# DISORDERS OF DECISION-MAKING IN THE CASE OF DEPRESSION: CLINICAL EVALUATION AND CORRELATION WITH EEG INDICATORS

**[1]Shamilov Vladimir Malakhonovich, [2]Prostyakova Natalia Turchaninova, [3]Sharapova Dilfuza Nematillayevna, [4]Shernazarov Farrukh**

[1]Siberian State Medical University, Russian Federation city of Tomsk
[2]Novosibirsk State Medical University, Russian Federation city of Novosibirsk
[3]Samarkand State Medical University Clinical ordenator in the direction of psychiatry
[4]608 group students of Samarkand State Medical University Faculty of Medicine

***https://doi.org/10.5281/zenodo.10336711***

***Abstract.*** *Recently, the problem of neurocognitive insufficiency in mental disorders has become increasingly relevant. Neurocognitive insufficiency is manifested in the form of impaired executive function (planning, control, braking, switching), energy components associated with memory, attention and endurance, as well as operational components of activity associated with cognitive and motor functions, which mainly leads to a violation of the social adaptation of patients, their performance of daily actions., professional and social functions. An important component of neurocognitive deficits is a violation of decision-making mechanisms.*

***Keywords:*** *depression, electroencephalography, mental disorders, neurocognitive deficiency.*

**Introduction.** Neurocognitive insufficiency develops due to damage to individual areas of the cortex and subcortical structures of the brain, as well as structural functional changes resulting from impaired internal and interhemispheric cortical connections and corticopodcor interactions [1]. Neurocognitive insufficiency is observed in various mental disorders. If neurocognitive insufficiency in schizophrenia is seen as a "third group of symptoms" along with positive and negative disorders, disorders of neurocognitive mechanisms in depressive disorders are studied weaklier [2-4]. Recording the electrical activity of the brain has long been used to study the neurophysiological basis of depression. The first studies of Affective Disorders with the EEG method, conducted in the 40s of the 20th century, revealed an unexpectedly large number of abnormalities in patients. Generalized literary evidence suggests that even with "regular" visual analysis of EEG, pathological signs are detected in 20-40% of depressive patients [5-8]. The use of modern methods of mathematical analysis and processing of EEG data further increases the diagnostic significance of the method.

Thus, according to the American neuropsychiatric Association [9-12], the suitability of EEG quantitative analysis data is found in I depressions, that is, their sensitivity and specificity are 72-93% and 75-88%, respectively. In addition, the American Academy of Neurology recommended EEG mathematical analysis as an additional tool for classifying depressive patients from healthy patients, as well as patients with schizophrenia, alcoholism and dementia, for unipolar and bipolar disorders [13-17]. The EEG method has been used not only in the examination of the diagnosis, but also in the prediction and evaluation of the results of the treatment of depression [18-20].

Currently, EEG studies that offer neurophysiological models of depression are of the greatest scientific interest. The context for the formation of such models is the ideas of reflecting the General Laws of emotional reaction in the EEG. The reflection of human emotional states in EEG wide literature on EEG changes in a variety of emotional contexts is usually devoted to and in brain pathology [21-27]. The EEG indicators of the main characteristics of a simple emotional reaction are described: valence, strength and motivational significance. Based on EEG data, the accuracy of classifying emotional reactions based on their Valency and strength reaches 80% [28]. Each emotional state is accompanied by a certain spatiotemporal pattern of changes in the electrical potential of the brain. Changes in cortical rhythm in emotional reactions consist of increased slow wave and gamma activity, and different sensory-specific changes in Alpha and beta power [29-33].

Thus, feelings of fear and sadness are accompanied by a Depression of the alpha rhythm, and joy and anger are accompanied by its growth. Intense hate and fear reactions have been found to induce desynchronization in the 10 to 18 Hz range, i.e. Alpha2 and Beta1 rhythms, which may reflect the role of non-specific activation in carrying out the emotional reaction [34-38]. Show Alpha depression1 rhythm in response to anxiety stimuli, increased alpha activity in response to facial display with anger expression has been recorded [39-41]. The overall increase in beta2 power and its decrease during the excitation of positive emotions, in the temporomarctic parietal sections, is localized by negative induction. Changes in slow rhythm are associated by many authors with an assessment of the emotional and motivational significance of stimuli, while beta and gamma are associated with strength and to a lesser extent with Impact valence [42-46]. Gamma rhythm has been shown to increase when an object of phobia is presented and from rest to normal arousal and anxiety experience. In addition, the large gamma force in the right temporal part is associated with the positive valence of the stimulus, with the left temporal and parietal-negative [47-50].

Regardless of the sign of emotion, the presence of an emotional reaction is accompanied by an increase in the rhythm gamut in the right frontal hooks [51]. It is also worth noting that a decrease in gamma strength and to some extent beta activity in frontal regions are observed before stimuli that cause conscious experience [52]. But, in general, [53] as noted, the specific role of changes in each frequency range in the creation and regulation of an emotional reaction is not fully understood. The views on the relationship between the parameters of the emotional reaction and the localization of changes in the brain potential are more consistent. Frontal sections are associated with features such as the valence and motivational significance of the stimulus. The left-brain asymmetry of Alpha Force reflects the dominance of approach motivation, while the right brain reflects the dominance of escape motivation [54]. The posterior regions of the right hemisphere are considered as the main branch of the brain system responsible for the activation aspects of the effect.

The purpose of this study: was to analyze the relationship of disorders of neurocognitive decision-making mechanisms based on both logic and reasoning and emotional experience with clinical and neurophysiological indicators in patients with depression.

**Materials and methods.** A multidisciplinary clinical-psychological-neurophysiological study carried out in compliance with the standards of modern biomedical ethics included 28 patients of the Sopb clinic (all women, right-handed, aged 18 to 56, with an average age of 36,3 ± 13,1 years). F31. Mild to moderate depressive states that meet the criteria of titles 3, F33.0 and

F33.1 on ICD-10. The long-lasting nature of depression was noted in many patients-in previous courses of treatment, the clinical effect of antidepressant pharmacotherapy of these patients was not enough. When hospitalized before the start of the therapy course, all patients received a quantitative assessment of the severity of depression on the Hamilton Scale for depression (HDRS-17). Quantitative evaluation of the cognitive functions of rational decision − making based on logic and reasoning was done using the computer version of the Wisconsin Card Sorting Test (Wisconsin CardSortingTest-WCST), which identified prefrontal cortex dysfunction. In the case of uncertainty based on emotional learning, a test was used to assess the decision-making function of the Iowa game problem (IowaGamblingTask-IGT). To assess the functional state of the brain, all patients were given a multichannel recording of the background electroencephalogram (EEG), in a waking state with closed eyes, followed by spectral analysis. The control group comprised 50 healthy women between the ages of 18 and 55 (with an average age of 33,1 ± 10,9 years) who performed only wcst and IGT psychometric tests. Groups of patients and healthy subjects did not differ statistically socially and demographically. Statistical data analysis was carried out using a set of SPSS programs. To compare the results of conducting psychometric tests by groups of patients with depression and healthy subjects, the anova method was used, correlation analysis methods were used to determine the relationship between clinical, psychometric and neurophysiological indicators.

Results and their discussion. Patients with depression have been shown to have neurocognitive deficits in decision making compared to healthy subjects. At the same time, patients had decreased decision-making ability based on logic and reasoning (based on WCST test results) and emotional learning (based on IGT test results). The low performance of both psychometric tests is associated with the severity of depressive symptoms in the form of large values of the total sum of HDRs-17 Hamilton Scale scores and the sum of signal cluster scores (the sum of scores on points 9, 10 and 11 of the HDRS-17 scale). Patients with endogenous affective disorders have made mistakes when performing this part of the Reye technique, in most cases it is not about skipping whole numbers, but about breaking their details, introducing new parts that were not previously presented in the sample. This may indicate a weakening of executive functions, primarily planning and organization. There is reason to assume that structures of the right hemisphere are involved in this process, in particular, the general dysfunction of prefrontal formations, mainly the right hemisphere.

When conducting a block of specialized neuropsychological methods, it was noted that minimal difficulties were noted in determining the rhythmic sequences presented in both groups of subjects. At the same time, in a group of patients with organic Affective Disorders who have difficulty replicating the sequence of motor movements, errors of the perceverative type ($0,05< p<0,1$) have been observed significantly more frequently (relative to the underlying group). These data show not only dysfunction of the premotor regions of the brain, but also elements of auditory Gnosis disorder, decreased selectivity and attention distribution in the selected group. The ability to detect subject images is fully conserved in 2/3 (68,8%) of the group of patients with endogenous depression, while in subjects with organic brain damage, such results were observed in more than half (45,5%) of those examined ($p<0,1$).

When identifying pictures of unfamiliar faces, patients with endogenous depression perform the task much better than patients with statistically confirmed organic Affective Disorders. Only 23,5 percent of such subjects performed error tasks, while 51,4 percent of patients

with organic Affective Disorders made mistakes in identifying unfamiliar faces ($p<0,05$). When conducting subtests of a standardized neuropsychological block of non-verbal geometric shape recognition methods, patients with organic Affective Disorders performed tasks much worse than patients with endogenous depression. Patients in the first group successfully performed the task in only 32,4% of cases, while patients with endogenous depression successfully performed the task in 70,6% of cases ($p<0,01$).

Thus, the data cited shows the predominance of short-term visual memory disorders that manifest primarily in nonverbal stimulus material in a group of patients with organic Affective Disorders. This allows us to talk about the selectivity of the right hemisphere (right hands), which is associated with the information described in the literature. The differences between the results in the groups examined in the initial neuropsychological study indicate that for patients with endogenous Affective Disorders, violations indicating the phenomena of executive functions, lack of functions for planning and organizing cognitive activity, discordation of interhemispheric interaction are common. Gnostic, Mnestic functions, spatial changes, dynamic Praxis disorders are more pronounced in patients with organic depression, but their severity does not reach the level of traditional neuropsychological syndromes.

Moderately pronounced disorders of auditory and visual Gnosis, short-term visual and auditory memory, nominative function of speech, dynamic praxis and simultan gnosis are identified in a weakly structured form, but this, by the totality of their manifestation, allows them to be classified as signs of insufficiency of the left temporal lobe, in particular, its convection-basal Sections. In addition, unlike healthy subjects, patients with depression alone had a reduced ability to make rational decisions based on logic and reasoning (based on wcst test results), which recorded a "compensatory shift" towards relatively high IGT test performance, i.e. better decision making based on emotional learning. Analysis of correlations between psychometric and neurophysiological indicators showed that higher wcst test rates were higher in most snails in patients with depression with spectral power values of Von EEG's Alpha-2 lower range (9-11 Hz), reflecting a more conserved functional state of the cerebral cortex. Conversely, difficulties in Task orientation in the WCST test are associated with large values of spectral strength of the EEG Delta sub-band (2-4 Hz) in the frontal-central-temporal hooks, which reflects a decrease in the functional state of the anterior regions of the cerebral cortex – "hypofrontal". High decision-making rates in IGT testing are associated with large values of teta-2 (6-8 Gts) and Alpha-1 (8-9 Gts) spectral power in most snails, reflecting a decrease in the functional state of the cortex and an increase in the activity of the hippocampal structures of the brain.

Analysis of the relationship of the quantitative values of EEG spectral capacity to the results of neurocognitive methods also confirms that there is interaction between different neurocognitive decision mechanisms in patients with depression, manifested in the form of "compensatory displacement". A decrease in the functional state of the anterior (frontal-central-temporal) regions of the cerebral cortex - "hypofrontal", which is reflected in the form of a predominance of low-frequency components of the EEG and causes a lack of executive functions based on logical thinking, can lead to disinhibition of hippocampal structures responsible for subcortical, including emotional behavior, an increase in their activation. EEG has been associated with the best indicators of emotional learning that are reflected in Teta rhythm amplification. Conclusions. In depression, there is a violation of neurocognitive decision-making mechanisms.

Compared to healthy subjects, patients with depression decreased their ability to make decisions based on logic and reasoning and emotional learning. The greater the lack of neurocognitive decision mechanisms, the more strongly depressive symptoms manifest. Relatively high rates of emotional learning have been reported in depression patients with decreased ability to make rational decisions based on logic and reasoning, i.e. there is a "compensatory shift" towards emotion-based decision making. In healthy subjects, the effect of" compensatory displacement " is not observed. The findings lead to disinhibition of "hypofrontal" subcortical, including hippocampal, brain structures that present difficulties in making decisions that require logical thinking, the activation of which may mediate higher rates of emotional learning. It should be noted again that a characteristic feature of disorders identified using sensitive neuropsychological tasks is the recognition (from memory) of stimuli with strict individual characteristics (unfamiliar faces, geometric shapes), which indicates great interest in the temporoparietal and parietal – occipital parts of the brain in the right hemisphere. The peculiarities of these diseases, especially in short-term memory mechanisms, impaired recognition as an intermediate operation, most likely indicate dysfunction of the structures of the Peypetic circle (hippocampus, amygdala, singulate gyrus, etc. at the same time, activation disorders are also clearly identified, indicating that limbic complex structures are inextricably linked with activating structures of interstitial brain and root formations. interaction with neocortical structures.

For patients with endogenous Affective Disorders, disorders that indicate a lack of executive functions, planning and organizing functions of cognitive activity are common. This indicates a possible dysfunction of the interrelated structures of the left and right temporal lobes with different sections of the prefrontal and orbitofrontal cortex.

**Conclusions.** Neuropsychologically, this is manifested in a violation of the decision-making process, given the emotional color of the situation, for example, due to an alarming and asthenic "attachment" to the depressive picture. Gnostic and other disorders characteristic of patients with organic depression are less pronounced in patients with endogenous affective disorders, with the exception of elements of auditory-speech memory and verbal thinking disorders (weakly expressed disorders), which is probably the result of the influence of Affective Disorders on the overall activation potential of the system of interconnected structures of the mesolimbic complex. The above data from the preliminary study requires structural and functional clarification, primarily using modern neuroimaging studies. It is envisaged in a multidimensional research design project, the results of which will be published when the relevant material is analyzed.

## REFERENCES

1. Aleksandrovna S. M. et al. Integrated approach to correcting neurocognitive defects in schizophrenia //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 76-81.
2. Allambergenov A. J. et al. Postcovid syndrome and its neuropsychiatric consequences after covid-19 in patients with alcoholism //European Journal of Interdisciplinary Research and Development. – 2023. – T. 11. – C. 42-46.
3. Anatolyevna S. Y. et al. Protective-adaptive complexes with codependency //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 70-75.
4. Asliddinovich M. O. et al. Psychological characteristics of patients with gastrointestinal diseases //IQRO. – 2023. – T. 3. – №. 1. – C. 225-230.

5. Hamidullayevna X. D., Temirpulatovich T. B. Clinical and psychological features of alcoholism patients with suicidal behavior //IQRO. – 2023. – T. 1. – №. 2. – C. 711-720.
6. Holdorovna, I.M. and Temirpulatovich, T.B. 2023. Optimization of complex methods of treatment of patients in schizophrenia. Journal of education, ethics and value. 2, 8 (Aug. 2023), 59–67.
7. Holdorovna, I.M. and Temirpulatovich, T.B. 2023. The Role of the Family in the Formation of Internet Addiction. Scholastic: Journal of Natural and Medical Education. 2, 7 (Jul. 2023), 10–15.
8. Murodullayevich K. R., Holdorovna I. M., Temirpulotovich T. B. The effect of exogenous factors on the clinical course of paranoid schizophrenia //Journal of healthcare and life-science research. – 2023. – T. 2. – №. 10. – C. 28-34.
9. Murodullayevich K. R., Temirpulatovich T. B., Holierovna K. H. Social assistance in patients with phobic anxiety disorders //Iqro jurnali. – 2023. – T. 2. – №. 2. – C. 408-413.
10. Nikolaevich R. A. et al. Social, socio-cultural and behavioral risk factors for the spread of hiv infection //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 49-55.
11. Ochilov U. U., Turaev B. T., Zhumageldiev N. N. Peculiarities of the formation and course of alcoholism in persons with character accentuations and personality disorders //Bulletin of Science and Education. – 2020. – №. 10-4. – C. 88.
12. Temirpulatovich T. B., Hamidullayevna X. D. Clinical and labarator changes in patients with alcoholism who have undergone covid 19, with various pathologies in the liver //Open Access Repository. – 2023. – T. 4. – №. 2. – C. 278-289.
13. Temirpulatovich T. B., Hamidullayevna X. D. Neuropsychiatric disorders that develop in a complication of covid-19 to alcoholism //European Journal of Interdisciplinary Research and Development. – 2023. – T. 11. – C. 47-51.
14. Temirpulatovich T. B., Murodullayevich K. R. Characteristic features of postkovid syndrome in patients with alcoholism, the presence of various liver diseases //Open Access Repository. – 2023. – T. 4. – №. 2. – C. 266-277.
15. Temirpulatovich T. B., Murodullayevich K. R., Uzokboyevich T. A. The Interrelationship of The Covid-19 Pandemic with Alcohol Abuse //Eurasian Medical Research Periodical. – 2022. – T. 8. – C. 137-139.
16. Temirpulatovich T. B., Sabrievna V. A. Effects of the Covid-19 Pandemic on the Frequency of Alcohol Abuse and Clinical and Psychopathological Features //Eurasian Medical Research Periodical. – 2022. – T. 8. – C. 68-71.
17. Temirpulatovich T. B., Uzokboyevich T. A. Biochemical Changes in the Liver After Covid-19 Disease in Alcohol-Dependent Patients and Their Effects on the Course of Alcoholism //The Peerian Journal. – 2023. – T. 15. – C. 28-37.
18. Turaev Bobir Temirpulatovich,Ochilova Nigina Ulug'bek qizi. "Study of the dominant signs of a manifest attack of schizophrenia with the use of psychoactive substances". Iqro jurnali, vol. 2, no. 2, Apr. 2023, pp. 388-94.
19. Turayev B. T., Ochilov U. U., Kubayev R. M. Distribution of anxiety and depression in affective disorders of somatized depression //International medical scientific journal. – 2015. – C. 60.

20. Turchaninova V. N. et al. Formation of rehabilitation motivation in the conditions of the medical and rehabilitation department of a psychiatric hospital //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 82-89.
21. Turchaninova V. N. et al. Opportunities for comprehensive psychometric assessment of anxiety states in late-age dementia //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 90-96.
22. Turgunboyev Anvar Uzokboyevich, Turaev Bobir Temirpulatovich, Kholmurodova Hulkar Holierovna 2023. Clinical and psychological analysis of the risk of second admission of patients with psychoses of the schizophrenia spectrum to a psychiatric hospital. Iqro jurnali. 2, 2 (Apr. 2023), 380–387.
23. Usmanovich O. U. et al. Detection of adrenaline and stress conditions in patients using psychoactive substances with hiv infection //CUTTING EDGESCIENCE. – 2020. – C. 42.
24. Usmanovich O. U. et al. The main forms of aggressive manifestations in the clinic of mental disorders of children and adolescents and factors affecting their occurrence //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 42-48.
25. Usmonovich, O.U. and Temirpulatovich, T.B. 2023. The influence of the presence of mentally ill children in the family on the psyche of parents. Journal of education, ethics and value. 2, 8 (Aug. 2023), 68–75.
26. Vadimovich A. S. et al. Association of dopaminergic receptors of peripheral blood lymphocytes with a risk of developing antipsychotic extrapyramidal diseases //Science and Innovation. – 2023. – T. 2. – №. 11. – C. 29-35.
27. Shernazarov Farrukh ORGANIZATION OF DIGITALIZED MEDICINE AND HEALTH ACADEMY AND ITS SIGNIFICANCE IN MEDICINE // SAI. 2023. №Special Issue 8. URL: https://cyberleninka.ru/article/n/organization-of-digitalized-medicine-and-health-academy-and-its-significance-in-medicine (дата обращения: 20.11.2023).