Schizophrenia Research: Cognition 12 (2018) 50–55

Contents lists available at ScienceDirect

Schizophrenia Research: Cognition

journal homepage: www.elsevier.com/locate/scog

Research Paper

Effect of cognitive function on jumping to conclusion in patients with schizophrenia

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ARTICLE INFO

Keywords:
Neurocognition
Social cognition
Jumping to conclusion
Schizophrenia

ABSTRACT

The "jumping to conclusion" (JTC) bias is related to the formation and maintenance of delusions. Higher JTC bias can be based on both neurocognitive dysfunction and social cognitive dysfunction in patients with schizophrenia. The aim of this study was to assess the relationship between JTC bias, neurocognition, and social cognition in patients with schizophrenia.

A total of 22 patients with schizophrenia and 21 controls participated in this study. Neurocognition and social cognition were assessed using the Brief Assessment of Cognition in Schizophrenia (BACS) and Social Cognition Screening Questionnaire (SCSQ), respectively. The JTC bias and the decision confidence were assessed using the beads task.

The patients were classified into the JTC group (with higher JTC bias; n = 10) and JTC-non group (n = 12). The JTC group scored significantly lower on verbal memory, working memory, and motor speed sub-scores of BACS than the JTC-non group. No difference in social cognition was observed between the two groups. The decision confidence was predicted by metacognition, which is an SCSQ sub-score. Similarly to the patients, the controls were classified into the JTC group (higher JTC bias; n = 9) and the JTC-non group (n = 12). There were no significant differences in neurocognition and social cognition between the control JTC and JTC-non groups.

The present results indicated that JTC bias is related to neurocognition and decision confidence is related to social cognition in patients with schizophrenia. These findings may bridge the gaps between psychotic symptom and cognitive dysfunction in schizophrenia.

1. Introduction

Previous studies have argued that people with delusion show a "jumping to conclusion" (JTC) bias whereby they are willing to accept hypotheses on the basis of less evidence than non-delusional people and with greater confidence in their judgment than controls (Lincoln et al., 2010; Warman et al., 2007; Moritz and Woodward, 2002, 2004, 2005). The JTC bias is typically assessed using a probabilistic reasoning task known as the beads task. During the test, the participants are initially presented with two jars of beads, which are later hidden from them. The experimenter would choose of the two jars and draws as many beads as the participants choose to. The participants are subsequently requested to decide about the jar of origin. After each draw, the participants would be asked if they would like to draw more beads or if they could say, with decision confidence made on a 0–100 scale, from which of the two jars were the beads drawn. The JTC bias has been operationally defined based on the number of draws before making a decision. In particular, it has been recently suggested that JTC bias is defined when a decision is made after viewing less than three beads being drawn (Freeman et al., 2008; Ward et al., 2018).

Recent studies have reported JTC bias in persons with schizophrenia regardless of the clinical characteristics (Garety et al., 2013; Ochoa et al., 2014). The relationship between JTC bias, neurocognition, and social cognition were also investigated (Ochoa et al., 2014; Woodward et al., 2009; Buck et al., 2012), but the results were inconsistent. For example, in patients with schizophrenia, JTC bias was reported to be correlated (Ochoa et al., 2014; Woodward et al., 2009) or not correlated (Buck et al., 2012) with neurocognition. Similarly, different studies reported different results on the relationship between JTC bias and social cognition in patients with schizophrenia. Social cognition, including the theory of mind (ToM) and metacognition, refers to psychological processes related to perception, encoding, storage, retrieval,

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https://doi.org/10.1016/j.scog.2018.04.002
Received 1 February 2018; Received in revised form 25 April 2018; Accepted 27 April 2018

and regulation of information about ourselves and other people (Green et al., 2008, 2015). Woodward et al. (2009) reported a correlation between JTC bias and neurocognition, but not ToM. Buck et al. (2012) reported a correlation between JTC bias and metacognition in patients with schizophrenia. These inconsistencies might derive from methodological differences. For example, the studies assessed social cognition using only one psychological test (Woodward et al., 2009; Buck et al., 2012). Therefore, more comprehensive assessment of social cognition is needed to investigate the relationship between social cognition and JTC bias in patients with schizophrenia. Roberts et al. (2011) developed the Social Cognition Screening Questionnaire (SCSQ) to measure multiple domains of social cognition and differentiate performance in these domains from non-social cognition. The SCSQ includes subscales measuring the non-social domain of verbal memory and schematic inference, as well as social cognitive domains including ToM, metacognition, and hostile attribution bias. It is still not clear which of these social cognition domains are crucial for predicting JTC bias.

To the best of our knowledge, only few studies have assessed the relationship between JTC bias and both neurocognition and social cognition in patients with schizophrenia. Thus, the aim of this study was to assess the relationship between JTC, decision confidence, neurocognition, and social cognition in patients with schizophrenia using relevant measuring scales.

2. Methods

2.1. Participants

Twenty-two patients with schizophrenia were selected, including 12 men and 10 women with a mean age (± standard deviation [SD]) of 42.64 ± 10.11 years. All patients were diagnosed with schizophrenia based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria. At the time of study admission, the patients were clinically stable, as judged by the therapeutic psychiatrist after drug adjustment was completed. There was no remarkable change in their psychopathology during this study. The exclusion criteria were: (1) past history or presence of any serious medical and neurological disorders that affect the brain or cognitive functioning, such as epilepsy, serious head injury, or brain tumor; (2) drug or alcohol abuse; (3) active drug use in the past year.

Moreover, 21 demographically matched healthy controls were selected, including 11 men and 10 women. They were college students, hospital employees, or their acquaintances, with a mean age of 42.76 ± 10.67 years. All participants provided written informed consent and the study was approved by the institutional ethics committee of Tokushima University.

We originally recruited 23 patients and controls. However, one patient and two controls withdrew their consents before starting experiment.

2.2. Measures

2.2.1. Japanese adult reading test

To estimate the intellectual ability, we used a 25-item short version of the Japanese adult reading test (Nelson and Willison, 1991; Matsuoka et al., 2006).

2.2.2. Positive and negative symptoms

To assess the positive and negative symptoms, we used the Positive and Negative Syndrome Scale (PANSS). Higher scores indicated a greater level of symptom severity (Kay et al., 1987, 1991).

2.2.3. Depression

To assess depression, we used the Calgary Depression Scale for Schizophrenia (CDSS). The CDSS was specifically developed to distinguish depressive symptoms from positive and negative symptoms or antipsychotic-induced adverse effects. Higher scores indicated a greater level of depression (Addington et al., 1993; Kaneda et al., 2000).

2.2.4. Side effects

To assess drug-induced extra-pyramidal symptoms, we used the Drug Induced Extra-Pyramidal Symptoms Scale. Higher scores indicated a greater level of extrapyramidal adverse effects (Inada, 1996).

2.2.5. Neurocognition

To assess neurocognition, we used the Brief Assessment of Cognition in Schizophrenia (BACS). The domains of neurocognition that were evaluated by the BACS included verbal memory, working memory, motor speed, verbal fluency, attention and speed of information processing, and executive function (Keefe et al., 2004; Kaneda et al., 2007).

2.2.6. Social cognition

To assess social cognition, we used the Social Cognition Screening Questionnaire (SCSQ). The SCSQ has five domains including were verbal memory, schematic inference, ToM, metacognition, and hostility bias. The task comprised 10 short vignettes. Higher scores represented a better level in each domain, except for hostility bias, where higher scores reflected larger bias (Roberts et al., 2011; Kanie et al., 2014). We used the ToM, metacognition, and hostility bias as social cognition.

2.2.7. Decision confidence and JTC

To assess JTC and decision confidence, we used a probabilistic reasoning task known as the “beads task.” The task consisted of two neutral versions, including a ratio of beads at 85:15 (easy) and another at 60:40 (difficult). We used the difficult version because of its stronger association with neurocognition (Garety et al., 2013; Ochoa et al., 2014). Briefly, the participants were presented physical two jars, one containing 60 red beads and 40 blue beads and another containing 60 blue beads and 40 red beads. The two jars were then hidden and the participants were told that one of the jars would be selected at random by the experimenter who would then draw beads from it upon their request. The sequences of beads shown to the subjects were decided with reference to Huq et al. (1988) before starting experiment, while Ochoa et al.'s (2014) bead task is drawn beads by random. We employed Huq's way to control the order of the color of the presented beads. After each bead draw, the participants were asked if they would like to draw more beads or if they would like to make a decision about which of the two jars were the draws made form, with decision confidence on a 0–100 scale. The key variables were the number of beads indicated by the participants before making a decision and the decision confidence. High JTC bias was indicated when requesting two or fewer beads, while the JTC-non groups were indicated when requesting three or more beads (Freeman et al., 2008; Ward et al., 2018).

2.3. Statistical analysis

Data analysis was conducted using PASW Statistics 18 software (SPSS Inc., 2009). The comparison of the demographic indices between patients with schizophrenia and controls and between the JTC and JTC-non groups was carried out using unpaired Chi-squared test and Welch's *t*-test. In addition, Pearson's correlation coefficients were calculated to evaluate the relationship between decision confidence and cognitive function both in patients with schizophrenia and in controls. Finally, simultaneous multiple regression analysis was performed with decision confidence as the objective variable and clinical variables that have significant correlation with decision confidence as explanatory variables.

3. Results

The demographic indices and cognitive performances of patients with schizophrenia and controls are summarized in Table 1. The results