The relationship between cognitive insight and cognitive performance among individuals with at-risk mental state for developing psychosis

Noriyuki Ohmuro [a,*], Masahiro Katsura [a], Chika Obara [a], Tatsuo Kikuchi [b], Yumiko Hamaie [a], Atsushi Sakuma [a], Kunio Iizuka [a], Fumiaki Ito [a], Hiroo Matsuoka [a,b,c], Kazunori Matsumoto [a,b,c]

[a] Department of Psychiatry, Tohoku University Hospital, 1-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi, Japan
[b] Department of Psychiatry, Tohoku University Graduate School of Medicine, 2-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi, Japan
[c] Department of Preventive Psychiatry, Tohoku University Graduate School of Medicine, 2-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi, Japan

ABSTRACT

Impairments in cognitive insight—the capacity to appraise and modify one's own distorted beliefs—are believed to be associated with the formation of psychosis. Nevertheless, the association between cognitive insight and cognitive function among people with at-risk mental state (ARMS) for developing psychotic illness has not been made clear. In this study, we used the Beck Cognitive Insight Scale (BCIS) to assess cognitive insight and the Brief Assessment of Cognition in Schizophrenia (BACS) and the Wisconsin Card Sorting Test (WCST) to assess cognitive functions. Fifty subjects with ARMS and 29 healthy volunteers were recruited as participants. The scores for the two groups on the BCIS, BACS, and WCST were compared and Spearman's rank correlations between the domains of the BCIS and cognitive performance were examined in each group. No significant differences were found in BCIS scores between these groups, whereas all of the cognitive function scores were poorer in the participants with ARMS. In the ARMS group, higher self-certainty on the BCIS was significantly correlated with lower performance in the mean number of categories achieved ($\rho = -0.31$, $P = 0.03$) and perseverative errors of the Nelson type ($\rho = 0.29$, $P = 0.04$) on the WCST. This indicates that excessively high self-certainty might be linked with weaknesses in cognitive flexibility or set-shifting ability in people with ARMS.

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1. Introduction

For decades, numerous researchers have explored the factors contributing to the onset of psychosis. For example, insight into ones' own illness, that is, "clinical insight," has been believed to be one of the main factors that influences the differences between individuals with fully psychotic illness and those with subthreshold symptoms (Lappin et al., 2007). In this line, the "cognitive model" is suggested to be a promising model for explaining the cognitive mechanisms relating to the onset of psychosis and maintenance of positive symptoms (Garety et al., 2001) and has been supported by accumulating neurobiological findings (Garety et al., 2007). This model underscores the role of biased processes of reasoning and appraisal of anomalous experiences or thoughts. In the same vein, Beck et al. (2004) proposed the concept of "cognitive insight." This was defined as the ability in individuals with psychosis to re-evaluate their own anomalous experiences and correct distorted beliefs and misinterpretations regarded as associated

with the development and maintenance of psychotic symptoms. Given the proposal that the critical determinant of psychosis may be appraisal of anomalous experiences (Garety et al., 2001, Lappin et al., 2007, Morrison and Baker, 2000), cognitive insight should also be one of the critical factors that influences differentiation between psychosis and non-psychosis. To measure an individual's capacity for cognitive insight, Beck et al. (2004) developed the Beck Cognitive Insight Scale (BCIS).

The BCIS is a 15-item self-report questionnaire that comprises two principle components—"self-reflectiveness," which includes 9 items assessing the ability to re-evaluate unusual experiences and correct erroneous judgments, and "self-certainty," which comprises 6 items representing one's tendency to be overconfident about one's own judgment. Previous studies have corroborated the reliability and validity of the BCIS (e.g., Pedrelli et al., 2004; Uchida et al., 2009) and showed that individuals with psychotic disorders exhibit lower cognitive insight (Engh et al., 2007; Martin et al., 2010; Warman et al., 2007). Furthermore, cognitive insight has been found to be associated with positive and negative symptoms (Bora et al., 2007; Pedrelli et al., 2004; Tranulis et al., 2008); neurocognitive dysfunctions (Nair et al., 2014, for a review); and variations in brain structure, including hippocampal volume (Buchy et al., 2010) and volume of the frontal, parietal, and temporal cortices (Buchy et al., 2016).

Although cognitive insight has been hypothesized to influence the onset of psychosis and maintenance of positive symptoms, its nature in individuals with a high risk for developing psychosis remains unclear. So far, only two studies have investigated this topic. One study (Uchida et al., 2014) found impairments in cognitive insight—namely, excessively high self-certainty—and a relationship between high self-certainty and attenuated delusional symptoms in individuals with the at-risk mental state (ARMS; Yung et al., 2004). In the other study, however, individuals with ARMS showed intermediate self-certainty scores between healthy controls (HCs) and individuals with schizophrenia, who showed significantly higher self-certainty scores than did HCs (Kimhy et al., 2014). Furthermore, Individuals with ARMS with markedly severe unusual thought content showed significant associations between high self-certainty and high suspiciousness. Thus, excessively high self-certainty might underlie the severity of attenuated psychotic symptoms in ARMS.

Recently, the relationship between cognitive insight and cognitive functions has drawn the interest of some researchers. One recent meta-analysis of seven studies in patients with psychotic disorders revealed that a composite index of cognitive insight was positively associated with total cognition, memory, and executive function (Nair et al., 2014). On the other hand, different relationship between sub-components of cognitive insight, that is, self-certainty and self-reflectiveness, and cognitive functions were also observed; higher self-certainty was significantly related to poorer performance on total cognition, IQ, and memory; however, there was no significant correlation between self-reflectiveness and performance in any neurocognitive domain. However, as was noted by the authors of the study, there were several limitations in this meta-analysis; the pooled sample of this meta-analysis was demographically and clinically heterogeneous; categorization of cognitive tests was somewhat crude; relatively recent and limited literature might increase publication bias. In fact, significant correlation between self-certainty and executive function (Cooke et al., 2010; Gilleen et al., 2011; Orfei et al., 2010) and those between self-reflectiveness and working memory (Orfei et al., 2010) and verbal memory (Buchy et al., 2010) were observed in individual studies, even though the meta-analysis failed to find such associations. Therefore, the relationship between cognitive insight and cognitive function does not appear to have been conclusively determined and further study is necessary.

To date, however, there has been no study on the relationship between cognitive insight and neurocognitive function among individuals with ARMS, that showed neurocognitive dysfunctions similar to full psychosis, including verbal memory, visual memory, processing speed, general intelligence, and executive function (Fusar-Poli et al., 2012; Bora et al., 2014). Thus, in the current study, we investigated the correlations between cognitive insight and cognitive performance in individuals with ARMS and compared them with correlations in healthy controls. We hypothesized that similar to full psychosis, cognitive functions in subjects with ARMS correlate with their poorer cognitive insight, particularly with self-certainty.

2. Methods

2.1. Participants

Fifty subjects with ARMS and 29 HCs who were Japanese speakers and aged between 14 and 35 participated in this project. The participants with ARMS were users of the SAFE Clinic, an expert clinical setting for individuals with ARMS (Mizuno et al., 2009; Katsura et al., 2014). The data shown in this article are baseline data collected from individuals with ARMS who provided their informed consent on participation in this project. The Comprehensive Assessment of At-Risk Mental States-Japanese version (CAARMS-J; Miyakoshi et al., 2009) was used to confirm whether the participants fulfilled the ARMS eligibility criteria. The participants had to meet at least one of the criteria for ARMS established by the PACE Clinic (Yung et al., 2004) and not have

a history of psychotic disorders. Most participants with ARMS in this study were also involved in another study that we had previously published; more details on the recruitment criteria used in the present study are described therein (Ohmuro et al., 2015).

The individuals in the HC group were university students recruited through intramural advertisements. A declaration by the participants in a brief interview confirmed that they did not have any history of psychiatric illness.

The present study received approval from the local ethics committees. Informed consent was provided by all the participants.

2.2. Measures

2.2.1. Clinical assessments

In the ARMS group, psychopathology was evaluated with the CAARMS-J and the Positive and Negative Syndrome Scale (Kay et al., 1987), the severity of subjective depressive symptoms with the Beck Depression Inventory-II (Beck et al., 1996), and Global function with the Global Assessment of Functioning (American Psychiatric Association, 1994). Estimated premorbid IQ was evaluated using the Japanese version of the National Adult Reading Test (JART, Matsuoka et al., 2006; original National Adult Reading Test by Nelson, 1982) for both groups.

2.2.2. Assessment of cognitive insight

The BCIS (Beck et al., 2004) is a self-report questionnaire containing 15 items, each rated from 0 (do not agree at all) to 3 (agree completely). Two component scores are calculated from these items: self-reflectiveness and self-certainty. Furthermore, a composite index indicating overall cognitive insight is calculated by subtracting the self-certainty score from that of self-reflectiveness, with higher scores indicating higher cognitive insight. We administered the Japanese version of the BCIS, which has confirmed reliability and validity (Uchida et al., 2009), to both groups.

2.2.3. Assessment of cognitive function

2.2.3.1. The brief assessment of cognition in schizophrenia (BACS). The Brief Assessment of Cognition in Schizophrenia (BACS) (Keefe et al., 2004), Japanese version (Kaneda et al., 2007), was administered by trained psychologists to assess subjects' overall and various specific types of neurocognitive performance. The BACS comprises six subtests: verbal memory, working memory, motor speed, verbal fluency, attention and processing speed, and executive function. Furthermore, a composite z-score was provided based on the results of the HC group, following the method of Keefe et al. (2004) because this method, as compared to the way of using the existing normative data set, enabled us to control for the scores of participants using covariates such as premorbid IQ. For the BACS, higher scores indicate better performance. All subjects were assessed with the BACS within two weeks of being assessed with the BCIS.

2.2.3.2. The Wisconsin card sorting test (WCST). The Wisconsin Card Sorting Test (WCST; Heaton, 1981) has been frequently used as a neuropsychological test for assessing certain types of executive function, in particular set-shifting ability (Greve et al., 2005; Nyhus and Barceló, 2009). We adopted this test to complement the BACS, because executive function as evaluated with the BACS is measured as the ability to mentally manipulate balls into indicated goals; as such, it lacks accurate assessment of deficits in other types of executive function, such as difficulty in set-shifting or a tendency to perseverate. In this study, we administered the modified computerized version of the WCST (i.e., the Keio version: Kashima et al., 1987) to both groups within two weeks of their being assessed with the BCIS. In this test, four stimulus cards illustrating one to four colored-geometric figures are presented in the upper part of the screen, while 48 response cards are shown in order