist circumference among men. However, we retained the IDF criteria for the European population.

In conclusion, this simplified screening method for metabolic syndrome, based on diastolic blood pressure and waist circumference, had little diagnostic value in this large Dutch sample of chronic schizophrenia patients.

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