

## ORIGINAL ARTICLE

# NEUROPSYCHOLOGICAL PRINCIPLES OF COGNITIVE AND COMMUNICATIVE ACTIVITIES DIAGNOSIS IN ADULTS WITH EXTRAPYRAMIDAL SYSTEM DISORDERS

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## ABSTRACT

**The aim** is to determine the neuropsychological peculiarities of cognitive and communicative activities in adults with the extrapyramidal system disorders.

**Materials and methods:** The research was conducted during 2018-2021, during which a retrospective analysis of medical treatment records of the patients with extrapyramidal disorders of various etiologies was performed. The research involved 137 adult patients with extrapyramidal disorders: 93 persons with Parkinson's disease, 36 people with manganese encephalopathy, 5 persons with progressive supranuclear palsy and 3 people with Wilson-Konovalov disease.

**Results:** A significant difference between the indicators of preservation of cognitive and communicative activities and the communicative and semantic component in the group of patients with Parkinson's disease without speech disorders and Parkinson's disease and between the groups of patients with Parkinson's disease without speech disorders and progressive supranuclear palsy indicates the need for experimental correctional and rehabilitation work to restore cognitive and communicative activities of the patients with extrapyramidal disorders.

**Conclusions:** The most preserved communicative and speech function was found in the patients who had initial and mild stages of the disease, in particular in the patients with Parkinson's disease without speech disorders. It should be emphasized that the diagnosis of cognitive and communicative activities and the communicative and semantic component in adults with extrapyramidal disorders is a necessary prerequisite for the organization of the process of comprehensive rehabilitation treatment.

**KEY WORDS:** neuropsychology, neuropsycholinguistics, extrapyramidal disorders, cognitive processes, speech disorders

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## INTRODUCTION

Deep assessment and understanding of the current state of implementation of comprehensive medical and psychological, as well as logopedic treatment in the system of medical, psychological and pedagogical rehabilitation of patients with disorders of the central nervous system allows us to consider it as a promising direction, which involves the search for innovative methods and techniques of restoring their cognitive and communicative activities [1-3].

An important condition for ensuring effective correctional and rehabilitation work is the use of an integrative approach, namely: the interpenetration of knowledge from different fields (medicine, psychology, neuropsychology, psycholinguistics, etc.) to achieve the corrective goal [4-9].

Parkinson's disease (PD) is one of the common diseases of the extrapyramidal system. This disease is considered as a neurological condition that occurs due to neurodegenerative changes in the brain. This condition can be hereditary or acquired due to age-related changes or adverse environmental influences, but the causes of PD are still unknown. The analysis of existing research dedicated

to the study of this pathology showed that it develops in 40-60 years old people, sometimes earlier, resulting in the disappearance of pigmented dopaminergic neurons of the substantia nigra, which are involved in the transmission of impulses from the brain to the muscles and promote smoothness of movements [10].

The patients with PD have disorders of cognitive activity and verbal communication along with motor disorders; they can also have depression and vivid dreams lasting up to 5 years or more. Motor disorders develop later in the form of bradykinesia, muscle rigidity, rest tremor and postural instability. Symptoms appear on one side of the body first proceeding with the other part within 2-3 years. The main symptoms that indicate the progression of PD include: severe bradykinesia, rigidity, ambulation disorder, parkinsonian posture, disorders of speech, swallowing, intellectual disabilities, depression, dyskinesia, falls and imbalance, changes in handwriting (micrography), stiffness when walking, the face becomes mask-like, etc. [10-12]. Based on a review of the results of a study of patients with PD, it was found that 89% of such individuals have speech or voice disorders, including

disorders of laryngeal, respiratory and articulatory functions and only 3-4 % of them undergo logopedic therapy. People suffering from PD and their families consider restriction in communication to be one of the most difficult consequences of PD due to the following factors: too quiet voice (hypophony), low tonal range (monotonous voice), hoarse voice, blurred articulation, and decreased facial expressions (hypomimia) [12, 13].

The main clinical manifestations of PD and methods of its treatment have been studied and described in the works many scientists [14, 15]. The scientists emphasize that speech disorders are the main symptoms and signs of the extrapyramidal system disorders. Therefore, the issue of diagnosis of cognitive and communicative activities disorders in case of extrapyramidal pathology requires consideration of neuropsychological and neuropsycholinguistic approaches.

Aspects of the functioning, problematics and comprehensive rehabilitation of people with extrapyramidal disorders have always been in the field of view of scientists of different centuries and different fields of knowledge. Thus, numerous investigations of such doctors as neuropathologists, therapists, rehabilitation specialists, etc. are devoted to the restoration of motor functions and the issues of medical treatment and physical rehabilitation of various patients with disorders of the central nervous system [16-18]. All studies of the organization of the correctional and rehabilitation process indicate the need to create special conditions for the restoration of cognitive and communicative function in people with extrapyramidal pathologies. However, the method of psychological and logopedic therapy for adults with extrapyramidal disorders, taking into account the symptoms and signs, severity and complication of the disease was not the subject of special scientific research.

The systematic analysis of the scientific papers shows that, despite the significant developments in the field of rehabilitation, the problem of a comprehensive approach to psychological and pedagogical as well as logopedic therapy for people with extrapyramidal disorders in the process of correctional and rehabilitation work is insufficiently disclosed.

Extrapyramidal motor disorders are the basis of the clinical manifestation of various neurodegenerative diseases with a predominant lesion of the subcortical basal ganglia. Numerous results of studies conducted by various scientists have shown that adults are more likely to have disorders of higher mental functions (memory, attention, imagination, thinking, speaking) and behaviour [15, 19, 20]. The appearance of such disorders indicates the first signs of the disease associated with disorders to the extrapyramidal system. Given that speech activity is an important human achievement that provides one of the main aspects of communicative function, the process of its recovery and normalization should be considered as a process of personal correction according to its individual capabilities, ensuring the success of social rehabilitation and return to normal life.

Deterioration of memory, attention, physical well-being, speech, etc. has been found to be characteristic of a number of diseases, including Alzheimer's disease, Parkinson's disease, and symptomatic forms of parkinsonism, including progressive supranuclear palsy (PSP) and Wilson-Konovalov disease (WKD). All these diseases are based on degeneracy caused by cerebral affection, which is characterized by disorders of mnemonic and other cognitive spheres, including speech, spatial orientation, abstract thinking, which leads to complications in everyday life and professional activities [3].

PSP is a neurodegenerative disease caused by damage to the subcortical and stem structures, which is manifested by postural instability, resulting in numerous falls, supranuclear ophthalmoparesis, pseudobulbar syndrome (dysarthria, dysphonia, dysphagia) and dementia of the subcortical-frontal type. Progressive supranuclear palsy is often referred to as atypical parkinsonism, which develops in 1 case per 10 cases of Parkinson's disease, and the annual incidence ranges from 0.3 to 1.1 cases per 100 000 population. PSP is also known as Steele-Richardson-Olszewski syndrome and most often develops in adults after the age of 45 [21, 22]. PSP was first described in 1963-1964 by neurologists, who conducted a detailed clinical and pathomorphological analysis of seven cases of a previously unknown neurodegenerative disease [22]. The cases of PSP have been described in the scientific literature before, but have been misinterpreted as manifestations of postencephalitic parkinsonism, where PSP is characterised by both clinical and pathomorphological similarities. The primary signs of the disease are postural instability with frequent falls (60 % of cases), dysarthria (33 %), slowness of movement (13 %) and visual disturbances (13 %). Much less often, the primary signs of PSP are dysphagia and stiffness when walking. This disease is manifested by paresis of the vertical gaze, akineticorigid syndrome, the development of postural instability with frequent falling back, pseudobulbar syndrome (dysarthria, dysphonia, dysphagia) and dementia of the frontal type [23].

Hypomimia is developed in patients with PSP, which results in masked facies. Due to the spastic tension of facial muscles, facial features are not smoothed, as is often the case with Parkinson's disease, but exacerbated. In this case, the face acquires a characteristic expression, which can be described as "surprise". Motor and speech perseverations, palilalia, echopraxia, echolalia are manifested. Examination of persons with extrapyramidal disorders revealed that such patients have speech disorders, manifestations of pseudobulbar syndrome (dysarthria, dysphonia, dysphagia), in particular, there is a decrease in speech activity, difficulty initiating and understanding speech. Cognitive and emotional disorders were moderate [24]. The authors agree that the main signs of the disease are ambulation disorder, balance disorder, falling back, rocking in the process of walking, body stiffness, slowness of movement, impaired eye motility, along with speech disorders, swallowing and cognitive impairment.

As for WKD, it is an inherited progressive disease with an autosomal recessive type of inheritance, the pathogen-

esis of contraction and progression of which foresees a violation of copper metabolism, which affects the central nervous system, is accumulated in brain tissue and internal organs. It is manifested as neurological and / or psychiatric symptoms and lesions of the kidneys, liver and cornea (Kayser-Fleischer ring) [25]. The symptoms of the disease most often appear when a person is from 5 to 30 years old. This disease requires mandatory medical treatment, without the use of which a fatal case occurs in 5-7 years.

Studies [26] have shown that the causes of the disease are a mutation in ATP7B, P-type ATP protein gene that transports copper cations. One atypical copy of this gene is present in 1 in 100 carriers of the disease. A child can develop Wilson's disease only if he inherits the disease gene from both parents. Usually the symptoms begin to appear at the age of 6 to 20, but cases have been described in much older people. Wilson's disease is found in 1-4 out of 100 000 people. The problems that have arisen in patients with Wilson's disease have hardly been studied in the direction of providing psychological and pedagogical assistance.

The acquired disorders that lead to the presence of movement disturbances (extrapyramidal disorders in general) include the excessive use of harmful chemicals. It has been established that the use of surrogate drugs obtained by treating medical preparations with potassium permanganate can lead to severe organic brain damage caused by the toxic effects of manganese compounds. Excess of manganese in the body leads to loss of appetite, hallucinations, memory impairment, atony, fatigue, depression, encephalopathy, muscle atrophy, the risk of parkinsonism.

Manganese belongs to a neurotropic poison that can cause the most severe forms of occupational neurotoxicosis. A feature of the pathogenesis of manganese intoxication is its tropism to the extrapyramidal (striopallidar) system. Manganese disrupts the metabolism of biogenic amines, a number of enzymes, inhibits adrenergic activity and activates the cholinergic activity of the nervous system, increases the content of acetylcholine in the synapses of the subcortical nodes and the hypothalamus. The main thing concerning the toxic effect of manganese is a violation of the synthesis and deposition of dopamine, resulting in impaired muscle tone, accuracy, agility and smoothness of voluntary movements [27].

The accumulation of manganese in the brain structures (pale bullet and substantia nigra) disrupts functioning of the cortico-subcortical pathways and pallidum-stem ligaments, which leads to the development of a complex combination of motor and neuropsychological disorders. Parkinsonism is the leading syndrome of chronic manganese intoxication. A rapidly increasing pseudobulbar syndrome with the development of severe hypokinetic-dystonic dysarthria is often the first manifestation of manganese encephalopathy. Cognitive disorders such as bradyphrenia, decreased attention, tendency to perseveration are often observed.

There are three degrees of severity of surrogate drug poisoning as in the case of chronic manganese poisoning. Mild degree is characterised by the patient's slight postural insta-

bility, focal dystonia, mild manifestations of pseudobulbar syndrome in the form of mild dysarthria and dystonia. Moderate degree is characterised by moderate postural instability, moderate multifocal dystonia and moderately manifested pseudobulbar syndrome, characterized by decreased voice volume, impaired pronunciation and monotony of speech. Severe degree causes a pronounced disability i. e. intense postural instability with very frequent falls, pronounced multifocal dystonia, which significantly impairs the gait and other motor functions of the patient, a pronounced pseudobulbar syndrome and severe dysarthria, which leads to speech loss. Thus, the analysis of existing studies on the causes and symptoms of disorders of the extrapyramidal system makes it possible to state that numerous works by scientists in various fields have been devoted to the study of disorders of cognitive processes and speech. However, insufficient attention has been paid to the problem of comprehensive research of cognitive and communicative activities in patients with extrapyramidal pathology using neuropsychological, psycholinguistic and neuropsycholinguistic approaches.

Therefore, various disorders of the cognitive and communicative system are manifested depending on the severity and the form of extrapyramidal disorders, which requires a detailed study of symptoms and signs, clinical manifestations in order to work out ways and directions of correctional and rehabilitation work and develop special methods for comprehensive rehabilitation taking into account medical, neuropsychological, psycholinguistic and neuropsycholinguistic approaches.

## THE AIM

The aim of this study is to determine the neuropsychological peculiarities of cognitive and communicative activities in adults with the extrapyramidal system disorders.

## MATERIALS AND METHODS

*Participants.* During 2018-2021, we conducted an experimental research of 137 adult patients with extrapyramidal disorders who were examined and treated in the neurology department and the advisory clinic department involving 93 people with Parkinson's disease, 36 patients with manganese encephalopathy (ME), 5 people with progressive supranuclear palsy and 3 people with Wilson-Konovalov disease.

*Methods.* The research is based on neuropsychological and neuropsycholinguistic approaches, which involve a systematic analysis of the brain and psyche in unity and interdependence [28]. It allows you to correlate the maturity and integrity of brain structures with the formation and preservation of mental functions involved in various human activities. Since cognitive processes and speech are forms of mental activity carried out on the basis of appropriate motives, regulated by appropriate goals and programs and subject to all laws of mental activity, the process of their recovery and normalization is the main

goal of comprehensive rehabilitation and social integration of patients with central nervous system (CNS) disorders.

To achieve the purpose of the research it was necessary to solve the following tasks:

- to identify neuropsychological peculiarities of cognitive and communicative functions in various extrapyramidal pathologies;
- to investigate the state of preservation of cognitive and communicative activities;
- to carry out a complex assessment of the revealed violations of the basic preconditions of communicative and speech activities (neuropsychological bases);
- to conduct a thorough study of cognitive and communicative activities as well as its speech and semantic component, to characterize them in order to organize effective correctional and rehabilitation work.

The first stage – diagnostic-clinical – involved acquaintance with the patients' medical cards, conclusions of neurologists about the results of clinical researches and the established diagnoses about extrapyramidal disorders. In addition, general clinical examinations, otolaryngological examinations, computed tomography and magnetic resonance imaging, and other medical examinations were performed as prescribed by a physician.

The second stage – neuropsychological and pedagogical – involved a neuropsychological and neuropsycholinguistic examination in order to study disorders of cognitive activities as well as expressive and impressive speech and to identify speech and non-speech disorders in adults with extrapyramidal disorders. The quality of cognitive and communicative function was assessed audioperceptively in the process of the conversation with the patient. The purpose of the second stage of the experiment was to assess the performance of tasks according to diagnostic methods and determine the level of preservation of neuropsychological bases of cognitive and communicative activities and basic speech characteristics (fluency, intelligibility, respiration, speech rate, etc.).

The neuropsychological research was performed using the MMSE (Mini-Mental State Examination) scale described in the examination of patients with extrapyramidal disorders and presented in many scientific sources. This scale of assessment of mental status was used to assess cognitive functions due to its comprehensiveness, as it covers its main components. Respondents were offered tasks consisting of 30 points, which were divided into groups according to the studied cognitive components: time orientation, spatial orientation, perception, attention, arithmetic, memory, speech (nominative function, impressive and expressive speech, understanding of complex instructions, reading, writing, etc.). This examination is recommended for the diagnosis of adult patients with disorders of the extrapyramidal system, as it allows to identify the impact of cognitive functions disorders, comprehension of addressed and written speech. Assessment of the level of preservation of cognitive processes during testing is indicated by the authors as a characteristic of patients according to their type i. e. attentive, sleepy, in a stupor, in a coma. The results of the

tasks were assessed according to the scoring system: 29-30 points – no cognitive disorders, 24-28 points – moderate cognitive disorders (slight neuro-cognitive impairment), 20-23 points – mild dementia (medium neuro-cognitive impairment), less than 19 points – severe dementia (pronounced neuro-cognitive impairment).

Therefore, the examination consists of two blocks. The first provides voice answers related to orientation, memory, attention and it is rated at a maximum of 21 points. The second block determines the ability to name objects, perform oral and written commands, spontaneously write sentences, copy a picture of a complex geometric figure and it is rated at 9 points. The total maximum score is 30 points.

This test takes very little time to perform and includes answers to 11 questions and is therefore especially practical for one-time and serial examinations. It is possible to draw conclusions about the patient's cognitive ability on the grounds of this test.

Thus, based on neuropsychological and neuropsycholinguistic approaches the indicators of preservation of cognitive and communicative activities are determined as follows: cognitive activity, preservation of cognitive activity, comprehension of addressed speech, carrying out elementary verbal instructions, preservation of writing skills. The communicative and semantic component defined by us acquires special significance for full-fledged realization of communicative and speech activity. The study of the communicative and semantic component of communicative activity involved the implementation of tasks to study the state of preservation of the main components of speech activity (lexical-grammatical, syntactic, etc.). The indicators of preservation of the communicative and semantic component are the ability to maintain conversation, understand and use lexical and grammatical constructions of varying complexity, talk about interesting (monologue speech), communicate on different topics, culture of speech behaviour, communication initiative, use of different forms of speech activity.

*Statistical analyses.* We used the coefficient of rank correlation according to the bilateral Student's t-test (for independent, unrelated samples) in order to compare the results of the research. The results were considered reliable at  $p < 0.05$ .

*Ethics approval.* The research was performed according to the requirements of the Regulations on Academic Honesty of Poltava V. G. Korolenko National Pedagogical University, which were developed on the basis of Ukrainian and world experience of ethical rulemaking. This document was approved by the Academic Council of Poltava V. G. Korolenko National Pedagogical University (Protocol No. 2 of 10.09.2020) and implemented by the order of the Rector of the University (Order No. 1098 of 10.09.2020). According to its provisions, the members of the scientific community are guided by the rules of ethical conduct and professional communication; respect the principles, values, norms, rules, and conditions of academic honesty in their activities. The consent to participate in the research was obtained from all participants.

## RESULTS

The results of the research of cognitive and communicative activity in 36 patients with manganese encephalopathy (namely the assessment of memory and cognitive processes) on Mini-Mental State Exam scale of mental status of patients revealed that the functions of all patients concerning their orientation in time and space, memory, the ability to concentrate and remember the events that happened to them before, the ability to perform a three-stage task, reading and writing a simple sentence were preserved almost completely.

That is, cognitive functions in patients with manganese encephalopathy were maintained at the level of a healthy person in the range of 27-30 points on the MMSE scale.

Almost all patients had hypomimia combined with a constant smile on their face associated with dystonia, reminiscent of a natural joyful expression ("Manganese Mask"). Patients showed micrographia i. e. the size of the letters when writing became reduced. Severe dysarthria was developed in 28 patients (77.8 %). There was a feeling of tightness in the throat. Forced involuntary manganese laughter was observed in most patients. Lip movements were reduced with a characteristically frozen (not mobile, "frozen") upper lip. The movements of the tongue were slow and jerky (intermittent). Six patients (16.7 %) had moderate salivation and only four (11.1 %) had minor difficulty in swallowing.

Hypokinetic dysarthria was observed in 16.7 % of patients, and hypokinetic dysarthria with dystonic component (with varying degrees of muscle tightness and compression) was observed in 72.2 % of the patients. Four patients (11.1 %) had a persistent dystonic voice without a hypokinetic component. Two patients (5.6 %) had mutism with complete loss of speech volume and speech initiation. Palilalia and the spastic component were identified during the pronunciation of individual words ("YES" – "NO"), which required great effort.

The research included 93 patients with Parkinson's disease, with the average age of  $65.5 \pm 0.75$  years old ranging from 31 to 83. There were two relatively young patients (31 and 36 years old) and five patients older than 75 among those involved in the research. The patients were offered to perform tasks also on the MMSE scale in order to determine the level of preservation of their cognitive and communicative activities.

Diagnosis of memory and cognitive functions using the MMSE scale revealed that memory of the patients with Parkinson's disease was reduced to 25-29 points at a rate of 30 points, indicating mild cognitive impairment. We found 28 (30.1 %) patients without pronounced speech disorders and 65 (69.9 %) patients with pronounced speech pathology among the examined patients with Parkinson's disease. We selected these groups as separate for the sake of purity of the experiment. Moderate neurocognitive disorders were diagnosed in 9 people (13.9 %), mild neurocognitive disorders were found in 35 people (63.8 %) and a high level of preservation of cognitive processes was found in 21 people (32.3 %) in the group of patients

with Parkinson's disease having pronounced speech disorders. A high level of cognitive and communicative tasks performance was found in 20 people (71.4 %) and a mild neurocognitive disorder was found in 8 people (28.6 %) in the group of patients with Parkinson's disease without pronounced speech disorders (28 people). The results of tasks performance on the cognitive and communicative criterion confirm a certain interdependence of the state of cognitive processes and speech activity. The level of preservation of cognitive processes is higher in the group of people with Parkinson's disease without pronounced speech disorders than in the group of people with PD with speech disorders (SD).

MMSE scale for assessing the mental status of patients was offered to determine the preservation of cognitive and communicative activities in the process of examining of 5 patients (2 men and 3 women) with progressive supranuclear palsy aged 48, 60, 62, 68, 72. It was found that all patients have a mild neurocognitive deficit (25-26 points) according to the results of the tasks performance.

The patients with PSP were diagnosed with impaired memory and concentration and writing quality. A score of 26 points indicates cognitive impairment in the patient.

The diagnosis of cognitive and communicative activities in three patients with Wilson-Konovalov disease: one patient was born in 1992, the second one was born in 1994 and the third patient was born in 1979. These are quite young people who have significant problems in communication at the social level.

The diagnosis of cognitive and communicative activities of two patients (66.7 %) with Wilson's disease (according to the MMSE scale) revealed a high level of preservation of cognitive processes (30 points), and one patient showed reduced level (27 points) (33.3 %), indicating a mild neurocognitive impairment.

The study of the preservation of cognitive and communicative activities revealed that most patients with extrapyramidal pathology have a high and sufficient level of preservation of cognitive functions. Most patients with Parkinson's disease (77.7 %) have mild and moderate neurocognitive impairment. Generalized results of preservation of cognitive and communicative activities of all patients with extrapyramidal disorders are presented in Table I.

The research revealed that the preservation level of cognitive and communicative activities is significantly lower in patients with extrapyramidal pathology, in particular with PSP, PD, WKD and ME than the patients with Parkinson's disease without speech disorders. The category of these patients is very heterogeneous in terms of cognitive and speech activities. The following levels of preservation of cognitive and communicative activities of patients are revealed: high, sufficient, medium and low. The coefficient of rank correlation by Student's t-test between the experimental groups is 1.987, 2.04, 2.045 at a significance level of  $\alpha = 0.05$ .

The generalized results of tasks performance on the communicative and semantic component in patients with manganese encephalopathy allowed to establish that 3 (8.3 %) patients have a high level, the majority of patients

**Table I.** The state of preservation of cognitive and communicative activities

Levels of cognitive and communicative activities	Experimental groups									
	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%
	Persons with ME	Persons with PD	Persons with PD without SD	Persons with PSP	Persons with WKD					
	36 people	65 people	28 people	5 people	3 people					
High (age norm)	23	63.8	21	32.3	20	71.4	-	-	2	66.7
Sufficient (mild neurocognitive impairment)	13	36.2	35	63.8	8	28.6	5	100	1	33.3
Medium (moderate neurocognitive impairment)	-	-	9	13.9	-	-	-	-	-	-
Low (severe neurocognitive impairment)	-	-	-	-	-	-	-	-	-	-

**Table II.** The state of preservation of communicative and semantic component in patients with extrapyramidal pathology

Levels of communicative and speech activities	Experimental groups									
	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%
	Persons with ME	Persons with PD	Persons with PD without SD	Persons with PSP	Persons with WKD					
	36 people	65 people	28 people	5 people	3 people					
High	3	8.3	5	7.7	10	35.7	-	-	-	-
Sufficient	29	80.6	12	18.5	15	53.6	2	40	3	100
Medium	4	11.1	18	27.7	3	10.7	3	60	-	-
Low	-	-	30	46.1	-	-	-	-	-	-

29 (80.6 %) have a sufficient level, 4 (11.1 %) patients have a medium level, no patients with a low level.

Certain patients had difficulties in performing tasks that focused on studying the level of understanding and use of lexical and grammatical as well as syntactic constructions of medium and high complexity. The patients did not always recreate the story without the help of an experimenter. There were errors in cause-and-effect relations in the narrative.

Analysis of the results of the tasks performance according to the communicative and semantic criterion of 65 patients with PD revealed that 5 (7.7 %) patients are characterised by a high level, 12 (18.5 %) patients – by a sufficient level, 18 (27.7 %) patients – by a medium level and most patients 30 (46.1 %) – by a low level. Most patients had difficulties in understanding logical and grammatical constructions with direct and inverted meaning, in performing tasks for semantic analysis and synthesis, in reproducing the text and creating a story. The generalized results of the tasks performance according to the communicative and semantic criterion of 28 patients with the initial stage of PD allowed to establish that 10 (35.7 %) patients are characterised by a high level, most patients 15 (53.6 %) – by a sufficient level, 3 (10.7 %) patients – by a medium level and no patients were detected with a low level. No communication and speech disorders were detected in these patients. Speech

activity had a somewhat slow nature, but in general a high and sufficient level according to the communicative and semantic criterion.

The results of the tasks performance according to the communicative and semantic criterion of 5 patients with PSP allowed to establish that 2 (40 %) patients are characterised by a sufficient level, 3 (60 %) patients – by a medium level and no patients were detected with high and low levels. Such patients showed no significant disorders of communicative and speech activities according to the communicative and semantic criterion. The analysis of the results of the tasks performance allowed to establish that all 3 patients with WKD were characterised by a sufficient level of preservation of speech according to the communicative and semantic criterion.

The levels of preservation of the communicative and semantic component in the patients with extrapyramidal disorders were identified according to the results of the tasks performance (Table II).

Thus, a certain correspondence has been revealed for all patients with extrapyramidal pathology between the levels of preservation according to the communicative and semantic criterion as well as the severity and degree of the patient's disease, its duration. It was established that extrapyramidal disorders cause cognitive and speech disorders that are common to all such patients. The com-

municative and semantic component of speech activity is most impaired in patients with Parkinson's disease, which confirms the need for specially organized correctional and rehabilitation treatment to restore communicative and speech activities.

The results of the experimental research have proved the expediency of application of comprehensive diagnostics of cognitive and communicative activities. Significant differences between the indicators of preservation of cognitive and communicative activities in the group of patients with Parkinson's disease without speech disorders and with Parkinson's disease and between the groups of patients with PD without speech disorders and with PSP indicate the need to organise experimental correctional and rehabilitation work to restore cognitive and communicative activities of the patients with extrapyramidal disorders.

## DISCUSSION

The revealed neuropsychological peculiarities of cognitive and communicative activities of the patients with extrapyramidal disorders, in particular with PD, manganese encephalopathy, PSP and WKD are characterized by the presence of psychophysiological, phonological, prosodic, articulatory and innervation, motorial, psychological, morphological, semantic and other groups of cognitive and speech disorders (dysfunction of the extrapyramidal system characterized by metabolic lesions of the basal ganglia or related structures of the speech-motor analyser, kinesthetic apraxia, lack of motivation for speech activity, etc.).

The results of the research of disorders of higher cortical functions (cognitive disorders) and olfactory functions in 20 patients with PD depending on the form, stage and duration of the disease revealed that such patients are characterized by slow cognitive processes, impaired visual and spatial perception, memory and olfaction at all stages of their disease. According to scientists [29], the presence of voice and speech disorders in patients may be a clinical tool for early detection of PD. At the same time other scientists note in their research that PD impairs cognitive functions such as memory, thinking, attention and speech, which correlate with the severity of the disease [10, 12, 17, 18, 30].

The results of our research allowed discovering the fact that the deterioration of memory, attention, physical well-being, speech, etc. is a characteristic feature of a number of diseases of the extrapyramidal system. The disorders of communicative and speech activities identified by us of prosodic, phonological, morphological and syntactic aspects in the process of speech generation are manifested in impaired communicative function due to damage to extrapyramidal pathways, impaired motor coordination and innervation of the articulatory apparatus characterised by hypokinesia, hypomimia, bradykinesia, rigidity which reduce speech activity. These peculiarities determine the search for optimal integrative medical, psychological and pedagogical approaches to the restoration and normalization of cognitive and speech activities in people with extrapyramidal disorders.

The developed method of diagnosing the state of preservation of cognitive activity and speech in extrapyramidal disorders should be considered as a necessary condition for the development of a unified comprehensive system of correctional treatment for persons with extrapyramidal pathology in the process of medical, psychological and pedagogical rehabilitation.

## CONCLUSIONS

The comparative analysis of the research results on cognitive and communicative activities revealed that the experimental groups' patients with ME, with PD without speech disorders, PSP and WKD have mostly sufficient and high levels, the group of patients with PD who made up the vast majority of all patients with extrapyramidal pathology were characterised by mostly sufficient level (63.8 % – 35 persons), high in 32.3 % (21 persons), medium in 13.9 % (9 persons).

The communicative and semantic component of speech activity turned out to be most impaired in the patients with PD, in particular: a low level was found in 46.1 % (30 people), a medium level in 27.7 % (18 people), a sufficient level in 18.5 % (12 people) and a high level in only 7.7 % (5 people). Other patients with disorders of the extrapyramidal system with ME, with PD without speech disorders, PSP and WKD revealed mostly sufficient and high levels of preservation of the communicative and semantic criterion of communicative and speech activities.

Thus, in general, the most preserved communicative and speech function was found in the patients who had initial and mild stages of the disease, in particular in the patients with PD without speech disorders. It should be emphasized that the diagnosis of cognitive and communicative activities and the communicative and semantic component in adults with extrapyramidal disorders is a necessary prerequisite for the organization of the process of comprehensive rehabilitation treatment. The success and pace of recovery and normalization of cognitive and speech activities in patients with extrapyramidal disorders are stipulated by the stepping of content-related aspect of the correctional treatment in medical institutions and the need to create special integrative medical, psychological and pedagogical conditions for rehabilitation. The effectiveness of the restoration of communicative and speech activities in people with extrapyramidal disorders is determined by the comprehensiveness, integrativeness and communicative orientation of special treatment, taking into account neuropsychological, psycholinguistic and neuropsycholinguistic approaches and the use of tango therapy, kinesiotherapy, physiotherapeutic means, etc. They also depend on the motive, psycho-emotional state and immersion of the patient in the communicative and speech situation both during special classes and in everyday life, stimulation of communicative activity in social and domestic situations. The results of the experimental research confirmed the need to create a system of integrative psychological and pedagogical conditions for the restoration of communicative and speech activities of patients with extrapyramidal disorders on the basis

of modern comprehensive integration approaches to the process of correctional and rehabilitation work based on neuropsychological and neuropsycholinguistic concepts.

We see the **prospect of further research** in the development of experimental methods for the development of social and communicative skills in patients with extrapyramidal disorders.

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