ORIGINAL ARTICLE

Relationship between executive function and problem solving ability of schizophrenia patients

Susmita Halder* Akash Kumar Mahato**

* Manipal College of Medical Science, Nepal; ** LGBRIMH, Tezpur, Assam.

ABSTRACT

Schizophrenia is a disorder associated with cognitive impairment and deficits, mainly in the area of attention, memory, and executive functions, which are related to an individual's adaptive and social skills. Schizophrenia patients also show mark deficit in their problem solving abilities and daily living activities. The present study aims to find out the relationship between clinical symptoms, executive function and problem solving abilities of schizophrenia patients.

30 schizophrenia patients were selected for the study and assessed using the Positive and Negative Syndrome Scale (PANSS), Wisconsin Card Sorting Test (WCST) and Problem Solving Inventory (PSI) respectively. Findings suggest that negative symptoms and executive functioning are potentially important mediating factor in a person's problem solving abilities in day- to- day life.

Key Words: Executive Functions, negative symptoms, Problem solving, Schizophrenia.

INTRODUCTION

It is widely recognized that schizophrenic disorders are often associated with a wide range of impairments of cognitive performances. Patients of schizophrenia, fare comparatively poor than normal controls on tasks of attention, memory and other cognitive functions as well as executive functions. In particular, patients with schizophrenia have been found to exhibit a cluster of symptoms collectively known as dysexecutive syndrome¹. Features like, disturbed planning, lack of inhibition, contextual inappropriate responses, reduced cognitive flexibility, and poor problem solving, have been commonly described in Schizophrenia. Dysexecutive syndromes have

a range of effects on activities of daily life, and social relationship. Green et al.² found that deficits in executive functions in patients with schizophrenia ultimately determine the functional outcomes in terms of poor community living skills, self- care activities, social problem solving skills, and psycho- social skills.

Problem solving abilities are implicated in all spheres of daily functioning of a person. They are vital in decision making required in small to complex situations a person comes across daily. The problem solving abilities in schizophrenia patients have been found impaired in general, which further limits the patient's ability to comprehend and aptly solve a situation. The situations may vary from instantly deciding the correct facial expression to follow daily routine work at time. Seeing its importance, there is always an onus on improving the problem solving abilities of schizophrenia patients. One of the frequently suggested moderators of problem solving in schizophrenia is cognitive functions. Revheim et al (2006)³ have shown in their studies, that functional outcome for individuals with schizophrenia has been associated with cognitive impairment. Recently, attention has been given to establish the relationship between cognitive impairment and its outcome in daily living skills⁴. In recent times, efforts are been put to establish and validate the relationship of impaired executive functions and daily living functioning in schizophrenia. Keeping the above points in view, the present study aimed to see how does impairment in executive function affects the problem solving abilities in schizophrenia.

METHODOLOGY

This is a cross- sectional, correlational study conducted to find out the relationship between clinical symptoms, executive function and problem solving ability of schizophrenia patients.

Sample: Based on purposive sampling technique, a sample consisting of 30 male, hospitalized schizophrenic patients were selected from RINPAS. Subjects were between the age range of 25-50 years, and having basic reading and

Correspondence: Susmita Halder, Department of Psychiatry, MCOMS, Pokhara, Nepal Email: susmitahalder@gmail.com

writing ability and no problem in color perception. All were right-handed. Individuals with Vision and hearing impairment, history suggesting organic pathology, substance abuse and mental retardation or significant physical illness and patients with severe psychopathology who have problem in comprehending instructions were excluded. All were cooperative and gave consent for the study. Sample characteristics are given in Table 1.

Tools

1. **Socio Demographic and Clinical Data Sheet:** It is a semi structured proforma especially designed for this study. It contained information about socio-demographic variables like age, sex, religion, education, marital status, domicile and occupation and clinical details, e.g., age of onset, mode of onset, course, duration, medication and side effects, history of alcohol or substance- abuse, any history of significant head injury, seizure, mental retardation, and family history of mental illness.
2. **Hand Preference Battery (Annett, 1970)⁵:** The hand preference battery was administered to check handedness of the subjects. The battery consists of 6 items. If all six items are performed by right hand the person is classified as right handed, if by left hand the person is left-handed and mixed performance is considered as mixed handedness.
3. **Positive and Negative Syndrome Scale (PANSS)⁶:** The PANSS is the standard tool for assessing clinical symptoms and outcome in treatment studies of schizophrenia and other psychotic disorders and is sensitive to change with treatment. The PANSS includes 30 items on three subscales: 7 items covering positive symptoms, 7 covering negative symptoms, 16 covering general psychopathology. Each item is scored on a seven-point item specific Likert scale ranging from 1 to 7. The ratings can be completed in 30- 40 minutes.
4. **Wisconsin Card Sorting Test (WCST)⁷:** It is a clinical neuro- psychological instrument originally developed by Grant and Berg (1948) to assess abstract reasoning ability, and the ability to shift cognitive strategy in response to changing environmental contingencies. WCST can be considered a measure of "executive function," requiring the ability to develop and maintain an appropriate problem- solving strategy across changing stimulus conditions in order to achieve a future goal. The WCST consists of four stimulus cards and 128 response cards that depict figures of varying forms, colors, and numbers of figures.

5. **Problem Solving Inventory (PSI)⁸:** Developed by P. Paul Heppner, the PSI consists of 35-item self-report measures on a 6-point Likert style format (Strongly agree to strongly disagree). The measure is designed to assess an individual's perceptions of his or her capabilities with regards to problem solving behaviors and attitudes. Subtests of the PSI are following

- a. **Problem-Solving Confidence** (self assurance while engaging in problem solving activities)
- b. **Approach-Avoidance Style** (a general tendency to either approach or avoid problem solving activities), and
- c. **Personal Control** (determines the extent of control one has over their emotions and behaviors while solving problems). High scores indicate general negative self appraisal.

Procedure

After taking the informed consent, only those patients were included in the study who met the criteria of schizophrenia following ICD- 10 DCR as well as the inclusion and exclusion criteria for the study. PANSS was administered to assess clinical symptoms. Problem solving ability and executive functions were measured by PSI and WCST, respectively.

Further, data were analyzed using descriptive statistics and correlation coefficient.

RESULTS

Socio- demographic and clinical details of the patients are shown in table 1 and 2 respectively. Mean age of patients was found to be 32.65 years. Majority of them were

Table 1. Sociodemographic data

Variables		Subjects
Age (in years)	Mean	32.65±7.32
Education	Upto class X	25
	Inter	2
	Graduate	3
Marital status	Married	22
	Single	8
Occupation	Unemployed	17
	Agriculture	9
	Business	4
Domicile	Urban	12
	Rural	18
Religion	Hindu	20
	Muslim	5
	Christian	5

Table 2. Clinical details

Variable	Mean	SD
Age of onset of illness (in yrs.)	26.96	7.23
Duration of illness (in yrs.)	7.72	4.1
PANSS Positive	14.23	9.3
Negative	27.24	6.2
General	35.72	9.6

Table 3. Relationship between PANSS and executive functions

Symptoms	Measures of Executive functions		
	Trials to complete 1st category	Perseverative error	Failure to maintain set
POSITIVE	.070	.039	.163
NEGATIVE	.119	.443*	.181

educated up to class X. Majority of the patients were married, unemployed, hailed from rural background (60%), and were Hindu by religion. Mean age of onset of illness of patients was 26.96 yrs and mean duration of illness was 9.72 years.

On PANSS, means (SD) scores were: Positive symptoms-14.23 (9.3), Negative symptoms- 27.24 (6.2), and General psychopathology- 35.72 (9.6) respectively.

Table 3 shows the correlation between clinical symptoms as assessed on PANSS and executive functions, in terms of measure of WCST. Only three measures of WCST were assessed. It shows negative symptom in PANSS is significantly correlated ($p < .05$) with perseveration scores in WCST.

Table 4. Relation between clinical symptoms and problem solving ability of the subject

Symptoms	Problem solving index		
	Problem solving confidence	Approach avoidance ability	Personal control
POSITIVE	-.064	-.476*	-.324
NEGATIVE	-.521**	.183	-.412*

Table 5. Relationships between executive functioning and problem solving abilities

Measures of Executive functions	Problem Solving		
	Problem solving confidence	Approach avoidance ability	Personal control
Trials to complete 1st category	-.064	-.523*	.324
Perseverative error	.183	-.285	-.623**
Failure to maintain set	.285	.141	.043

Table 4 shows the correlation between clinical symptoms and problem solving ability, in terms of measures of the Problem Solving Inventory (PSI). Considering the positive and negative factors of PANSS, significant correlations were observed between positive factors and approach avoidance ability ($r = -.476$, $p = .05$). Negative symptoms was significantly correlated to problem solving confidence ($r = -.521$, $p = .01$) and personal control ($r = .412$, $p = .05$).

Table 5 shows the correlation between executive function (WCST measures) with Problem Solving Index measures. Most significant correlation was found between Perseverative errors in WCST with personal control ($r = .623$, $p = .01$), and then between Trials to complete first category and Approach avoidance style ($r = -.523$, $p = .05$).

DISCUSSION

The present study was conducted on 30 male patients diagnosed with schizophrenia, to know the relationship between clinical symptom, executive function and problem solving ability. Although the Wisconsin Card sorting Test is a comprehensive tool used to assess executive functions; only three of its measures, sensitive to problem solving skill were included; i.e Trials to complete 1st category Perseverative error and Failure to maintain set.

Overall findings of this study indicate problem solving ability is associated with the clinical symptoms and executive functions.

Clinical Symptom and executive function

Results showed that negative symptoms were significantly affecting Perseverative errors on WCST. Implication wise, it suggests that negative symptoms are affecting the subject's ability/ aptness to adopt newer strategies in event of failure of the present one. The findings are consistent with previous studies^{9,10} which suggest that negative symptoms do affect executive functions.

Clinical Symptoms and Problem solving ability

Relating clinical symptoms with problem solving abilities, it was found that negative symptoms are affecting problem solving abilities more than positive symptoms. While positive symptom was detrimental to Approach avoidance ability; negative symptoms were found affecting the subjects problem solving confidence, and personal control. This seemed to be quite obvious and validate that clinical symptoms first act like a barrier for the schizophrenia patient to actively involve in some activity; and even if they involve in the activity they are highly prone to leave the task in between. This is reflected in the reluctant and poorly motivated behavior of schizophrenia patient.

The findings are consistent with previous studies that

suggest that negative symptoms rather than positive symptoms are related to daily problem solving skills and confidence^{3, 11, 12}.

Executive function and problem solving ability

Findings related to Problem solving ability with executive functions are consistent with previous reports of relation between neurocognitive aspects of functional outcome. Results revealed that, executive functions did have impact on problem solving ability, as participants with poor score performance in executive function tests also showed low score in problem solving skills depicting poor ability to solve daily problems. In particular, trial to complete first category was related to approach avoidance; and perseverative error was related to personal control, indicating cognitive flexibility is a potentially important mediating factor in social and problem solving components. Findings are consistent with previous studies¹³. As Perseverative errors are indicative of subject's capacity to change his set according to changing situation; it further validates its role in patient's inability to aptly change and cope with real world situations, which keep on changing.

Limitations of the study include small sample size, and limited measures of executive functioning assessed. A follow up assessment after amelioration of symptoms could have given more information on role of clinical symptoms. Still, the findings were able to indicate on the role of clinical features and executive functions in problem solving. This can have major implication in treatment plan of schizophrenia patients, by improving their problem solving skills.

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