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Impaired central coherence in patients with anorexia nervosa

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ABSTRACT

The purpose of this study was to investigate the characteristics of central coherence in patients with anorexia nervosa (AN). 22 female patients with AN (median age = 31.50 (QD = 8.13) years) and 33 female healthy controls (HC) (median age = 28.00 (QD = 8.50) years) participated in the study. Their central coherence was assessed with the Rey Complex Figure Task (RCFT). Clinical symptoms were evaluated with the Beck Depression Inventory-II and the State-Trait Anxiety Inventory-Form JYZ. The results showed that AN patients' Central Coherence Index and accuracy scores in copy, 3-min delayed recall and 30-min delayed recall tasks of the RCFT were significantly lower than those of HC. Moreover, the significant differences in Central Coherence Index score in copy task and accuracy scores in 3-min delayed recall and 30-min delayed recall tasks remained when the effects of depression, anxiety and starvation were eliminated statistically. These findings may explain some characteristics of AN patients such as focusing on local rather than global picture in their perception of body or life.

1. Introduction

Since previous studies have reported that some traits of autistic spectrum disorder were often observed in anorexia nervosa (AN) patients, cognitive dysfunction found in autistic spectrum disorder patients have been paid attention to in the research of AN (Nilsson et al., 1999; Okuhira, 2008). So far, set-shifting, central coherence and social cognition of AN patients have been investigated to find the neurocognitive factors associated with pathology of AN (Tenconi et al., 2010; Kanakam et al., 2013; Oldershaw et al., 2010), and it is also reported that cognitive deficits were found in healthy relatives of AN patients (Roberts et al., 2010).

Holliday et al. found that difficulty of set-shifting in AN patients was not a consequence of starvation (Holliday et al., 2005), and other researchers also reported that impaired set-shifting was not due to the influence of other psychiatric symptoms. Regarding social cognition, previous studies reported that AN patients had impaired metacognition and theory of mind (Dapelo et al., 2015; Davenport et al., 2015; Olstad et al., 2015; Harrison et al., 2009, 2010), and we also found that impairment in metacognition and theory of mind was not caused by depression, anxiety and lowered body mass index (BMI)(Hamatani et al., 2016).

On the other hand, although some researchers reported that AN patients had weak central coherence that leads to their focus on local rather than global processing, particularly in visuospatial domain (Lopez et al., 2008), research on central coherence in AN patients seems to be at the initial stage. Zuchova et al. found a significant negative correlation between recall accuracy in central coherence test and the Eating Disorders Examination Questionnaire score and no association between BMI and central coherence ability (Zuchova et al., 2013). Moreover, it is reported that weak central coherence was found in healthy relatives of AN patients (Tenconi et al., 2010). However, Lang et al. (2016) reported that there was no difference in performance in Rey Complex Figure Test between recovered AN and healthy controls (HC) groups. Their finding suggests that poor central coherence observed in AN patients might be due to their clinical symptoms.

As it seems unclear whether poor performance in central coherence of AN patients is caused by their clinical symptoms such as depression, anxiety and starvation state (Gillberg et al., 2007; Lopez et al., 2009; Southgate et al., 2008), the purpose of this study is to elucidate it.

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2. Methods

2.1. Subjects

Clinical data were collected at Department of Psychiatry, Tokushima University Hospital from 1 March 2015 to 31 December 2016. Subjects were 22 female patients having a DSM-5 (American Psychiatric Association, 2013) diagnosis of AN and 33 female HC. Patients were excluded if they presented with any organic central nervous system disorder, epilepsy, mental retardation, severe somatic disorder or substance dependence. Of 28 patients, 23 agreed to participate in the study. However, as one patient did not complete all the assessments, data from 22 were used for analysis. Of 22, four had diagnosis of other psychiatric disorders (one had major depressive disorder, one panic disorder, one borderline personality disorder and one dissociative identity disorder) and 12 were taking psychotropic drugs (five were taking antidepressant drugs, four antipsychotic drugs and six anxiolytic drugs). As for HC, subjects were excluded if they had a history of any psychiatric disorder, if their score of depression or anxiety was not within the range of mean ± 2SD or if their body mass index (BMI) was not within normal range (18.5–24.9) (World Health Organization Expert Committee on Physical Status, 1995). The subjects of HC were recruited from students and staffs at Tokushima University and their acquaintances.

All subjects were native Japanese speakers and gave us written consent to participate in the study.

2.2. Measures

Subjects were examined by experienced clinical researchers using the following measures.

2.2.1. Japanese Adult Reading Test (JART)

To evaluate intellectual ability, we used the JART (Matsuoka et al., 2006) that is the Japanese version of the National Adult Reading Test (Nelson and Willison, 1991). In this study, 25-item short version of the JART was used.

2.2.2. Beck Depression Inventory-II (BDI-II)

The Japanese version of the BDI-II (Beck et al., 1996; Kojima et al., 2002) was used to assess depressive symptoms. The BDI-II consists of 21 self-report items and each item is rated on a 4-point scale. Higher score indicates severer level of depression.

2.2.3. State-Trait Anxiety Inventory-Form JYZ (STAI-JYZ)

The STAI-JYZ (Hidano et al., 2000) is the Japanese version of the STAI (Spielberger et al., 1983). It was used to evaluate state anxiety in this study. It consists of 20 self-repot items and each item is rated on a 4-point scale. State anxiety reflects evoked anxiety to a temporary situation. Higher score indicates higher level of anxiety.

2.2.4. Rey Complex Figure Test (RCFT)

The RCFT (Rey, 1941) is a tool to evaluate degree of central coherence in the drawing process (Booth, 2006). First, subject was told to copy the figure on a blank piece of paper. Second, the figure was removed and subject was asked to re-draw the figure 3 min later (3-min delayed recall). Third, thirty minutes after the 3-min delayed recall task, subject was asked to re-draw the figure (30-min delayed recall) (Yamashita, 2007). Accuracy score was calculated using a scoring system developed by L.Taylor. Higher accuracy score indicates better visual memory ability. Central Coherence Index (CCI) was also calculated from the style index and the order index (Lopez et al., 2008; Booth, 2006) Higher CCI score indicates better global processing ability.

2.2.5. Eating Disorder Inventory-2 (EDI-2)

AN patients were assessed with the Japanese version of the EDI-2 (Garner, 1991; Shimura et al., 2003). It consists of 53 self-report items and has nine subscales that are Drive for thinness, Body dissatisfaction, Bulimia, Interoceptive confusion, Interpersonal difficulty, Negative self-image, Compulsion for control, Impulse regulation, and Maturity fears.

2.3. Statistical analysis

Data analysis was performed using the PASW Statistics 18 software (SPSS Japan institute 2009). The comparison of demographic variables and scores of clinical variables including the RCFT between AN and HC groups was carried out using Mann-Whitney U test, and r(Z/√N) was calculated to provide effect sizes, with an effect size of >0.1 defined as small, >0.3 as medium and >0.5 as large (Field, 2005; Cohen, 1988). Then, in order to investigate whether there is still a significant difference in scores of the RCFT between the two groups when controlling for the effects of other clinical and demographic variables, analysis of covariance test (ANCOVA) was performed with the variables that showed significant differences in the preceding comparison as covariates. Since it is reported that ANCOVA is available if dependent variables show normal distribution or homoscedasticity (Olejnik and Algina, 1984), after confirming that there is no strong correlation between the covariates in each group and no significant deference of the correlation coefficients among the covariates between the two groups, we chose ANCOVA as a next step. η_p^2 (SS effect / (SS effect + SS error)) was calculated to provide effect sizes, with an effect size of >0.01 defined as small, >0.06 as medium and >0.14 as large (Cohen, 1988).

2.4. Ethical considerations

This study was approved by the Clinical Research Ethics Committee of Tokushima University Hospital.

3. Results

Demographic and clinical variables in AN and HC groups are shown in Table 1. There was no significant difference in age and estimated level of intelligence quotient between the two groups. AN group presented a significantly lower BMI ($U = 0.00$, $p < 0.0001$, $r = 0.84$) than HC group. And there were significant differences in the BDI-II score ($U = 48.50$, $p < 0.0001$, $r = 0.73$) and the STAI-JYZ state anxiety score ($U = 98.50$, $p < 0.0001$, $r = 0.61$) between the two groups.

Scores of the RCFT in AN and HC groups are shown in Table 2. There were significant differences in copy accuracy ($U = 219.50$, $p = 0.011$, $r = 0.34$), copy CCI ($U = 220.50$, $p = 0.014$, $r = 0.33$), 3-min delayed accuracy ($U = 195.00$, $p = 0.004$, $r = 0.39$), 3-min delayed order ($U = 204.50$, $p = 0.006$, $r = 0.37$), 3-min delayed CCI ($U = 203.00$, $p = 0.006$, $r = 0.37$), 30-min delayed accuracy ($U = 177.50$, $p = 0.001$, $r = 0.43$) and 30-min delayed CCI ($U = 222.50$, $p = 0.016$, $r = 0.33$) between the two groups.

ANCOVA with scores of the BDI-II, the STAI-JYZ state anxiety and BMI as covariates showed significant differences in scores of copy CCI ($F(1, 50) = 6.014$, $p = 0.018$, $\eta_p^2 = 0.09$), 3-min delayed recall accuracy ($F(1, 50) = 8.09$, $p = 0.006$, $\eta_p^2 = 0.11$) and 30-min delayed recall accuracy ($F(1, 50) = 7.46$, $p = 0.009$, $\eta_p^2 = 0.10$) between the two groups.

4. Discussion

Cognitive dysfunction in patients with mental disorders has been paid attention to and poor cognitive function has been widely reported. However, previous study reported a significant correlation between depression severity and cognitive performance (McDermott and Ebmeier, 2009), suggesting that their impaired cognitive function might be caused by coexisting symptoms. Therefore, although it has