

## Late-Life Depression and Cognitive Deficits: A Neuropsychological Portrait

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## Депрессия в позднем возрасте и когнитивный дефицит: нейropsychологический портрет

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**Abstract.** The article presents an analysis of the symptoms of neurocognitive deficit in late-life depression, revealed in the neuropsychological diagnostic study of 197 patients with depression (average age  $68 \pm 13$  years), who were on inpatient treatment in the clinic of the Scientific center of mental health (Moscow). The results of the study allowed to give a description of the features of memory, attention, different types of perception, voluntary movements and actions, language functions, thinking in late depressions. The author of the article formulated assumptions about possible variants of localization and lateralization of brain dysfunctions in late depression, the degree of severity of neurocognitive deficit, the possible role of age, educational factors and social status in reducing cognitive functioning. The findings state that various manifestations of neurocognitive deficit in late-life depression are observed quite often. Therefore, therapy of late depression should be aimed not only at optimizing the affective status of patients, but also to compensate for the deficit of cognitive functioning.

**Keywords:** *aging; depression; neuropsychological approach; mental functions; neurocognitive deficits*

**Аннотация.** В статье представлен анализ симптомов нейрокогнитивного дефицита при депрессии в позднем возрасте, выявленных при нейропсихологическом диагностическом исследовании 197 пациентов с депрессией (средний возраст  $68 \pm 13$  лет), находившихся на стационарном лечении в клинике Научного центра психического здоровья (Москва). Результаты исследования позволили дать характеристику особенностей памяти, внимания, различных типов восприятия, произвольных движений и действий, языковых функций, мышления при поздних депрессиях. Автором статьи сформулированы предположения о возможных вариантах локализации и латерализации мозговых дисфункций при депрессии в позднем возрасте, степени выраженности нейрокогнитивного дефицита, возможной роли возраста, образовательных факторов и социального статуса в снижении когнитивного функционирования. Полученные данные свидетельствуют о том, что различные проявления нейрокогнитивного дефицита при депрессии позднего возраста наблюдаются довольно часто. Поэтому терапия депрессии в позднем возрасте должна быть направлена не только на оптимизацию аффективного статуса больных, но и на компенсацию дефицита когнитивного функционирования.

**Ключевые слова:** старение; депрессия; нейропсихологический подход; психические функции; нейрокогнитивный дефицит

## Introduction

In recent decades, many countries around the world have seen a significant increase in the number of elderly and senile people (Frolkis, 1991; Gavrilova, 2011; Korsakova, 1996; Krasnova & Lidars, 2002; Stuart-Hamilton, 2010). Accordingly, the frequency of certain mental diseases, especially affective disorders, increases. Their prevalence in old age significantly exceeds the indicators of young and middle age. Depressions cause a decrease in the quality of life, exacerbate the course of somatic diseases, and increase the risk of social isolation. Cognitive impairment in late-onset depression plays a role in chronicling the disease with a worsening prognosis. Affective disorders of the depressive spectrum are now one of the central objects of research in psychiatry, neurology, and clinical psychology (Balashova & Mikeladze, 2015b; Birren & Schaie, 1985; Kontsevoy, 1999; Kontsevoy, Medvedev, & Yakovleva, 1997; Ryakhovskiy, 2011; Simutkin, 2000). The special attention of scientists to late-life depressions is due not only to their high prevalence, but also to the fact that some aspects of this mental disorder are still insufficiently studied.

One of these aspects is the neurocognitive deficit that accompanies affective disorders of late age. In publications of recent decades, there are frequent references to possible memory and attention deficit in late depressions (Kontsevoy, 1999; Ryakhovskiy, 2011). The degree of severity of this deficit can vary from very serious violations (with so-called “pseudo-dementia”) to minor ones, noticeable only to specialists. The third mental function, which is often mentioned in domestic and foreign publications on late-life depressions — is the perception of time (Balashova & Mikeladze, 2013; Balashova & Mikeladze, 2015a; Balashova & Mikeladze, 2015b; Balashova & Portnova, 2006; Ivry &

Spencer, 2004). But what about other mental processes? What other cognitive functions are more or less vulnerable to affective disorders of the depressive spectrum in the elderly and old people? Is it possible to assess the extent of this vulnerability? What can we say about the localization of brain dysfunctions in such disorders?

We will try to give answers to these questions in the present article.

## Methods and Participants

### Methods

All participants underwent a comprehensive neuropsychological examination (Balashova & Kovyazina, 2012; Luria, 2000). This survey included diagnostic methods aimed at studying perception, memory, voluntary movements and actions, speech functions, attention, thinking, energy and regulatory components of mental activity. Qualitative analysis of the results, their interpretation in the context of the methodology of the Luria's syndrome approach, as well as quantitative processing, were carried out.

### Participants

In the study, 197 patients of Mental Health Research center (Moscow, Russia) with depression (average age 68+13 years) were voluntarily admitted. Neuropsychological examination of patients was performed on the recommendation of the attending medical doctor. Patients had the following diagnoses: recurrent depressive disorder (F33) — 93 patients; bipolar affective disorder (F31) — 46 patients; depressive episode (F32) — 24 patients. In addition, a separate group of patients with other types of depression was identified — 34 patients. The studied sample was dominated by apato-adyamic and anxiety depressions of moderate severity. Among the patients, 59 % were women and 41 % — men, 63 % had higher education, 37 % — secondary or specialized secondary education; 76 % of patients were retired, 24 % continued to work. According to the self-report, 90 % of patients were right-handed, 4 % left-handed, and 6 % were Ambidextrous.

## Results

The data of neuropsychological examination allowed us to state a number of features of cognitive functions that are characteristic of many depressive patients.

### Memory

In the mnestic sphere, patients with late depression often have increased inhibition of traces of unorganized auditory-speech material and individual violations of their selective purposeful actualization in the form of contamination. These symptoms are clearly noticeable when memorizing and delayed playback of five words and two groups of three words (Balashova & Kovyazina, 2012). When performing the first of these methods, it may also

be difficult to remember the order of auditory-speech stimuli. The process of memorizing the material proceeds more slowly in depressed patients than in healthy individuals of late age; they require more presentations of the word series; they have lower productivity of delayed reproduction (Balashova, 2016; Zarudnaya & Balashova, 2018). A number of these negative manifestations can be compensated for when introducing semantic organization of the material (for example, when memorizing and delaying the reproduction of two sentences). In some patients, there is also a decrease in involuntary memory: they cannot remember a small text they have just read. In addition, in a significant part of patients, indicators of updating knowledge stored in long-term verbal memory deteriorate. When it is necessary to name a number of words that have a common perceptual feature (five sharp objects), patients often paused; they need verbal stimulation from the psychologist or a hint in the form of additional clarification of the semantic field (Zarudnaya & Balashova, 2018). Patients with depression may have difficulty in remembering and delayed recall of visual-spatial stimuli and symptoms of reduced involuntary memorization.

### **Attention**

In most patients with depression, neuropsychological examination reveals fluctuations in attention. These fluctuations are closely related to the uneven level of achievement in the performance of various tasks; in many cases, they appear in a single syndrome with a slowdown in the pace of mental activity, difficulties in including in the performance of tasks, total or partial exhaustion.

Fluctuations in attention could be manifested in special tests (for example, when searching for numbers in Schulte tables), as well as in other types of mental activity. Recall that in modern Russian neuropsychology, the prevailing idea of attention as a special quality (selectivity) of any mental process (Chomskaya, 1987). Sometimes the fluctuations in attention observed in patients with depression were modal-specific. As an example, we can mention the left-hand “inattention” in the visual sphere, which is manifested, in particular, when it is necessary to count the characters in the story picture “Carefully,” when performing visual object gnosis tests, etc. (Balashova & Kovyazina, 2017). Note also that in late-life depressions, such gross attention disorders as “field behavior” or pathological distraction are never encountered (Luria, 2000).

### **Perception of Time**

The perception of time, according to many modern psychologists, is a complex functional system (Mikeladze, 2016). This system includes orientation in the past and current time, the ability to evaluate and measure intervals of various durations, understanding the sequence or simultaneity of events, as well as verbal and figurative representations of time, structuring and experiencing the temporal perspective of the individual as a continuum of the past, present and future. In the case of late-age depressions, the functional system described can be identified as safe and vulnerable links. The first includes orientation in time, understanding the sequence or simultaneity of events, using logical and grammatical structures that describe various time relations and categories, possession

of the rules for using the means of determining time created in the course of cultural and historical development (clocks, calendars, etc.). Now let's talk about the vulnerable links. In late-age depressions, subjective time is accelerated (patients usually have a very short subjective minute; they tend to overestimate the short time intervals between two clicks of the stopwatch; they often have a significant error in the direct (without relying on the clock) assessment of the current time and duration of the neuropsychological examination) (Balashova & Mikeladze, 2015a; Balashova & Portnova, 2006; Carrasco, Bernal, & Redolat, 2001; Hazeltine, Helmuth, & Ivry, 1997). In later depressions, the time perspective also changes in comparison with normal aging. According to the findings, received when using Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999), depressive patients begin to dominate negative assessments of the past, fatalistic perception of the present, and reduced orientation to the future (Balashova & Mikeladze, 2013).

### **Tactile, Auditory, Visual Perception**

If we talk about tactile, auditory, visual perception, in general, they are quite intact in affective disorders of late age. Their changes in depression are never qualified as agnosia. In the sample we examined, we observed almost no cases of deficits in tactile gnosis, speech perception, visual object and letter gnosis. In the examined group of patients with depression, we observed almost no cases of deficits in tactile gnosis, speech perception, visual object and letter gnosis. However, in a fairly noticeable part of patients, there may have been some errors in the assessment of the rhythmic structures presented to the ear and in the optical-spatial tasks. In the latter case, it was the error so-called "on step" ( $\pm 5$  minutes,  $\pm 1$  hour) in determining the time by the "silent" clock and in self-alignment arrows drawn on the clock, the deficit of spatial representations with self-drawing and copying of volume objects (table on four legs, cube, etc.), slight constriction of the volume of visual perception.

### **Voluntary Movements (Praxis)**

The sphere of voluntary movements (praxis) in late-life depressions, it also presents an ambiguous picture. Errors in tests of kinesthetic and regulatory praxis are quite rare; only sometimes in these types of movements there are so-called "errors of attention," which have the character of individual manifestations and in most cases are available for independent correction or correction on the instructions of a psychologist.

The areas of spatial and dynamic praxis are somewhat more problematic. In sensitized versions of H. Head tests (i. e., in reproducing cross and two-handed poses), patients with depression often make mirror errors or simplify the sample pose. Interestingly, after minimal intervention by a psychologist, these errors disappear, and the performance is again stabilized. This fact testifies not only to a certain decrease in the level of the spatial factor and independent control functioning over the course of activity, but also to the possibility of compensating for the cognitive deficit when external mediation is enabled. In dynamic praxis, quite often (especially at the initial stages of performing tests), there is a tendency to deautomatization of movements, to stereotypes, to a decrease in speech self-regulation. These symptoms are also partially compensated. Manifestations of deautomatization, lack

of dynamic organization of movements (A. R. Luria called it kinetic melody) can also be observed in writing and when copying a pattern of two changing links (Balashova & Kovyazina, 2012; Luria, 2000).

### **Language Functions**

In the language sphere, there are no pronounced manifestations of any aphasia in late-age depressions. However, the majority of patients have some difficulties in remembering the names of details of objects (these questions are usually included in the procedure for studying visual object gnosis). Sometimes it is also difficult to differentiate images of subject complexes described by speech constructions with prepositions *for* and *before*, *right* and *left*. However, constructions with prepositions *under*, *on*, and *in* are usually interpreted correctly. Sometimes patients with depression had insufficient speech activity when composing stories based on scene pictures, when explaining the figurative meaning of proverbs and metaphors.

### **Thinking**

As for thinking, many patients with depression have single errors in the process of serial subtraction from 100 to 7 (while preserving the ideas about the bit structure of the number and performing counting operations separately). The same can be said about a test in which the omitted sign of an arithmetic action must be reconstructed based on the result (Balashova & Kovyazina, 2017). It is also difficult to solve arithmetic problems without relying on the help of a psychologist (especially at the stages of orientation in the conditions, building the program and changing it when moving to a new task).

In other verbal-logical tasks, many patients have uneven levels of achievement, when some subtests are performed quickly and correctly, and in others there are difficulties or a decrease in the level of generalization. Such unevenness is observed when explaining the figurative meaning of Proverbs, metaphors and idioms, when selecting antonyms for nouns, adjectives, adverbs, verbs, when excluding an extra item from the four proposed options, when highlighting essential features of objects and phenomena, when comparing concepts. It is interesting that about a quarter of the examined patients, when excluding an extra item, as well as when comparing concepts, noted cases of using latent, unusual properties of objects, difficulties in differentiating their essential and secondary features. Such manifestations of features of cognitive activity characteristic of individuals of the schizoid circle indicate a possible endogenous radical in the clinical picture of some late depressions.

Explanation of the meaning of various plot images is generally available to depressive patients; only in a small number of cases there are superficial interpretations of their content, insufficient attention to the individualized (in the words of Ya. A. Meerson) signs of the depicted people and objects, or manifestations of a lack of simultaneous perception.

### **Localization and Lateralization of Brain Dysfunction in Late-Life Depressions**

The neuropsychological portrait of late depressive disorders would be incomplete without data on the localization of brain dysfunctions in such diseases.

Our research shows that late-life depressions are most characterized by symptoms of dysfunction of the subcortical structures of the brain, the frontal and temporal zones. For example, it turned out that certain symptoms of dysfunction of subcortical structures of the brain were found in all patients without exception. Analysis of the results also revealed that the manifestations of subcortical dysfunction in late-age depression were variable. Some of them reflected general changes in the energy support of mental activity and could be observed when performing almost any task of neuropsychological examination; others were of a more “partial” nature and were detected only in certain types of motor or graphic activity. The obtained data also indicate that in late depressions, a number of vulnerable links are found in the state of a number of parameters of mental activity provided by subcortical structures. Thus, difficulties in including in performance of tasks were observed in 78 % of patients, fluctuations in voluntary attention and level of achievement — in 82 %, slow pace of task completion — in 46 %, tremor — in 42 %. Depletion (deterioration in the quality of activity at the end of the neuropsychological examination or when performing a single task) and micrography were less common in the examined group of depressed patients.

Dysfunction of the frontal parts of the brain was most often expressed in a small deficit of control, in impulsivity, in a lack of criticality to mistakes made, in violations of dynamic praxis. At the same time, some mistakes made could be successfully corrected after the instructions of a psychologist. Impulsivity was manifested in the fact that the patient began to act without previous thinking about the sequence of operations, without analyzing its conditions. According to modern scientists, this symptom is characteristic of dysfunction of the right frontal area. In the tasks of dynamic praxis (related primarily to the functioning of the posterofrontal region of the left hemisphere of the brain), in patients with depression may be observed a tendency to deautomatization of movements, to stereotypes, to a decrease in speech self-regulation. At the same time, in the syndrome of frontal dysfunction in late-age depressions, manifestations of pathological inertness (perseverations), echolalia, echopraxia, and severe voluntary attention disorders were very rare.

According to the concepts of modern neuropsychology, dysfunction of the temporal parts of the brain is usually expressed in violations of the assessment and reproduction of rhythmic structures, nominative speech function, in manifestations of narrowing the volume of auditory-speech perception. There may also be manifestations of increased inhibition of traces of auditory-verbal memory and a deficit in their selective actualization, errors in the reproduction of word order, violations of phonemic hearing, sound-letter analysis, and some other symptoms. Analysis of the results of our study showed that the most common symptoms of temporal brain dysfunction in the group of depressive patients were increased inhibition of traces of auditory-verbal memory, narrowing of its volume and violations of word order during memorization or delayed reproduction. These symptoms were observed mainly when memorizing unorganized auditory-verbal material (five words, two groups of three words). Somewhat less frequent were manifestations



of a deficit in the nominative function of speech (i. e., difficulties in naming objects and / or their details) and errors in evaluating and reproducing rhythmic structures.

The question of lateralization of brain dysfunction in late-life depressions is quite complex. The following facts can be noted. Brain dysfunction in depression is not local, but diffuse. Quite often, the neuropsychological syndrome is limited to manifestations of a deficit of neurodynamic support for mental activity, the specific manifestations of which (exhaustion, fluctuations in attention, slow speed of task completion, etc.) simply cannot be associated with changes in the work of the left or right hemisphere only. In later depressions, neuropsychologists often observe bilateral brain dysfunction. However, in many cases, they also report more distinct symptoms from the right hemisphere of the brain. Such symptoms include, for example, manifestations of left-hand inattention in the visual sphere, difficulties in evaluating simple rhythmic structures, specific errors in visual-spatial gnostic and graphic tasks, failures of the left hand in reciprocal coordination, fragmentation of visual perception and specific changes in the perception of time.

## Discussion

The obtained data allow us to make a number of observations about the nature of neurocognitive deficit in late-life depressions.

First, we should say about the brain substrate of the described symptoms. In all probability, most often we can talk about the dysfunction of subcortical structures of the brain. Processing of data obtained during the neuropsychological examination shows that in the examined group there were 100 patients with dysfunction of subcortical brain formations. In 13 patients with depression, dysfunction of subcortical formations was combined with changes in the posterior (mainly temporal and/or parietal) parts of the brain; in 47 patients — with changes in the work of the anterior parts of the brain. In 35 patients, the brain dysfunction was more extensive: along with the dysfunction of subcortical formations, symptoms were observed from both the posterior and anterior parts of the brain. In 2 people, the examination did not reveal any pathology of mental functions. If we talk about the predominant connection of the identified brain dysfunctions with changes in the work of the brain hemispheres, it can be stated that the most likely is the right-hemisphere accent of the complex of symptoms. This is evidenced by the nature of performing a number of optical-spatial tests, changes in the perception of time, the absence of any significant language disorders, etc.

Secondly, the degree of severity of the detected neurocognitive deficit in most cases is not significant. These data coincide with the clinical indicators of the MMSE test (Mini Mental State Examination), which detect the absence of cognitive impairment or the presence of mild to moderate disorders in patients with late depression.

Third, the severity of many aspects of neurocognitive deficit is associated with a number of factors. These are age, educational level, and social status. Patients with higher education who continue their work are more successful in performing of the majority



of neuropsychological tests. Results are also reduced in patients over 75 years of age compared to younger patients. However, the study does not reveal significant gender differences, as well as the influence of the factor of manual dominance. The degree of severity and nature of neurocognitive deficit may be associated with the duration of the disease, with the characteristics of its course and clinical manifestations.

Finally, it should be noted that the presence of neuropsychological dysfunctions may be associated with the prognosis of the disease. In particular, the presence of symptoms of frontal dysfunction is a risk factor for further development of depression.

## Conclusion

In conclusion, it should be said that various manifestations of neurocognitive deficit (in terms of components and degree of manifestation) are observed quite often in late-age depressions. Therefore, therapy for late depression should be aimed not only at optimizing the affective status of patients, but also at compensating the certain aspects of cognitive functioning.

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