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Original Research

Clinical and Psychometric Features of Cognitive and Negative Disorders in Schizophrenia

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Objectives. To establish the characteristics of clinical manifestations and cognitive tests in patients with schizophrenia with a predominance of cognitive and negative disorders. **Materials and methods**. A total of 76 patients were examined (66 in the study group, 10 in the reference group), who were undergoing treatment at the Alekseev Psychiatric Clinical Hospital No. 1 (Moscow) and the Gannushkin Psychiatric Clinical Hospital No. 4 (Moscow). Clinical-psychopathological, psychometric, and statistical methods were used. Cognitive functioning was assessed using the Frontal Assessment Battery (FAB) and the Edinburgh Amyotrophic Lateral Sclerosis Behavioral and Cognitive Assessment Scale (ECAS). Emotional intelligence was assessed using the Ekman Facial Emotion Recognition (EFER) test. **Results.** Patients with schizophrenia showed dominance of one of three types of deficit symptoms: cognitive, emotional, or volitional. Cognitive functions decreased significantly in patients with schizophrenia as compared with the reference group (mean FAB score ($M \pm$ SD) 13.44 ± 2.97 in patients with schizophrenia vs. 16.10 ± 1.70 in the reference group; $t = 4.10$; $p < 0.001$). Cognitive functions were particularly decreased in patients with volitional deficits (mean total score on the EFER scale 42.40 ± 9.0 in patients with volitional deficits vs. 47.21 ± 6.33 in patients with cognitive deficits; $t = 2.12$; $p = 0039$; mean scores on the FAB scale were 12.83 ± 3.29 in patients with volitional deficiency vs. 16.10 ± 1.70 in patients in the reference group; $p < 0.001$; mean scores on the ECAS, which is specific for ALS, were 78.80 ± 9.07 in patients with volitional deficiency and 84.50 ± 6.71 in patients from the reference group; $t = 2.18$; $p = 0.034$). **Conclusions.** The greatest contribution to the development of cognitive impairment in schizophrenia was made by dysfunction of the frontal (especially) and temporal cortex. Executive functions, language skills, and verbal fluency were the most affected.

Keywords: schizophrenia, cognitive disorders, deficit symptoms, frontal dysfunction battery (FAB), Edinburgh Cognitive Scale (ECAS), Ekman Face Test (EFER).

Cognitive impairment in patients with schizophrenia (CIS) has been actively studied in recent years, as it represents a pressing problem in modern psychiatry. One of the reasons for researchers taking a close interest is the extensive prevalence of this pathology. Studies have demonstrated that data obtained by clinical observation and analysis of the use of psychometric scales leads to detection of cognitive impairment in more than 80% of patients with schizophrenia [1]. The most recent versions of ICD-11 and DSM-5 include dimensions of cognitive symptoms in the diagnostic criteria for schizophrenia [2, 3].

At this stage of research into CIS, the dominant concept is that cognitive symptoms are present at all stages of the development of schizophrenia, becoming deeper as the schizophrenic process develops [4].

In addition to the fact that cognitive impairments (CI) are detected at all stages of the course of schizophrenia, data showing CI in close relatives of patients with schizophrenia (first-degree relatives) have been reported [5].

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According to modern concepts of CIS, its manifestations are very diverse and affect multiple aspects of memory, intelligence, and attention. Researchers have found that functions such as memory (immediate and delayed recall, episodic and working memory) are affected, along with social and emotional intelligence, executive functions (management and planning processes, control of cognitive activity, setting and following of goals), speech impairment (verbal fluency, language skills such as speech comprehension and pronunciation), visual-spatial perception, and thinking, and attention (focus, distribution, and retention of attention) [6–9].

The particular relevance of studying CIS is due to the fact that they have a strong correlation with patients' levels of functioning, which makes CIS a significant predictor of possible favorable prognoses and an important therapeutic target [10–13].

The variety of cognitive tests used to study CIS can provide insight into the future prognosis and risk of possible relapse in patients with schizophrenia [14, 15].

The aim of the present work was to establish the characteristics of the clinical manifestations and cognitive tests in schizophrenia patients with a predominance of cognitive and negative disorders.

Materials and Methods. The study was carried out at the clinical bases of the Department of Psychiatry and Medical Psychology, Pirogov Russian National Research Medical University, Russian Ministry of Health, i.e., the Alekseev Psychiatric Clinical Hospital No. 1 (Moscow) and the Gannushkin Psychiatric Clinical Hospital No. 4 (Moscow). Patients with paranoid schizophrenia (study group, $n = 66$) who were admitted in an acute psychotic state to Psychiatric Clinical Hospitals Nos. 1 and 4 from September, 2022 to January, 2024 were selected at random. Diagnoses of schizophrenia were made according to ICD-10 criteria. Productive symptoms were assessed in these patients during psychosis. The severity of negative and cognitive disorders was assessed in the patients after relief of acute psychotic symptoms.

The reference group consisted of patients with phasic mental disorders (schizoaffective disorder (SAD), bipolar affective disorder (BAD), and recurrent depressive disorder (RDD)). The reference group included 10 patients who were examined at Psychiatric Clinical Hospitals Nos. 1 and 4 from November, 2023 to January, 2024. Diagnoses of SAD, BAD, and RDD were made according to ICD-10 criteria. SAD was diagnosed in two patients, BAD in two, and RDD in six.

Inclusion criteria: compliance of the clinical picture with the criteria for schizophrenia (F20) according to ICD-10 (for the study group); compliance of the clinical picture with the criteria for SAD (F25), BAD (F31), or RDD (F33) according to ICD-10 (for the reference group); in the case of the study group, the presence during hospitalization of an acute psychotic state meeting the criteria for paranoid schizophrenia (F20.0) according to ICD-10; history of no more than two hospitalizations to a 24-hour hospital at the time of examination; patient's age at the time of examination 18–60 years; patients' consent to participate in the study.

In most patients ($n = 53$, 69.7%), the current hospitalization was the first, while in 10 (13.1%) it was the second admission and in 13 (17.2%) it was the third.

Exclusion criteria: presence of severe somatic and neurological pathology; concomitant addiction disease disorders; presence of severe organic disorders.

The study complied with all provisions of the Declaration of Helsinki and was approved by the local Ethics Committee.

The study used clinical-psychopathological, psychometric, and statistical methods. All patients included in the study were examined as in-patients and were monitored throughout the entire hospitalization period.

Clinical qualification of cognitive, negative, and productive disorders was based on complaints, history, and clinical examination.

The productive symptoms of schizophrenia were assessed using the Brief Psychiatric Rating Scale (BPRS) [16]. The severity of negative symptoms of schizophrenia was assessed on the Brief Negative Symptoms Scale (BNSS) [17]. Patients' levels of social functioning were assessed on Global Assessment of Functioning Scale (GAF) [18]. The cognitive symptoms of schizophrenia and indicators of emotional intelligence in patients were assessed using questionnaires, i.e., the Frontal Assessment Battery (FAB) [19], Ekman's Facial Emotion Recognition Test (EFER) [20], and the Edinburgh Cognitive and Behavioral ALS (Amyotrophic Lateral Sclerosis) Screen (ECAS) [21].

The ECAS scale consists of two blocks. The first, which assesses ALS-specific impairments, identifies impairments in the prefrontal cortex (language skills, verbal fluency, and executive functions). The second block, which examines disorders not specific to ALS, assesses cognitive functions such as memory (immediate reproduction, delayed reproduction, and delayed recognition) and visuospatial perception (counting dots, cubes, and determining the position of a number), i.e., functions whose impairments demonstrate involvement of the temporal cortex.

The Frontal Assessment Battery (FAB), which was developed to screen for frontal dementia and contains items assessing generalization, verbal fluency, motor programming, and voluntary attention, is a reliable and accepted tool for assessing cognitive impairment in patients with schizophrenia [22].

Statistical data processing, taking account of the fact that the distributions of the study variables corresponded to the normal, was run using parametric statistical methods (calculation of Student's t test for independent samples for mean and relative values). In addition, descriptive statistics were used to calculate means, standard deviations, and percentages. Results were taken as statistically significant at $p \leq 0.05$.

Results. The characteristics of the study group, the reference group, and the sample as a whole, including data on pa-

TABLE 1. Characteristics of Patients in the Study and Reference Groups

Parameter	Study group (schizophrenia) (n = 66) (%)	Reference group (RDD, BAD, SAD) (n = 10) (%)	Whole cohort (n = 76) (%)
Age, years; $M \pm SD$	36.8 ± 10.0	27.8 ± 9.5	35.6 ± 10.4
Men	20 (30.3)	2 (20.0)	22 (28.9)
Women	46 (69.7)	8 (80.0)	54 (71.1)
Family status			
married	19 (28.7)	2 (20.0)	21 (27.6)
not married (divorced and single)	47 (71.3)	8 (80.0)	55 (72.4)
Social status			
working or studying	24 (36.3)	5 (50.0)	29 (38.1)
not working or studying	42 (63.7)	5 (50.0)	47 (61.9)
Education			
intermediate	8 (12.1)	3 (30.0)	11 (14.5)
intermediate vocational	12 (18.8)	1 (10.0)	13 (17.1)
higher	46 (69.1)	6 (60.0)	43 (56.6)
Proportion of cases with manifestations			
<18 years	4 (6.1)	2 (20.0)	6 (7.9)
18–30 years	29 (43.9)	6 (60.0)	35 (46.0)
30–40 years	16 (24.2)	1 (10.0)	17 (22.3)
>40 years	17 (25.8)	1 (10.0)	18 (23.8)
Duration of disease			
<5 years	40 (60.8)	6 (60.0)	46 (60.5)
6 – 9 years	13 (19.6)	3 (30.0)	16 (21.0)
≥10 years	13 (19.6)	1 (10.0)	14 (18.5)
Number of hospitalizations, including the present hospitalization, $M \pm SD$	1.2 ± 0.5	1.5 ± 0.8	1.3 ± 0.6
Duration of disease, $M \pm SD$	5.0 ± 4.0	5.6 ± 5.3	5.1 ± 4.3
Mean total score, BPRS, $M \pm SD$	56.24 ± 15.11*	33.20 ± 9.48	53.21 ± 16.46
Mean total score, BNSS, $M \pm SD$	38.53 ± 9.72	34.40 ± 12.80	37.99 ± 10.28
Mean total score, GAF, $M \pm SD$	48.53 ± 14.78*	66.10 ± 13.11	50.84 ± 15.74
Mean total score, EFER, $M \pm SD$	43.68 ± 8.21	44.60 ± 3.72	43.80 ± 7.77
Mean total score, FAB, $M \pm SD$	13.44 ± 2.97*	16.10 ± 1.70	13.79 ± 2.97
ECAS, $M \pm SD$			
mean total score,	103.33 ± 11.44	108.80 ± 13.38	104.05 ± 11.86
mean score specific for ALS	79.88 ± 8.69	84.50 ± 6.71	80.49 ± 8.60
mean score not specific for ALS	23.45 ± 4.51	24.30 ± 7.16	23.57 ± 4.95

Here and in Tables 2–5: *$p < 0.05$.

tients' ages, the numbers of men and women, social and family status, levels of education, age of manifestation, disease duration, number of hospitalizations, and scores on the BPRS, GAF, BNSS, EFER, FAB, and ECAS are given in Table 1.

TABLE 2. Comparison of Test Results in Patients with Different Levels of Education

Parameter ($M \pm SD$)	Higher education ($n = 46$)	Intermediate education ($n = 8$)	Intermediate vocational education ($n = 12$)
Mean total score, EFER	44.26 ± 8.02	40.25 ± 11.01	43.75 ± 5.86
Mean total score, FAB	13.33 ± 2.94	13.13 ± 4.32	14.08 ± 2.27
ECAS			
mean total score,	105.80 ± 10.38*	99.50 ± 15.27	96.42 ± 10.37
mean score specific for ALS	81.98 ± 7.8*	75.63 ± 11.48	74.67 ± 7.69
mean score not specific for ALS	23.83 ± 4.39	23.88 ± 5.11	21.75 ± 4.73

It should be noted that comparison of the study group and the reference group in terms of gender, age, dynamics of mental disorders, social and family status, level of education, and dynamic parameters (age of manifestation, duration of the disease) revealed no statistically significant differences.

Overall, the groups (study and reference groups) were comparable in terms of these parameters, such that correct comparisons could be made between them in terms of various indicators.

The mean total score on the BPRS scale was significantly higher in patients of the study group (relative to patients of the reference group) ($t = 6.53$; $p < 0.001$). This is explained by more severe acute psychotic symptomatology at admission of patients to hospital and at the time of examination. A significantly higher score on the GAF scale ($t = 3.88$; $p < 0.001$) in patients from the reference group as compared with the study group arises from the less severe manifestations of negative and cognitive symptoms, and, consequently, a higher level of social functioning. Although the study did not include patients with disabilities due to mental illness and there were no significant differences in the numbers of workers/non-workers in the study group and the reference group, GAF data reflect the real level of social adaptation of patients with paranoid schizophrenia, which was significantly lower than that in patients with RDD, BAD, and SAD.

As part of the study, the authors were interested in assessing the impact of parameters such as level of education, age of manifestation, and duration of disease on the cognitive functions of patients with paranoid schizophrenia. Comparison of test results in patients with different levels of education is shown in Table 2.

The results of cognitive tests demonstrated significantly higher scores on the ECAS scale ($t = 2.79$; $p = 0.007$) in patients with higher education than in patients with secondary vocational education, the differences applying to both the total score and ALS-specific score (language skills, verbal fluency, executive functions) ($t = 2.92$; $p = 0.005$). No relationship was found between test results on the FAB and EFER scales and level of education. Overall a higher level of education can be taken as a factor with positive influences on cognitive functions.

Table 3 compares test results from patients with different ages of manifestation of schizophrenia. Cognitive test results were not significantly different in patients with different ages of manifestation of schizophrenia. Differences were detected only in the EFER test ($t = 2.91$; $p = 0.009$). Patients with onset before 18 years of age were significantly worse at recognizing facial expressions than patients whose symptoms began after 40 years of age. It is reasonable to suggest that early disease onset may influence indicators of emotional intelligence.

Table 4 compares test results from patients with different durations of schizophrenia.

There were no significant differences in questionnaire scores with different disease durations. This can be explained by a generally uniform distribution of disease durations within the cohort.

With the aim of obtaining more precise assessment of the severity of cognitive and negative symptoms in patients of the study group, the patients of this group were divided into three subgroups according to clinical signs determined by the characteristics of deficit symptoms, i.e., groups were dominated by cognitive, emotional, or volitional deficits.

In the subgroup with predominance of cognitive deficits, a decrease in cognitive functions came to the fore. These patients showed decreases in memory and attention, as well as intellectual productivity. Severe formal disturbances in thinking were present, while productivity and the ability to focus thinking were impaired.

Patients of the subgroup with predominance of emotional deficits displayed a variety of disorders in the emotions domain. Emotional coldness, monotony, impoverishment of the emotional sphere, and the phenomena of emotional blunting came to the fore. The plasticity of emotional responses and the subtle nuances of emotional manifestations were lost.

Patients of the subgroup with predominance of volitional deficits mainly showed disorders such as poverty of motivation, narrowing of the range of interests and objectives, and decreases in social and professional activity, while the motivation to perform one or another purposeful activity disappeared. Inconsistency in everyday life and the professional domain was noted. Volitional activity decreased to the level of abulia.

TABLE 3. Comparison of Test Results in Patients with Different Ages of Manifestation of Schizophrenia

Parameter ($M \pm SD$)	Manifest under 18 years ($n = 4$)	Manifest at 18–30 years ($n = 29$)	Manifest at 31– 9 years ($n = 16$)	Manifest after 40 years ($n = 17$)
Mean total score, EFER	35.0 ± 8.12*	43.10 ± 6.76	43.0 ± 11.58	47.35 ± 5.09
Mean total score, FAB	11.75 ± 4.19	13.86 ± 2.75	13.06 ± 3.42	13.47 ± 2.79
ECAS				
mean total score	92.0 ± 20.61	103.48 ± 11.42	104.50 ± 13.13	104.65 ± 5.92
mean score specific for ALS	71.75 ± 13.38	79.93 ± 9.18	80.44 ± 9.75	81.18 ± 4.76
mean score not specific for ALS	20.25 ± 7.27	23.55 ± 3.69	24.06 ± 6.28	23.47 ± 3.18

Significant differences between group with manifestation at under 18 years and the group with manifestation at age over 40 years.

TABLE 4. Comparison of Test Results in Patients with Different Durations of Schizophrenia

Parameter ($M \pm SD$)	Duration 5 years ($n = 40$)	Duration 6–9 years ($n = 13$)	Duration >10 years ($n = 13$)
Mean total score, EFER	44.18 ± 7.20	41.23 ± 10.83	44.62 ± 8.76
Mean total score, FAB	13.83 ± 3.05	12.15 ± 3.34	13.54 ± 2.18
ECAS			
mean total score	102.90 ± 11.82	102.23 ± 12.63	105.77 ± 9.89
mean score specific for ALS	79.33 ± 8.67	79.31 ± 9.20	82.15 ± 8.91
mean score not specific for ALS	23.58 ± 5.04	22.92 ± 4.52	23.62 ± 2.90

TABLE 5. Comparison of Test Results in Patients with Different Types of Deficits and Patients in the Reference Group

Parameter ($M \pm SD$)	Cognitive deficit ($n = 14$)	Emotional deficit ($n = 17$)	Volitional deficit ($n = 35$)	Reference group ($n = 10$)
Mean total score, EFER	47.21 ± 6.33*[1]	43.41 ± 7.67	42.40 ± 9.0	44.60 ± 3.72
Mean total score, FAB	14.0 ± 2.83*[2]	14.24 ± 2.25	12.83 ± 3.29	16.10 ± 1.70
ECAS				
mean total score	104.71 ± 10.23	104.88 ± 10.50	102.03 ± 12.58	108.80 ± 13.38
mean score specific for ALS	81.29 ± 7.63*[3]	80.94 ± 9.15	78.80 ± 9.07	84.50 ± 6.71
mean score not specific for ALS	23.43 ± 4.80	23.94 ± 4.72	23.23 ± 4.47	24.30 ± 7.16

[1] Significant difference between groups with cognitive and volitional deficits; [2] significant difference between groups with volitional, cognitive, and emotional deficits and the reference group; [3] significant differences between the group with volitional deficit and the control group.

Table 5 compares test results from patients with different types of deficit and patients of the reference group.

These data allow us to take a more focused look at the features of cognitive decline in patients in different deficit groups. In general, the worst indicators of cognitive functioning were found in the group with volitional deficits ($t = 2.12$; $p = 0.039$). In particular, emotional intelligence scores on the EFER scale in this group were significantly worse than those in the group of patients with cognitive deficits. FAB scores showed that all deficit groups showed statistically significant differences from the reference group ($p < 0.05$), though the difference in the volitional deficit group was particularly significant ($t = 2.18$; $p = 0.034$). The ECAS scale, especially the ALS-specific scores relating mainly to verbal fluency and executive functions, showed that the volitional deficit group displayed (in contrast to the emotional and cognitive deficit groups) significantly lower scores ($p < 0.05$) than the reference group.

In general, patients with volitional deficiency showed less motivation to perform certain tasks, spent less effort on thinking, and made almost no effort to get hints from researchers or to correct their mistakes in the process of performing cognitive tests as compared with the other two deficiency groups. They also showed little or no interest in their test results.

Discussion. Recent years have seen both Russian and foreign studies addressing studies of the structure of deficit symptoms in schizophrenia. These works have shown that

the neuropsychological approach to the study of brain defects is promising and effective, as it yields information on the mechanisms of higher mental functions. Some studies have demonstrated impairments to the cortical and brainstem-subcortical areas of the brain, influencing decreases in the speed of activity, weakness of interhemispheric interactions, and insufficiency of the motivational component of mental activity, in which the affected frontal and temporal areas of the brain also have a role in patients with schizophrenia [23].

Non-Russian studies have been reported in which neuropsychological functioning in schizophrenia and other nosologies were compared and patients diagnosed with schizophrenia were found to display more severe CI [24].

Some studies addressing the results of neuropsychological investigations in schizophrenia have also described disorders of higher mental functions such as memory, attention, and verbal fluency, which are associated with the systemic organization of cognitive processes, as well as the executive functions which are responsible for planning current actions in accordance with an overall objective and depend on the normal functioning of the prefrontal cortex [25, 26].

The ECAS has been shown to be highly effective in the study of executive functions, verbal fluency, language skills, memory, and visuospatial perception in patients with ALS [27].

Current views hold that the structure of cognitive deficits in most patients with ALS involves dysfunctions of the frontotemporal regions of the cerebral cortex [28].

Current concepts hold that ALS is part of a spectrum of frontotemporal degenerative conditions, which also includes frontotemporal dementia, progressive supranuclear palsy, corticobasal degeneration, and argyrophilic granule disease [29]. Thus, the similarity between cognitive impairments in schizophrenia and ALS lies in the predominant involvement of the frontotemporal regions of the brain.

The results of the present study are largely consistent with these data. As shown here, patients with schizophrenia display not only significantly more severe productive symptoms and a significantly lower level of social functioning as compared with the reference group, but also significant decreases in the level of cognitive functions. These differences are even more clearly apparent when patients with specific types of deficits were compared with the reference group. Cognitive functioning was particularly affected in patients with volitional deficits, suggesting a worse prognosis in this group of patients.

Measures of cognitive decline were most pronounced in relation to tests assessing the functions supported by the prefrontal cortex. The Frontal Assessment Battery and a set of subscales of the ECAS questionnaire, which assess cognitive symptoms specific to ALS (also reflecting predominantly frontal dysfunction) showed that the most significant differences in cognitive status were found in patients with schizophrenia, as compared with RDD, BAD, and SAD. These data largely support the hypothesis that impairments to the functioning of various parts of the prefrontal cortex have the most significantly effects on cognitive and negative symptoms. Cognitive decline is particularly severe in patients with a predominance of volitional deficits, and the symptoms of cognitive and negative disorders are maximally interacting and mutually reinforcing factors.

Conclusions. The data obtained here indicate that cognitive disorders in patients with schizophrenia have a subtle and complex structure from both the psychopathological and neuropsychological points of view. The greatest contribution to the development of CIS comes from dysfunctions of the frontal (especially) and temporal areas of the cortex. Executive functions, language skills, and verbal fluency are the most affected domains. Cognitive impairment is especially severe in patients with a predominance of volitional deficit, which reflects the interaction and connection between cognitive and negative disorders in patients with schizophrenia.

The authors declare no conflict of interest.

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