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Postural sway and flexibility in patients with schizophrenia-spectrum disorders: A cross-sectional study

Saeko Ikai [a,*], Hiroyuki Uchida [a,b], Takefumi Suzuki [a,c], Kenichi Tsunoda [d], Yasuo Fujii [e], Masaru Mimura [a]

[a] Department of Neuropsychiatry, Keio University School of Medicine, 160-8582, 35, Shinanomachi, Shinjuku-ku, Tokyo, Japan
[b] Geriatric Psychiatry Division, Centre for Addiction and Mental Health, 1001, Queen St W, Toronto, ON, Canada M6 J 1H4
[c] Department of Psychiatry, Inokashira Hospital, 181-0012, 4-14-1, Kamirenjaku, Mitaka, Tokyo, Japan
[d] Department of Psychiatry, Minamihanno Hospital, 357-0042, 415, Soya, Hanno, Saitama, Japan
[e] Department of Neuropsychiatry, Yamanashi Prefectural Kita Hospital, 407-0046, 3314-13, Kamijo Minamiwari Asahi-machi, Nirasaki, Yamanashi, Japan

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ABSTRACT

Coordinated bodily balance is necessary to prevent falls, where postural sway and/or body inflexibility should be relevant. We aimed to assess postural sway and flexibility in patients with schizophrenia and identify clinical characteristics.

Postural sway (length and range of trunk motion, and Romberg ratio) and flexibility (anteflexion in sitting) were measured in schizophrenia. The Positive and Negative Syndrome Scale (PANSS) and the Drug Induced Extrapyramidal Symptoms Scale (DIEPSS) were used for the assessment of psychopathology and extrapyramidal symptoms, respectively. Characteristics associated with postural sway and flexibility were examined with regression analysis. A total of 100 patients (68 men, mean ± S.D. age: 49.3 ± 13.8 years, PANSS score: 83.4 ± 15.1, DIEPSS score: 2.2 ± 2.2) participated in this study. The anteflexion in sitting was not significantly correlated with length of trunk motion, range of trunk motion, or Romberg ratio. Postural instability was associated with higher DIEPSS overall severity score and PANSS positive symptoms. A significant correlation was also found between less flexibility and increased PANSS negative symptoms. In conclusion, flexibility and postural stability might be regarded as separate elements of physical fitness in schizophrenia. Prospective exercise intervention would be worthy of investigation to enhance postural stability and flexibility in an effort to prevent falls.

1. Introduction

As aging society progresses, effective prevention of falls is an urgent public health issue. This is also the case in patients with chronic psychiatric disorders who already have a number of risk factors in association with falls such as use of psychotropics and the disorder itself that may adversely affect cerebellar functioning. In fact, patients with schizophrenia are reported to suffer more from postural instability in comparison with healthy people (Kent et al., 2012; Koreki et al., 2011; Marvel et al., 2004). It has been found that visual information has less pertinence in balance control among patients with schizophrenia compared to healthy subjects (Ahlgren-Rimpilainen et al., 2010). Further, motor deficits were reportedly associated with the severity of general psychopathology in patients with schizophrenia (Kent et al., 2012). However, the studies on postural sway in schizophrenia are still limited in number as well as scope. Moreover, recent evidence has shown potentially negative impact of antipsychotics on bone mineral density (Takahashi et al., 2013), which can result in pathological fractures (Takahashi et al., 2013). This point is also of relevance in considering prevention of falls in patients with schizophrenia. This topic is highly relevant since the problems associated with an aging society are expected to affect patients with chronic schizophrenia as well, rendering prevention of falls an important issue among those at higher risk.

Coordinated bodily balance is considered necessary to prevent falls, where postural sway and body inflexibility are highly relevant. In fact, poor postural balance was found to be a major risk factor for falls especially in the elderly people (Piirtola and Era, 2006). Postural instability is a critical element since it may elevate

* Corresponding author. Tel.: +81 3 3353 1211; fax: +81 3 5379 0187.
E-mail address: sako0609@gmail.com (S. Ikai).

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the likely risk of falls that may further lead to fractures as well as life-threating consequences (Hien le et al., 2005). Moreover, greater flexibility is associated with better balance in healthy people (Costa et al., 2009; Weirich et al., 2010). Thus, better postural stability and greater bodily flexibility are both expected to exert protective effects against falls. However, there has been no study that has evaluated the impact of demographic and clinical characteristics on bodily balance and flexibility. Therefore, in the present cross-sectional study, we assessed postural sway and flexibility in patients with chronic schizophrenia and identified demographic and clinical characteristics associated with those parameters.

2. Methods

2.1. Study design & participants

This cross-sectional investigation was conducted at Yamanashi Prefectural Kita Hospital, Yamanashi, Japan in December 2013. Patients with schizophrenia-spectrum disorders (F20–F29 according to the International Classification of Diseases, 10th edition) (World Health Organization, 1992) were invited through advertisements and word-of-mouth around the hospital. Eligible patients were restricted to those 18 years or older who had been taking the same psychotropics for four weeks. Patients who were unable to provide informed consent, suffered from clinically significant physical and neurological comorbidities such as neurosyphillis, vision problems, and neuropathy, or had current alcohol problems including alcohol dependence, defined as a score of >8 in the Alcohol Use Disorder Identification Test (AUDIT), were excluded (Babor et al., 1992; Conigrave et al., 1995). This study was approved by the hospital's institutional ethics board, and prior to study entry participants provided written informed consent after receiving detailed information about the protocol.

2.2. Main measurements

The main outcome measures were postural sway and flexibility. The Clinical Stabilometric Platform (CSP) (ANIMA® GS-7, Tokyo, Japan) was used for the assessments of the postural sway. The assessments took place between 9:00 A.M. and 12:00 P.M. Participants stand on the platform for 30 s with the eyes closed, feet together, and arms down. The position of the center of pressure (COP) on the platform, and the range of the trunk motion were calculated from forces and moments. The parameter also included the measure of an outer line of COP sway area (the length of the trunk motion), which was automatically computed as values in cm^2. A longer value shows more instability. The Romberg ratio was calculated as a ratio of sway areas with the eyes opened and closed, and a lower value indicates a smaller difference in both conditions.

The flexibility was measured using the long seat type body anteflexion measurement device (TOEI LIGHT®, Tokyo, Japan) between 9:00 A.M. and 12:00 P.M. Participants sat down with the legs being stretched and leaned forward as far as possible, pushing the measuring gauge away with the tips of their fingers. In this study, two trials were individually performed, and the average value was used for the analysis.

2.3. Clinical assessments

Symptomatology was evaluated with the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987), extrapyramidal side effects with the Drug Induced Extrapyramidal Symptoms Scale (DIEPSS) (Inada, 1996), and global functioning with the Functional Assessment for Comprehensive Treatment of Schizophrenia (FACT-Sz) (Suzuki et al., 2008). Alcohol use was assessed using the AUDIT (Babor et al., 1992;). Trained psychiatrists administered all clinical and diagnostic scales. In addition, other information collected included sex, age, height, weight, body mass index (BMI), illness duration, comorbidities of physical conditions, circumference of the waist, and daily doses of antipsychotics which were calculated to chlorpromazine equivalents (Inagaki et al., 1999).

2.4. Statistical analysis

As we did not have empirical data on which to base our estimations, no formal sample size calculation was performed. However, previous studies of this sort recruited about 72 to 524 patients (Piirtola and Era, 2006) and a sample size of 100 was expected to yield interpretable results. Categorical data were analyzed by using chi-square test. Spearman correlation coefficients were calculated to evaluate the relationship between postural measures (the total length of trunk motion, the range of trunk motion, and the Romberg ratio) and anteflexion measure. Stepwise multiple regression analyses with the Shapiro–Wilk test were used to examine the impact of the following factors on body stability (i.e. the total length of the trunk motion, the range of the trunk motion, and the Romberg ratio) and anteflexion, respectively: age, sex, BMI, chlorpromazine equivalent daily doses, PANSS positive symptoms, negative symptoms, and general psychopathology scores, DIEPSS overall severity score, and FACT-Sz score. These multiple regression analyses were also performed in a subgroup of subjects who did not show extrapyramidal symptoms (EPS), defined as a score of zero (normal) in all items of the DIEPSS. All statistical analysis was carried out using the Statistical Package for Social Science (SPSS) software for Mac. A two-tailed p-value <0.05 was considered statistically significant in all tests.

3. Results

3.1. Characteristics and dispositions of subjects

A total of 103 patients with schizophrenia-spectrum disorders were approached for possible participation in this study. One patient refused to participate and two patients were excluded because of current alcohol problems. Thus, 100 participants agreed to take part and completed the entire study procedure. Their demographic and clinical characteristics are summarized in Table 1. The most frequent diagnosis was schizophrenia ($n = 82$, 82.0%), followed by delusional disorder ($n = 12$, 12.0%) and schizoaffective disorder ($n = 6$, 6.0%). The antipsychotics used were: risperidone ($n = 26$, 26.0%), olanzapine ($n = 24$, 24.0%), clozapine ($n = 12$, 12.0%), fluphenazine ($n = 10$, 10.0%), quetiapine ($n = 7$, 7.0%), aripiprazole ($n = 6$, 6.0%), haloperidol ($n = 6$, 6.0%), blonanserin ($n = 4$, 4.0%), propericiazine ($n = 3$, 3.0%), perospirone ($n = 1$, 1.0%), and levomepromazine ($n = 1$, 1.0%). Twenty participants (20.0%) were treated with long-acting injectable antipsychotics, and 43 (43.0%) with antipsychotic polypharmacy. Comorbidities of physical conditions included hypertension ($n = 18$, 18.0%), diabetes mellitus ($n = 5$, 5.0%), hyperlipidemia ($n = 3$, 3.0%), Hashimoto's disease ($n = 1$, 1.0%), uterine cancer ($n = 1$, 1.0%), and pulmonary emphysema ($n = 1$, 1.0%).

3.2. Postural sway and flexibility

Anteflexion in sitting was significantly correlated neither with the length of the trunk motion, the range of the trunk motion, nor the Romberg ratio. Details on the correlations between postural stability and flexibility were shown in Table 2.