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Symptom severity and executive functioning in chronic schizophrenia: A correlational study

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Abstract

Background: Schizophrenia is a debilitating disease which involves positive, negative, and cognitive symptoms. Understanding their interplay can guide towards designing a tailored intervention approach.

Aims/objectives: This study aimed to assess the correlation between executive functioning and symptom severity in chronic schizophrenia.

Methods: A total of thirty people with chronic schizophrenia were chosen using the purposive sampling method. Their symptoms and executive functioning were measured using PANSS and M-WCST respectively. The correlation among these were calculated using Spearman's rank order correlation.

Result: The severity of negative symptoms and anergia in chronic schizophrenia was found to be significantly correlated with the executive functioning whereas the positive symptoms and other clusters such as paranoia, thought disturbance, activation and depression did not show any significant relationship.

Conclusion: The major findings of this research was negative symptoms and anergia showed significant correlation with executive functioning of the individuals with chronic schizophrenia. It gives rise to the need of more holistic approach in intervention process to deal with all of these aspects simultaneously.

Keywords: Chronic Schizophrenia; Executive functioning; Positive and negative symptoms; Anergia; Cognitive impairment

1. Introduction

A complex mental disease, schizophrenia is characterized by a wide range of symptoms, such as delusions, hallucinations, disorganized thinking and behavior and diminished or impaired social contact. These symptoms can significantly affect a person's day-to-day life, making it difficult to maintain relationships, find steady work, and participate in daily activities. This is probably a reflection of the intricate relationship between the psychopathology and related cognitive deficits in schizophrenia [1].

Attention, memory, executive functioning, social cognition, and other cognitive abilities are among the cognitive impairments associated with schizophrenia. Previous studies have clearly demonstrated that those with chronic schizophrenia or longer disease durations exhibit more cognitive impairment than those with acute schizophrenia or shorter illness durations [2].

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Among all the cognitive functions affected in Schizophrenia, highly significant impairment has been seen in the area of executive functioning [3]. Executive functioning is a set of cognitive skills an individual uses to decide, plan, organize as well as to set a goal and carrying out the tasks to attend that goal effectively. Executive functioning impairment in chronic schizophrenia mostly manifests as impairment in working memory, set shifting or cognitive flexibility, sustained attention response inhibition, planning and information processing etc. [4]. Hence, it affects the daily life functioning of the individuals as well specifically in areas of decision making, doing tasks that involves steps and stages, inhibiting automatic responses and adapting to new situations [5][6].

Studies have suggested that there exists a link between the severity of symptoms experienced by individuals with chronic schizophrenia and their executive functioning deficits. Positive symptoms in Schizophrenia includes delusions, hallucinations, formal thought disorders such as tangentiality, circumstantiality, loosening of associations etc., and aggressive or hostile behaviors. Negative symptoms include affective flattening, anhedonia, alogia, avolition, apathy and asociality as well. Among the positive symptoms in schizophrenia, thought disorders like delusions, disorganized thought process, hallucination and bizarre behavior has been seen to be correlated with impairment in cognitive flexibility and inhibition, and information processing in working memory as well [7][8][9]. In case of the negative symptoms, a significant medium-sized correlation was established with executive functioning impairment in this population [11][12]. Neuropsychological studies have suggested that negative symptomatic manifestation in schizophrenia mirrors the prefrontal cortex dysfunction to some extent which is mainly responsible area for executive functioning in the brain [13][14][15].

This study basically aims to explore the relationship among symptom severity with cognitive impairments, specifically impairment in executive functioning which is a higher order functioning affecting the quality of life of the individuals. It can have significant implication in understanding the cognitive impairment to some extent beforehand and designing a tailored intervention approach well suited for the holistic therapeutic management of the condition. Though studies have been conducted worldwide on executive functioning impairment in schizophrenia and its correlation with symptom manifestations, there is a dearth of research findings regarding this in Indian context.

Aim of the study

To investigate the correlation between executive functioning impairment and the severity of symptoms in chronic schizophrenia.

2. Methods

The study was initiated after getting institutional ethics committee approval [IEC Appln. No.- 1426, Date 16.08.2023. For this research investigation, a total of thirty people with chronic schizophrenia [lasting more than two years] were chosen using the purposive sampling method.

2.1. Inclusion criteria

- Individuals who have been diagnosed with schizophrenia using the ICD-11 diagnostic criteria.
- The illness lasted longer than two years.
- Chronic schizophrenia patients reported to S.C.B. Medical College and Hospital, Cuttack's M.H.I. [CoE].
- Individuals having only a 10th standard of secondary education.

2.2. Exclusion criteria

- Individuals with acute schizophrenia, neurodevelopmental problems, and other mental illnesses;
- Patients with co-occurring symptoms such as depression and drug abuse.

2.3. Tools used

2.3.1. Positive and Negative Syndrome Scale

The Positive and Negative Syndrome Scale [PANSS] is used to rate the intensity of clinical symptoms in individuals with schizophrenia. Given by Stanley Kay, Lewis Opler, and Abraham Fiszbein in 1987, it is considered as the gold standard assessment tool. The total number of items is thirty, distributed among three domains: Positive, Negative, and General Psychopathology. There are seven items on each of the positive and negative symptom scales, and the general psychopathology category has sixteen overall. The degree of severity of each item is ranked from 1 to 7, with 1 denoting absence, 2 minimal, 3 mild, 4 moderate, 5 moderately severe, 6 severe, and 7 extreme. Test-retest reliability on the scale is adequate, ranging from 0.77 to 0.89 [Kay et al., 1987]. The test also consists of 5 symptom clusters such as Paranoia,

thought disturbance, depression, activation and anergia. Each cluster consists of some specific items of the test. Paranoia consists of the items P6 [suspiciousness/persecution], P7 [hostility] and G8 [uncooperativeness]. Thought disturbance consists of items P2 [Conceptual disorganization], P3 [Hallucinatory behavior], P5 [Grandiosity], G9 [Unusual thought content]. Activation consists of P4 [Excitement], G4 [tension], G5 [Mannerism and posturing]. Depression consists of items G1 [Somatic concern], G2 [Anxiety], G3 [Guilt feelings], G6 [Depression]. Anergia consists of items N1 [Blunted affect], N2 [Emotional withdrawal], G7 [motor retardation], G10 [Disorientation].

2.3.2. Modified Wisconsin Card Sorting Test

The Modified Wisconsin Card Sorting test is a variation the widely used test i.e. Wisconsin Card sorting test. David J. Schretlen delivered it in 2010. Its foundation is the card sorting exercise that Grant and Berg created initially. There are four key cards and 48 response cards in all. It is employed to gauge a person's executive functioning. It is standardized for people in the 18–92 age range. Over a two-year test-retest period, its reliability measures for the number of correct categories were 0.65, the number of perseverative errors was 0.64, and the executive functioning component was 0.50. Its concept validity is explained by the fact that it correlates favorably with tests serving the same objective, i.e., TMT r=-0.52 to 0.51.

2.4. Statistical analysis

The data was analyzed by using SPSS. Descriptive statistics were performed to explain the socio demographic details i.e. the age, sex, education positive symptoms, negative symptoms and executive functioning composite score as well. The normality of the data was examined by Shapiro-wilk test. Spearman's rank order correlation was employed to find out the correlation between positive symptoms and negative symptoms and the five clusters with executive functioning composite T score.

3. Results

Table 1 Socio-demographic details

Variable	**N**	**Mean & S.D.**	**% of total**
Age	30	M=32.7	
		S.D.= 6.33	
Sex	Male= 18		Male= 60%
	Female= 12		Female=40%
Education:			
12th	11		36.7 %
10th	13		43.3 %
Graduate	5		16.7 %
Masters	1		3.3 %

The information presented here describes the composition of a sample group. It includes details about the average age, gender distribution, and educational background of the participants. The average age of the sample is 32.7 years, with a median age of 32.0 years and a standard deviation of 6.33 years, indicating a moderate spread in ages around the mean. Among the participants, 60% are male [n=18] and 40% are female [n=12]. In terms of education, 36.7% have completed 12th grade [n=11], 43.3% have completed 10th grade [n=13], 16.7% have graduated [n=5], and 3.3% have attained a Masters' degree [n=1]. These findings offer insights into the demographic characteristics of the sample group.

Table 2 Spearman's rank order correlation between symptoms T score on PANSS and executive functioning composite T score

Symptom domain	Positive symptoms	Negative symptoms	Paranoia	Thought Disturbance	Anergia	Activation	Depression
Correlation coefficient with Executive functioning composite score	-0.079	-0.766***	-0.002	-0.024	-0.488**	0.084	-0.289
p-value	0.677	<0.001	0.993	0.900	0.006	0.657	0.121

Level of significance are denoted by * $p < .05$, ** $p < .01$, *** $p < .001$

In table 2, the relationship was examined between positive symptom T scores and executive functioning composite T scores, as well as between negative symptom T scores and executive functioning composite T scores. The correlation between each cluster of PANSS such as Anergia, paranoia, thought disturbance, depression, activation with executive functioning composite were examined individually as well. Spearman's rank order correlation was used. The correlation coefficient between positive symptom scores and executive functioning composite scores was ρ=-0.079, with 28 degrees of freedom [df] and a *p*-value of 0.677, indicating a lack of significant correlation at the 0.05 or 0.01 significance level. However, the correlation coefficient between negative symptom scores and executive functioning composite scores was ρ=-0.766, with 28 degrees of freedom [df] and a *p*-value of <0.001, indicating a highly significant negative correlation at the 0.001 significance level. Among all the clusters of PANSS, the correlation between scores of Anergia and executive functioning composite score was ρ=-0.488, with 28 degrees of freedom and a *p*-value of <0.01, indicating a highly significant negative correlation at the 0.01 significance level. Correlation between other clusters and executive functioning composite are: for paranoia ρ=-0.002, with 28 degrees of freedom, for thought disturbance ρ=-0.024 with 28 degrees of freedom, for activation ρ=0.084 with 28 degrees of freedom, and for depression ρ=-0.289 with 28 degrees of freedom. But these correlation coefficient values lack significance at 0.05 or 0.01 significance level.

4. Discussion

The main findings suggest that in individuals with chronic schizophrenia, greater severity of negative symptoms and anergia symptoms are associated with poorer executive functioning, while the severity of positive symptoms and other clusters of symptoms such as Paranoia, thought disturbance, depression, activation do not show a significant correlation with executive functioning. Although previous research has reported mixed results, most of the studies support a stronger relationship between the severity of negative symptoms and executive functioning in chronic schizophrenia. The findings in this study goes in line with the findings of a neuro-imaging study which showed that negative symptoms profile correlates with reduced prefrontal cortex activation, majorly in the area of Left anterior frontal cortex[17][18]which has executive functioning as one of its major functions.

Among the symptom domains of schizophrenia, negative symptoms and disorganized symptoms had been found to be more significantly correlated with executive dysfunction rather than positive symptoms [19]. These findings also align with the previous meta-analytic findings [20][21]. Research studies suggest that duration of manifestation of negative symptoms in schizophrenia also influences their executive function i.e. a differential relationship is found at different stages of schizophrenia. As per the Two-syndrome model of schizophrenia, significantly high cognitive impairment often occurs with predominately high negative symptoms [22]. Studies also found that negative symptoms and cognitive symptoms in Schizophrenia may have interrelated aetiology, similar symptom manifestation and influence on distal prognosis of the condition [23].

There are also some studies which haven't been able show significant correlation among these two factors or showed a relatively weaker correlation [20][21]. This can be justified in terms of different tools used to measure executive function, lack of consideration for duration of illness, difference in socio-demographic details and clinical characteristics and inclusion of comorbidities.

It was found that negative symptoms and executive functioning impairment share symptomatic manifestations. Hence, these two seems to be correlated with prognosis and propose significant challenges for intervention as these are mostly resistant to currently available intervention strategies [23].

This study suggests that negative symptom manifestations correlate significantly with executive functioning impairment which indicates these symptoms occur simultaneously with functional impairment in areas of problem

solving, cognitive flexibility, response inhibition, task organization and planning, working memory and sustained attention as well i.e. the components of executive functioning as a whole. This suggests a dire need to formulate an intervention approach specifically tailored to address these two symptom domains in order to show holistic improvement of the patients.

Limitations

Though the findings of this study align with the past literature findings, there are some limitations present in this which should be considered as well. Small sample size in this study is one of the limitations when it comes to generalizability of the findings. More tools could have been used to measure the different domains of executive functioning and their correlation with the symptomatology of schizophrenia which would provide more in-depth picture of the scenario. Randomized controlled study on this would have been better for the increased external validity of the findings here.

5. Conclusion

The research study investigated the correlation of severity of symptoms in chronic schizophrenia with executive functioning. The result denoted significantly high negative correlation of executive functioning with negative symptom severity i.e. ρ=-0.766, with $p<0.001$ and high negative correlation with Anergia cluster symptoms i.e. ρ=-0.488, with $p<0.01$. No significant correlation was found between executive functioning and positive symptom severity and with other cluster of symptoms as well. These findings suggest that, while formulating an intervention strategy for chronic schizophrenia, cognitive rehabilitation or remediation training should be tailored in consideration with the negative symptom profile of the individuals. This will be easier to imply and more beneficial to the individual as it will address the issues in a holistic approach.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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