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Neurocognition, Social Cognition and Symptoms in Schizophrenia

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Abstract

The purpose of this study was to investigate the neurocognition (intelligence, executive function), social cognition (theory of mind, jumping to conclusion), and symptoms in schizophrenia. The relationship among each variables was examined. Performance of 47 stable outpatients with schizophrenia and 34 controls was compared on all test. The STATA 10.0 program was used for nonparametric tests(χ^2 Mantel-Hanenszel test, Wilcoxon rank sum test, Spearman's rank correlation) with propensity score analysis. Korean-Wechsler intelligence scale, Wisconsin card sorting test(WCST), hinting task, false belief task, beads test, and schedule for the assessment of positive/negative symptoms were used as measurements. The patients with schizophrenia performed worse than controls in neurocognition and social cognition tests. Performance of false belief task was correlated with IQ, and related on errors of WCST negatively in patients. Negative symptom had negative relationship with performance of beads test(draw of certainty). Through the finding of this study, social cognition is highly recommended as a new target of nursing intervention for schizophrenia.

Keywords: *Schizophrenia, Cognition, Symptom*

1. Introduction

The schizophrenia is characterized by poor social functions and cognitive impairment. Neurocognition including attention, information processing, memory, learning ability, and executive function may be related to social problem solving[1]. More recently, social cognition may be even more strongly account for the social outcome in patient with schizophrenia [2, 3]. Social cognition has been generally defined to represent social information[4]. Also, social cognition has been proposed as possible mediators of the relationship between neurocognition and social function in schizophrenia [3]. There are several domains of social cognition including emotion perception, theory of mind (ToM), jumping to conclusion (JTC), and etc. Patients with schizophrenia tend to focus on menacing stimuli selectively, it make them not to understand intention of other people. Also, such cognitive biases may give rise to form persecutory delusions [5].

Theory of mind (ToM) have known as representing human mental state and inference of another's intention. Sprong, Schothorst, Vos, Hox and van Engeland [6] analyzed previous studies about ToM, published between 1993 and 2006. According to the results, estimated overall effect size was large and showed significant and mild ToM impairment in schizophrenia. The patients with schizophrenia showed lower capacity to judge facial affect and intention of others than normal control group. ToM deficit was observed for those with

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schizophrenia who had persecutory delusion [7]. Accordingly, one significant account for delusion hypothesis that a reasoning bias leads to delusion formation. Garety and Freeman [8] proposed that there is strong evidence for a reasoning bias in people with delusions which is best described as a data-gathering bias, a tendency for them to gather less evidence than controls so that they jump to conclusions(JTC). The patients with schizophrenia who has clinical symptoms tend to show JTC[9]. They try to make decisions impatiently on the basis of limited evidence in a undefined situation, so they draw a conclusion incorrectly using insufficient informations[10].

The factors of social cognition could be useful concept to understand symptoms and neurocognition in schizophrenia. If elements related to social cognition deficit can be identified clearly, it can be useful data for developing new approach to modulate processing of cognition. But previous empirical evidences based on social cognition are insufficient and limited in terms of domains and method of evaluation. Therefore, in the present study, we evaluated the social cognition by using revised Korean version task reducing reading efforts. The aims of our study was to compare cognitive functioning of patients with schizophrenia to normal control group, and investigated relations among social cognition, neurocognition, and symptoms. Clinical group to provide advanced knowledge in the understanding of chronic schizophrenia in community.

2. Methods

2.1. Participants

Participants were each recruited from three community psychiatric centers in city of Deajon, Korea. All patients were in remission, defined as not in need of hospital admission. Forty seven outpatients with schizophrenia and thirty four normal controls participated in this study. Drug abuse, comorbid medical disorders, and neurological disease history were exclusion criteria. All participants provided informed consent prior to participation and this research was approved by the Daejeon institute of science and technology research ethical council. The duration of the time for assessment was approximately 70~100 min. All participants had resting period for 10 min per every 30min through testing. We explained in advance that they could refuse the test whenever they want to.

2.2. Statistical Analyses

Statistical analysis was carried out using STATA 10.0 program. Shapiro-Wilk test was conducted to check normal distribution of main continuous variables. In this result, there was no normal distribution except relationship change. And then, non-parametric method was conducted. Descriptive statistics were computed for general characteristics in overall subjects and clinical characteristics in patient group. χ^2 Mantel-Hanenszel test and Wilcoxon rank sum test were used to identify homogeneity between patients and normal control group. To test on differences in neurocognition and social cognition between patients and control group, propensity score matching method was used to control the age and education variables not being homogeneous between groups. A propensity score is the likelihood that a patient received a treatment given all the observed covariates. It is a conditional probability of receiving treatment and thus always has a value between 0 and 1. Propensity score analysis is an effective statistical method to reduce selection bias and further derive causal effects in observational studies. It also provides an alternative approach to the classical multivariate regression, stratification, and matching techniques for examining the effects of nursing interven with a large number of confounding covariates in the background [11]. We also used

Spearman's rank correlation to explore the relations among neurocognition, social cognition, and symptoms.

3. Measures

3.1. Neurocognition

a. Intelligence assessment

We used the short version of the Korean Wechsler Adult Intelligence Scale [12]. The short version is useful for psychiatric patients who have difficulty concentrating and who lack motivation. It has been confirmed to have good reliability when used in clinical settings[13].

b. Wisconsin Card Sorting Test: WCST

We used computerized version for Wisconsin Card Sorting Test [14] to measure executive functioning. Participants are required to match to one of four key cards based on unnamed matching criterion. The rules of allocating the cards were made known to the participants. Related abilities include planning, sequencing, concept formation, set shifting, and maintenance, primarily involved in organizing.

3.2. Social Cognition

a) Hinting Task

The Hinting task[15] is a instrument to test abilities of inferencing real intentions behind indirect speech utterances. In the original version of the task, there are 10 passages explaining dialogue between two characters. At the end of each passages, one of the characters gives an obvious hint. Participants were asked what the character really meant. An appropriate answer was given two points. If they response inappropriately, further information is given to the participant and a subsequent appropriate answer is given one point. We revised English version task to Korean cartoon forms. Then, a few words were revised again to limit a difference of cultural meaning.

b) False belief task

False belief task was taken from Frith and Corcoran [16] that consisted of six stories to assess understanding of first and second order false beliefs. The cartoons were showed to the participants. There are question at the end of each passages, question about mental state of character.(0= incorrect answer and 1= correct answer). We revised English version task to Korean cartoon forms.

c) Beads task

To measure the tendency of a data gathering bias known as the jumping to conclusion, we used computerized version outlined by Garety, Hemsley and Wessely [17] was used as follows. Four jars each containing 100 beads of two different colors were used, two jars in each conditions. In the first conditions to exam draws decision, the two jars contained black and yellow beads in the proportions (85: 15); in the second condition to exam draw certainty, the jar contained green and red beads in the same proportions. In both conditions, two jars were hidden from view, and beads from selected jar were shown to the participants one at a time in predetermined order. In the first condition, the participants were allowed as many beads as they needed to be completely sure as to which jar had been chosen. In the second condition, participants were shown 10 beads only. Participants were asked after each draw to indicate their estimates of the likelihood of jar a having been selected and put a mark on a degree of confidence from 0 percent to 100 percent.

3.3. Clinical Symptoms Assessment

We assessed clinical symptoms by the Scale for Assessment of Positive and Negative Symptoms of Schizophrenia (SAPS and SANS). [18, 19]. The SAPS provides item ratings(from 0 for absent, to 5 for severe) for specific positive symptoms as well as global ratings for the subscales of hallucinations, delusions, bizarre behavior, and positive thought disorder. The SANS provides item ratings for specific negative symptoms as well as global ratings for the subscales of alogia, avolition, anhedonia, and concentration.

4. Results

4.1. Demographic and clinical characteristics

Table 1 summarized the demographic and clinical details of the patient and control groups. Patient group were composed of thirty one male (66.0%) and sixteen female (34.0%). Normal controls have seventeen male (50%) and seventeen female (52.9%). Mean age of patients group was 36.6 (20~55) and control group was 30.1 (19~44). Mean education level of patients group was 13.5 (SD=1.79), normal controls was 14.1 (SD=0.81). There were significant differences between patients and normal controls on age (Z=-3.40, p=.001) and year of education (Z=2.04, p=.042).

The result of clinical assessment for patients with schizophrenia was presented in Table 2. Mean age of onset was 26 (SD=4.32). Duration of illness was 11.1 (SD=6.45). Mean of medication (daily chlorpromazine equivalents dose) was 280.0mg (SD=202.35). Chlorpromazine equivalents for second-generation antipsychotics were calculated as suggested by Woods [20]. The score of positive symptom was 26.9 (SD=22.51), and negative symptom was 25.3 (SD=19.31).

Table 1. Comparison of the General Characteristics between Patients and Controls

Characteristics	Category	Pt.(n=47)	Con.(n=34)	Mantel-Hanenszel	P
		N(%) or M±SD	N(%) or M±SD	χ^2 or Z	
Sex	Male	31(66.0)	16(47.1)	2.86	.091
	Female	16(34.0)	18(52.9)		
Age		36.6±8.73	30.1±6.11	-3.40	.001
Education(yrs)		13.5±1.79	14.1±0.81	2.04	.042

§ Pt.=Patient Group, Con.=Control Group

Table 2. Clinical Characteristics in Patient Group

Characteristics	M±SD	Range
Onset age (yrs)	26±4.32	18~51
Period of disease (yrs)	11.1±6.45	1~29
Medication(Chlorpromazine Equivalent)	280.0±202.35	100~1000
Positive symptom (0~175)	26.9±22.51	0~85
Negative symptom (0~120)	25.3±19.31	0~66
Interpersonal relationship(25~125)	75.6±13.48	45~100

4.2. Group Differences

Table 3 shows group differences regarding neurocognition and social cognition 6 samples of severe outlier (10~20) and irrational data by lack of understanding in beads test were excluded in this analysis. We used propensity score matching method to control the differences in age and education between groups and checked that group differences of age and education were disappeared after matching through balance test (age p=.669~.809, education p=529~.760). In the result of test on difference by propensity score matching, there were significant differences between groups on IQ (t=-7.90, p<.001), WCST (WCST-TE t=3.28, p<.001, WCST-PE t=3.75, p<.001), Hinting task (t=-6.85, p<.001), false belief task(t=-2.01, p<.05), and JTC(draw certainty t=2.43, p<.05).

4.3. Relationship Among Neurocognition, Social Cognition, and Symptoms in Patient Group.

Spearman correlation analysis were used to identify the relationship among neurocognition(IQ, Wisconsin card sorting test), social cognition(false belief task, hinting task, jumping to conclusion), and symptoms(SAPS, SANS)(Table 4). First, false belief was significantly correlated with education(r=.301, p<.05), IQ (r=.410, p<.001), and WCST – TE(r=-.340, p<.001), WCST –PE (r=-288, p< .05). Beads test(draw of certainty) was significantly correlated with IQ(r= -300, p<.05), negative symptoms(r=-402, p<.001). Meanwhile, there were no association between medication dose and other variables. Also, positive symptoms was not related with any other variables.

Table 3. Differences in Neurocognition and Social Cognition between Patients and Controls

Category	Variable	Unmatched			Propensity Score Matched			t
		Pt(M) (n=47)	Con(M) (n=34)	Difference (M±SD)	Pt(M) (n=33)	Con(M) (n=34)	Difference (M±SD)	
Neuro cognition	IQ	103.2	121.8	18.7±2.39	102.6	124.7	-22.1±2.79	-7.90**
	WCST-TE	56.2	33.9	22.3±4.88	53.7	28.6	25.1±7.64	3.28**
	WCST-PE	34.0	17.5	16.5±3.68	34.8	14.3	20.5±5.46	3.75**
Social cognition	Hinting task	14.8	17.8	-3.1±0.59	14.4	18.6	-4.2±0.61	-6.85**
	False belief task	8.5	9.9	-1.4±0.68	8.4	10.4	-2.0±0.99	-2.01*
	draws of decision	2.1	2.6	-0.5±0.31	2.0	2.1	-0.1±0.62	-0.17
	draw of certainty	83.8	80.2	3.6±4.15	85.9	60.0	25.9±10.62	2.43*

§ Pt.=Patient Group, Con.=Control Group *p<.o5, **p<.01

Table 4. Correlation of Neurocognition, Social Cognition and Symptoms

	Medication	Education	IQ	WCST -TE	WCST -PE	Positive Symptom	Negative Symptom
Hinting Task	.015	.063	.132	-.009	.105	.034	-.292
False Belief task	-.039	.301*	.410**	-.340**	-.288*	.533	-.050
Beads test 1 (draws of decision)	.068	.193	.201	-.007	-.053	.167	.431
Beads test 2 (draw of certainty)	-.102	.026	-.300*	-.215	-.031	-.414	-.402**

§ WCST-TE: Wisconsin Card Sorting Test–Total Errors, WCST-PE: WCST–Perserverative Errors
*p<.o5, **p<.01

5. Discussion

This study was conducted to investigate impairment of neurocognition (IQ, executive functioning) and social cognition (theory of mind, jumping to conclusion) in patients with schizophrenia. We examined differences of performance between patients with schizophrenia and normal control group, and associations among all variables in patients.

First, the mean of onset age in patients was mid-20s and duration of illness was more than 10 years. The patients were worse than normal controls on the performances of all tasks involving IQ, WCST and theory of mind task.

Patients showed poor executive functioning such as concept formation, problem solving ability, and cognitive flexibility on WCST. In patient group, the score of hinting task, false belief task and jumping to conclusion was lower than controls. In line with the findings of Pickup and Frith [21], patients were poor at interpreting and understanding the social cues and mental states (thought, intention) of other people. In the present study, patients have normal IQ and remission state. Although, they still performed more worse than healthy controls on ToM task. In particular, patients have more difficulties performing on the false belief task than hinting task. There is JTC tendency to make a hasty decision for patients. They did require less beads to make decisions and had more certainty just as they decide. It is supported that patients with schizophrenia tend to make decisions incorrectly not being able to tolerate uncertainty. They can not suspend judging and gathering sufficient informations when confronted with a disconfimatory situation. Similar to our findings, Garety, Hemsley and Wessely [17] proposed that deluded or paranoid patients with schizophrenia requested less information before reaching a decision and were more ready to change their estimates in a probablistic inference task.

Notes on relationships among social cognition, neurocognition, and symptoms are as follows. First, performances on false belief task were related with performance of IQ and have negative relationship with errors of WSCT. But we could not find an association between hinting task and any other neurocognitive variables. This findings proposed that false belief task more required cognitive effort and executive functions to perform. Consistent with these findings, other previous studies reported that ToM have strong correlated with working memory in stable schizophrenia[22] and executive function was related to concrete social cue recognition[23]. And any relation on ToM(hinting task and false belief task) with symptoms

was not verified through this study. Our results suggest that positive and negative symptoms may not contribute to deficits of ToM. This finding may not support other reports of previous studies[22, 24]. Positive symptoms were related with dose of medication. It has widely known that positive symptoms represented by hallucinations and delusions seem relatively easy to subside by antipsychotics. However, in present study, medications which prescribed were all atypical antipsychotics. The score of beads test2(draw of certainty) was negative correlation with IQ and negative symptoms. We may suggest that remaining negative symptoms such as withdrawl and avolition have adversely influence to have certainty on the beads test. A limitation in this study was that we couldn't secure sufficient sample size by power analysis for many variables. We could consider the problem of instruments, fatigue of subjects, small sample size, and heterogeneous of subjects as any causes for this.

Investigations of association among variables and differences between patients and controls were significant contribution of this study. One of the research direction based on our results was about controlling intelligence and a neurocognitive variable. There were many cases to control intelligence beforehand in precedent researches, through using exact matching method or excepting samples under IQ 80. In present study, we included only cases over IQ 90 of patient group in analysis. Subjects need to understand research processes and relevant performance.

6. Conclusion

In this study, we found that the patients with schizophrenia has social cognitive deficits on performance of neurocognition and social cognition test comparing with normal control group. And there are partial relationships among neurocognition, social cognition, and symptoms in patients with schizophrenia. So we suggested that the social cognition(theory of mind, jumping to conclusion) can be target indicator to improve functions in schizophrenia and need management.

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