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Validity of the 6 min walk test in outpatients with bipolar disorder

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ABSTRACT

Cardiorespiratory fitness is a major modifiable risk factor for cardiovascular diseases. People with bipolar disorder have a reduced cardiorespiratory fitness and its assessment within a multidisciplinary treatment therefore is necessary. We investigated the validity of the 6 min walk test in people with bipolar disorder. A secondary aim was to assess clinical and demographic characteristics that might interfere with cardiorespiratory fitness performance. 19 (5♂) outpatients (47.1 ± 8.3 years) underwent a 6 min walk test and a maximal cardiopulmonary exercise test on a cycle ergometer and completed the Positive-and-Negative-Affect-Schedule (PANAS) and Beck Depression Inventory (BDI). The distance achieved on the 6 min walk test correlated moderately with peak oxygen uptake obtained during the maximal cardiopulmonary exercise test. The variance in age, weight and the PANAS negative score explained 70% of the variance in the distance achieved on the 6 min walk test. The 6 min walk test can be used as a measure-of-proxy to gauge cardiorespiratory fitness in people with bipolar disorder when maximal cardiopulmonary exercise test equipment is not available. Negative mood should be considered when evaluating the cardiorespiratory fitness of this vulnerable population.

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1. Introduction

According to the World Health Organization global burden of disease study, bipolar disorder ranks within the top 20 causes of disability among all medical conditions worldwide and 6th among the mental disorders (Whiteford et al., 2013). This is exemplified by a more than 10 years reduced life expectancy (Chang et al., 2011). The underlying causes for the increased risk for premature mortality are complex and multi-factorial. However, it is known that for most part it is due to natural causes and in particular by circulatory, respiratory (Hayes et al., 2015) and metabolic diseases (Vancampfort et al., 2013a, 2015a) associated with unhealthy lifestyles and adverse effects of treatments (Vancampfort et al., 2013b). Despite the recognition that bipolar disorder imposes a tremendous health burden, lifestyle interventions designed to address medical co-morbidities are scarce. Also only a limited number of screening, monitoring and treatment guidelines refer to the role of physical activity and exercise in people with severe mental illness, yet none of these guidelines have an adequate focus on the importance of cardiorespiratory fitness testing within this population (De Hert et al., 2011). Cardiorespiratory fitness is an

important health outcome measure, predictive for cardiorespiratory diseases and premature mortality (Kodoma et al., 2009) and sensitive to physical activity (Naci and Ioannidis, 2013), also in people with severe mental illness (Vancampfort et al., 2015b). Cardiorespiratory fitness testing therefore has important clinical implications and can be used to help guide the intensity of exercise prescriptions.

Various forms of fitness testing are available, with the 6 min walk test (American Thoracic Society, 2002) being of particular interest in patients with bipolar disorder. The 6 min walk test is a safe, easy to administer and inexpensive physical fitness test. It evaluates the global and integrated responses of the cardiorespiratory, peripheral circulation and neuromuscular systems involved during exercise. Although the 6 min walk test does not provide specific information about the function of each of the different systems involved in exercise or about the mechanism of exercise limitation as is possible with maximal cardiopulmonary exercise testing, it assesses the sub-maximal level of physical fitness (i.e., the functional exercise capacity). Because most activities of daily living are performed at sub-maximal levels of exertion, the 6 min walk test may better reflect the functional exercise level for daily physical activities. Furthermore, among the sedentary population of people with bipolar disorder who might develop symptoms below their theoretical maximal exercise capacity

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(Vancampfort et al., 2015c), the 6 min walk test may be particularly relevant. Despite the fact that the 6 min walk test has been shown to have an excellent test-retest reliability with an intraclass correlation coefficient of 0.98 (95% confidence interval 0.97–0.99) in inpatients with bipolar disorder (Vancampfort et al., 2015d), its validity has never been assessed among patients with bipolar disorder.

The aim of the present study therefore was to investigate the validity of the 6 min walk test in outpatients with bipolar disorder. A secondary aim was to assess clinical and demographic characteristics that might interfere with performing the 6 min walk test.

2. Method

2.1. Study protocol and design

Over a 9-month period, outpatients with a DSM-V diagnosis of bipolar disorder at the UPC KU Leuven campus Kortenberg in Belgium were invited to participate in this study. Participants were invited on 2 occasions. A baseline evaluation of socio-demographic details (age, sex, height, weight, blood pressure and a resting electrocardiogram) and a maximal incremental exercise test on a cycle ergometer was performed at visit 1, while the 6 min walk test and questionnaires were completed on visit 2. Visit 2 took place exactly one week after visit 1 on the same hour of the day. On the days of their visits, participants were asked to not eat a large meal for at least two hours prior, and to refrain from caffeinated beverages and vigorous physical activity. Since severe substance abuse might impair walking capacity, participants were excluded if they had a co-morbid DSM-V diagnosis of substance abuse during the previous 6 months. Somatic exclusion criteria included evidence of significant cardiorespiratory, neuromuscular and endocrine disorders which according to the *American College of Sports Medicine* (2013) might prevent safe participation in the study. The study procedure was approved by the Scientific and Ethical Committee of the UPC KU Leuven, campus Kortenberg, Belgium, and conducted in accordance with the principles of the Declaration of Helsinki. All participants gave their informed written consent.

2.2. The 6 min walk test

The test was performed according to the *American Thoracic Society* (2002) guidelines in an indoor corridor with lack of external stimuli. Two cones 25 m apart indicated the length of the walkway. Participants were instructed to walk back and forth around the cones during 6 min, without running or jogging. Resting was allowed if necessary, but walking was to be resumed as soon as the participants were able to do so. The total distance walked in 6 min was recorded to the nearest decimeter.

2.3. Cardiopulmonary exercise testing

Graded exercise tests were performed on a cycle ergometer (Siemens-Elema 380B; Ergometrics 800S, Ergometrics, Bitz, Germany) in an air-conditioned laboratory where the room temperature was regulated at 18–22 °C. Patients were asked to cycle at a constant rate of 60 rates per minute. The initial workload of 20 W was increased by 20 W every minute. Blood pressure was measured at rest, with the patient sitting on the bicycle, and every 2 min during graded exercise. Heart rate and a 12-lead electrocardiogram (Max Personal Exercise Testing[®], Marquette, WI, USA) were registered continuously. In- and expired gasses were analyzed breath-

by-breath by means of the Oxyxon Pro (Jaeger, Mijndhardt, The Netherlands). All patients were asked to perform a symptom-limited graded exercise test until exhaustion. Exhaustion was defined by the patients based on feelings of exhaustion, dyspnea, pain, and/or tiredness in the legs. Peak values were defined as the 30 s average at the highest workload achieved. The capability of performing an exercise test until maximum was defined by the criteria described by Mezzani et al. (2009).

2.4. Anthropometric assessments

Anthropometric measurements included body weight and height. Body weight was measured in light clothing to the nearest 0.1 kg using a SECA beam balance scale, and height to the nearest 0.1 cm using a wall-mounted stadiometer.

2.5. Questionnaires

The Positive-and-Negative-Affect-Schedule (PANAS) (Watson et al., 1988), a widely used 20-item questionnaire assessing positive and negative affect, was chosen as a measure of normal daily mood while the Beck Depression Inventory (BDI) (Beck and Steer, 1987) assessed the presence and/or severity of current depressive symptoms.

2.6. Statistical analyses

Data were assessed for normality using the Shapiro–Wilk test and found to be normally distributed. Descriptive statistics are presented as mean and standard deviation (SD). Validity was evaluated by calculating the Pearson's *r* correlation between the distance achieved on the 6 min walk test and the peak oxygen uptake (peakVO₂). Also Pearson's *r* correlations with the distance achieved on the 6 min walk test and peakVO₂ were calculated. A backward stepwise multivariable regression analysis was performed to evaluate independent demographical and clinical variables explaining the variance in the 6 min walk test performance. A priori, a two sided level of significance was set at $p < 0.1$. Statistical analysis was performed using the statistical package SPSS version 22.0 (SPSS Inc., Chicago, IL).

3. Results

3.1. Participants

A total of 26 outpatients with bipolar disorder were invited to participate. One person was excluded as a consequence of a severe locomotor disorder and two due to a current DSM-V diagnosis of substance abuse. Of the 23 eligible persons with bipolar disorder, 3 declined to participate (i.e., were not interested) and one dropped out (i.e., overlap with another appointment at the second test day). The demographical and clinical characteristics, 6 min walk test and maximal incremental cardiopulmonary exercise test data of the 19 (5 σ) included participants are shown in Table 1. The mean body mass index was 26.1 (5.1). The median relative VO₂peak (predicted) was 94% (range: 71–118%). All participants were able to complete the maximal incremental cardiopulmonary exercise test until volitional exhaustion without symptom limitation.

3.2. Validity of the 6 min walk test

The distance achieved on the 6 min walk test correlated significantly with the VO₂peak ($r=0.51$, $p=0.025$) (see Table 1).

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