Available online at www.sciencedirect.com
ScienceDirect
Psychiatry Research 159 (2008) 281–289
PSYCHIATRY RESEARCH
www.elsevier.com/locate/psychres

Impairment of motor dexterity in schizophrenia assessed by a novel finger movement test

Akira Midorikawa [a,b,c], Ryota Hashimoto [d,e,f], Hiroko Noguchi [f], Osamu Saitoh [g], Hiroshi Kunugi [f], Katsuki Nakamura [b,c,*]

[a] *Department of Psychology, Chuo University, Tokyo, Japan*
[b] *Department of Animal Models for Human Disease, National Institute of Neuroscience, National Center of Neurology and Psychiatry, Tokyo, Japan*
[c] *CREST, Japan Science and Technology Agency, Saitama, Japan*
[d] *Osaka-Hamamatsu Joint Research Center for Child Mental Development, Osaka University Graduate School of Medicine, Osaka, Japan*
[e] *Department of Psychiatry, Osaka University Graduate School of Medicine, Osaka, Japan*
[f] *Department of Mental Disorder Research, National Institute of Neuroscience, National Center of Neurology and Psychiatry, Tokyo, Japan*
[g] *Department of Psychiatry, Musashi Hospital, National Center of Neurology and Psychiatry, Tokyo, Japan*

Received 5 May 2006; received in revised form 4 February 2007; accepted 6 April 2007

Abstract

Schizophrenia is characterized by a series of serious mental disturbances, including social, cognitive, and emotional dysfunctions. Although motor dysfunctions as well as the cognitive impairments in schizophrenia have been noted since the era of Kraepelin, little attention has been paid to motor dysfunctions until recently. Here, we examined the characteristics of motor dysfunctions and their relationship to other cognitive functions in schizophrenia. Subjects were 27 patients who met the DSM-IV criteria for schizophrenia and 49 healthy volunteers. A series of motor tests, i.e., pegboard, mirror drawing, normal drawing, and finger movement tests, were administered, and cognitive functions were assessed with the Wechsler Adult Intelligence Scale Revised, the Wechsler Memory Scale Revised and the Wisconsin Card Sorting Test. The finger movement test is a novel motor test that we developed to assess motor dexterity independent of motor speed. A stepwise discriminant analysis revealed that the finger movement and delayed recall tests were able to distinguish patients and controls most effectively. The scores of these two tests showed no correlation. Educational level was correlated with the delayed recall score, but not with the finger movement score. A significant difference was observed in the finger movement test score between inpatients and outpatients. There was no significant correlation between dosage of antipsychotic drugs and finger movement score in the patient group. The present results suggest that impairment in motor dexterity is a major characteristic of schizophrenia, which might be independent of cognitive functions.

Keywords: Schizophrenia; Motor function; Cognitive function; Education level

1. Introduction

Patients with schizophrenia have a wide spectrum of disturbances, including social, cognitive, and emotional dysfunctions. Of these, the most serious dysfunction may be cognitive impairment (Goldberg and Seidman, 1991),

* Corresponding author. Department of Animal Models for Human Disease, National Institute of Neuroscience, National Center of Neurology and Psychiatry, 4-1-1 Ogawa-Higashi, Kodaira, Tokyo 187-8502, Japan. Tel./fax: +81 42 346 1724.
E-mail address: katsuki@ncnp.go.jp (K. Nakamura).

0165-1781/$ - see front matter © 2007 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.psychres.2007.04.004

with the associated memory deficits (Saykin et al., 1991, 1994; Heinrichs and Zakzanis, 1998). Whereas motor dysfunctions, as well as cognitive impairments, have been noted since the time of Kraepelin (Kraepelin, 1919), research interest in motor activity diminished after the introduction of antipsychotic drugs, when symptoms of motor dysfunction were mainly interpreted as side effects. Nevertheless, motor function in schizophrenia has been revisited by recent investigators (e.g. Rogowska et al., 2004; Jahn et al., 2006).

The most remarkable motor dysfunction in schizophrenia may be the deficit in fine motor skills (Rosofsky et al., 1982; Manschreck, 1986). Three tests have most commonly been used to evaluate motor function in schizophrenia: the reaction time test to evaluate the speed of initial timing, the finger tapping test to examine the speed of continued oscillatory movement, and the pegboard test to determine motor dexterity (King, 1958; Heinrichs and Zakzanis, 1998). However, scores on the pegboard test are thought to be affected by motor speed as well as dexterity (Rosofsky et al., 1982). Therefore, the development of a motor test that can evaluate dexterity irrespective of motor speed would be beneficial. The examination of movement dexterity has recently received an increasing amount of attention because dexterity has been shown to be associated with functional outcomes (Lehoux et al., 2003). Furthermore, some studies have found that deficits in dexterity were greater in familial than in sporadic forms of schizophrenia (Sautter et al., 1997; Gschwandtner et al., 2005).

In this study, we attempted to elucidate motor dysfunction using some traditional tests and a newly developed test (finger movement test) in chronic schizophrenia. We also attempted to elucidate which among several motor and cognitive tests most effectively discriminated patients from controls.

2. Methods

The research protocol was approved by the ethics committee of the National Center of Neurology and Psychiatry (NCNP), Tokyo, Japan. Written informed consent was obtained from all subjects.

2.1. Subjects

The participants in the present study were 27 patients who met the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria for schizophrenia and 49 healthy volunteers (Table 1). The patients were under treatment at the Department of Psychiatry, Musashi Hospital, NCNP. A consensus diagnosis of schizophrenia was made by at least two psychiatrists based on clinical interviews, observations, and case notes. Patients had been clinically stable and maintained on a stable dose of antipsychotic medication for at least 3 months prior to the neuropsychological testing sessions. Among 27 patients, there were 15 inpatients under long-term care. Healthy volunteers from hospital staff and their associates who had no history of psychiatric treatment were recruited. The subjects had no history of central nervous system disease, severe head injury, alcohol/drug dependence, or mental retardation. They were biologically unrelated Japanese who resided in the same geographical area, the Western part of the Tokyo metropolitan area.

2.2. Procedures

We selected the following four motor function tests: pegboard, mirror drawing, normal drawing, and finger movement tests. The pegboard test has been widely used to evaluate motor dexterity (e.g. King, 1958; Heinrichs and Zakzanis, 1998). The mirror drawing test measures visuo-motor coordination and procedural learning, which have been shown to be impaired in patients with schizophrenia (Scherer et al., 2003). To assess whether deficits in the mirror drawing test depend on the mirroring procedure, a normal (non-mirror) drawing test using the same figure was also administered. In order to evaluate motor dexterity, excluding the effect of motor speed, we developed the "finger movement test". In addition to the motor domain, memory, intelligence, and executive functions were also examined, since such functions have been found to be impaired in schizophrenic patients (e.g. Bilder et al., 2000). The handedness of each subject was evaluated using the Edinburgh inventory (Oldfield, 1971). With the exception of the finger movement test, each motor test was performed with the dominant hand.

The grooved pegboard test (Matthews and Klove, 1964) was used with minor modifications, i.e., the subjects were asked to pinch aluminum rivet pins (3 mm in diameter, 1.5 cm in length) one by one and insert them into small holes arrayed in a 5×5 grid as fast as possible. The time (seconds) for completion was measured as the score. In the mirror drawing test (Milner et al., 1968), the subjects were asked to use a pencil to trace a shape, which was a modified hexagon with double lines (Fig. 1) while looking at it through a mirror apparatus (TAKEI Corporation, Tokyo, Japan). The width between the lines was 3 mm. At the beginning of a trial, the examiner put the tip of the pencil at the starting position and asked the subject to trace the shape as fast as