



Reduced word-repetition effect in the event-related potentials of thought-disordered patients with schizophrenia

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Received 4 February 2004; accepted 11 March 2004

Abstract

Repetition effect in event-related potentials (ERPs) was studied in 10 non-thought-disordered (non-TD) patients with schizophrenia, 8 thought-disordered (TD) patients with schizophrenia, and 10 normal control subjects while they performed a semantic categorization task with incidental word repetitions. All patients were in a stable or partially remitted stage. Although both healthy control and non-TD groups produced more positive ERPs to the repeated words than to the new words (ERP repetition effect) for 250–500 ms, the TD group did not show the ERP repetition effect. These findings suggest that the abnormal attenuation of the ERP repetition effect during semantic processing may be more prominent in schizophrenic patients with thought disorder than in those without the symptom.

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Keywords: Schizophrenia; Thought disorder; Priming; Semantic processing; Memory; N400; Vulnerability

1. Introduction

It has been suggested that schizophrenic symptomatology is composed of three or more symptom complexes, and formal thought disorder is one of the key features of schizophrenia (Buchanan and Carpenter, 1994). Because the clinical manifestations of

schizophrenia are heterogeneous, examining a patient group with a more homogeneous form of symptomatology, such as formal thought disorder, could help to elucidate the underlying neural and cognitive processing abnormalities at the core of the disorder. Recent studies have demonstrated that thought-disordered (TD) schizophrenic patients show abnormal patterns of behavioral response (Kuperberg et al., 1998) and brain activation (Kircher et al., 2001) during semantic processing compared with non-TD patients and healthy controls.

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According to the vulnerability model of schizophrenia (Nuechterlein and Dawson, 1984), formal thought disorder is a mediating vulnerability factor, and it comprises both state-dependent and trait-like characteristics. In fact, formal thought disorder associated with schizophrenia is known to vary with general psychopathology, and it remains after clinical improvement (Hurt et al., 1983). In addition, sub-clinical or mild thought slippage observed in relatives of schizophrenic patients (Johnston and Holzman, 1979; Shenton et al., 1989) confirms that there is a genetic component. Therefore, we believe that patients who exhibit a thought disorder during the stable phase have a deficit in cognitive processing that may be associated with trait-like, lasting vulnerability.

Event-related potentials (ERPs) have been used to investigate cognitive functions including language and memory, and evidence consistently suggests that ERPs evoked by repeated words are more positive than those evoked by words at first presentation (Rugg, 1995). When words are presented visually, this “ERP repetition effect” begins about 200–250 milliseconds poststimulus, lasts for several hundred milliseconds, and is generally maximal over the midline electrodes. The effect reflects several aspects of memory as well as some aspects of linguistic processing (Rugg and Nagy, 1987; Rugg, 1995). Previously, we demonstrated that the early phase of the ERP repetition effect was not evident in schizophrenic patients when words were repeated immediately during an implicit memory task and suggested that this ERP abnormality could reflect a deficit in on-line monitoring of consecutive stimuli (Matsuoka et al., 1999; Matsumoto et al., 2001).

Guillem et al. (2001, 2003) replicated the reduced ERP repetition effect in schizophrenia using face stimuli and suggested that this abnormality might be correlated with formal thought disorder but not with reality distortion (e.g., hallucinations and delusions). Therefore, if both face and word-repetition tasks recruit a common neural process, the reduced word-repetition effect on the ERP might be more prominent in patients with formal thought disorder than in those without the symptom.

To examine the possibility that the attenuation of the ERP repetition effect is sensitive to formal thought disorder, we recorded ERPs in stable schizophrenic patients with and without thought disorder while they

were performing a semantic decision task with incidental word repetition. Because there is some evidence that TD patients show behavioral or neural deficits during semantic processing and repetition memory tasks, we hypothesized that TD patients would exhibit an attenuation of the word-repetition effect in their ERPs compared with non-TD patients and healthy control (HC) subjects. In line with previous studies, we predicted that the deficit would be evident in the early phase of the ERP repetition effect.

2. Methods

2.1. Subjects

Eighteen patients recruited from the psychiatric unit at Tohoku University Hospital participated in the study after providing written informed consent. All were right-handed native speakers of Japanese. All patients met the DSM-IV criteria for schizophrenia. No patient showed additional DSM-IV Axis I disorder or history of substance abuse. All available clinical records were carefully screened. Fifteen patients had no prominent psychotic symptoms and thus met the criteria for residual type. Two patients met the criteria for paranoid type because of active hallucinations, and two patients met the criteria for the undifferentiated type. All patients were in a stable phase or partial remission.

Patients were assigned to groups according to the severity of formal thought disorder as assessed by the Thought Disorder Index (TDI) (Johnston and Holzman, 1979; Solovay et al., 1986), which is one of the most widely used scales for thought disorder. The TDI is sensitive to a wide range of types and severities, and it is an optimal measure for stable patients with mild and subtle cognitive slippage. The Rorschach test was administered by a trained psychologist. Tape-recorded verbal responses to the Rorschach test were scored by two raters who had no knowledge of the patient's diagnosis. The interrater reliability, tested by Spearman rank-order correlation, was 0.91. The mean total TDI score of all schizophrenic patients (6.5 ± 6.2) was used as a cut-off point by which patients were divided into two groups (Table 1), a non-TD group ($n=10$) and a TD group ($n=8$). The mean total TDI score was

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