

## 1. Introduction

Cognitive impairment is an etiologically heterogeneous condition that is one of the most common manifestations of organic brain damage [1, 2]. Impairment of cognitive functions not only negatively affects the quality of life of the patient, but also leads to maladaptation in everyday life [3, 4]. The study of the neuropsychological profile allows a more accurate picture of the involvement in the pathological process of various brain structures and thus facilitate the differential diagnosis [5, 6].

Patients with neurodegenerative pathology are characterized by different in structure and severity of disorders of arbitrary regulation of mental activity [7], cognitive functions [8, 9], perceptual-gnostic and emotional spheres [10]. A study involving more than 100 patients with hepatocerebral dystrophy found in their cognitive sphere the predominance of voluntary attention dysfunction, modal-non-specific memory impairment, decreased overall mental productivity and its speed characteristics. The structure of dysfunctions of arbitrary-regulatory processes was dominated by violations of self-control and insufficiency of the executive component of activity with the relative preservation of planning processes. Dysfunctions of constructive, oral and dynamic types of praxis, as well as acoustic gnosis prevailed in the structure of perceptual-gnostic disorders. The authors concluded that the patterns of formation and structure of mental disorders in patients with hepatocerebral dystrophy indicated a predominant insufficiency of nonspecific and subcortical structures of the brain in combination with dysfunction of the prefrontal and motor areas of the frontal lobes [11].

Thus, the study of cognitive impairment is an urgent task of modern neurology.

**The aim of the research:** on the basis of studying the cognitive features of patients with neurodegenerative (demyelinating) pathology to consider the possibility of their psychoneurological adaptation.

## 2. Materials and methods

As part of this study, in 2019, 104 patients diagnosed with multiple sclerosis (MS) who were treated at the "Insti-

## EVALUATION OF COGNITIVE FUNCTIONS IN NEURODEGENERATION

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**Abstract:** Cognitive functions and their disorders in patients with neurodegenerative diseases are an urgent problem of modern neurology. Such functions include memory, attention, praxis, gnosis, language, thinking, control functions. The study of the neuropsychological profile allows a more accurate picture of the involvement in the pathological process of various brain structures and thus facilitate the differential diagnosis. The aim of the research: on the basis of studying of cognitive features of patients with neurodegenerative (demyelinating) pathology to consider possibilities of their psychoneurological adaptation.

**Materials and methods.** The survey data of 104 patients with remitting type of multiple sclerosis, who were treated at the state institution "Institute of Neurology, Psychiatry and Addiction of the National Academy of Medical Sciences of Ukraine" are presented. To study the disorders of verbal memory, the method of A. R. Luria "Memorization of 10 words" was used, which allows to estimate such parameters as the amount of direct memory and the strength of delayed memory (i.e. indicators of short-term and long-term memory). The Schulte Table method was used to study arbitrary attention disorders. This technique allows you to evaluate such characteristics of random attention as volume, functions of concentration distribution and switching of attention.

**Results.** The data obtained indicate that, depending on the severity of relapses, there are significant differences in the course of mnemonic processes. It was found that in severe variants of remissions in women with relapsing-remitting multiple sclerosis (RRMS) more pronounced than in men, there is a lack of ability to work and exhaustion.

**Conclusions.** It is concluded that the assessment of cognitive deficit out of connection with personal characteristics and emotional and volitional disorders significantly reduces the informativeness and ability to correct cognitive dysfunction. Timely detection of cognitive and emotional-personal changes can not only improve the quality of life of patients with neurodegenerative diseases, but also act as an independent part of the psychoneurological model of adaptation of this category of patients.

**Keywords:** neurodegenerative pathology, demyelination of the central nervous system, cognitive dysfunction, memory, attention, neuroplasticity, psychoneurological adaptation.

tute of Neurology, Psychiatry and Addiction of the National Academy of Medical Sciences of Ukraine" were examined with informed consent. Criteria for inclusion in the study were: diagnosis of multiple sclerosis (for verification used the criteria of McDonald 2010, MRI data); uniformity of MS course (all respondents have a remitting type of MS). The study was conducted in compliance with bioethical standards (protocol No. 8 from 30.01.2020, approved by the Commission on Ethics and Deontology at the State Institution "INPN NAMS of Ukraine"), and fully complies with the principles of the Declaration of Helsinki.

The first group of patients (n=66) is represented by a relapsing-remitting multiple sclerosis (RRMS) with a history of mild to moderate recurrence (RRMS1). Mild relapses were characterized by a short duration (not more than 3–4 weeks), rapid rates of recurrence and exit from them, mono- or oligosyndromic symptoms with minimal signs of neurological deficits, no need for glucocorticosteroids. Recurrences of moderate severity were characterized by a gradual rate of recurrence and slow rate of recovery, oligo- or polysyndromic symptoms with moderate neurological deficit, the average duration of relapse – from 1.5 to 3 months. There were 23 men in this group and 43 women. The second group (n=38) consisted of patients with a remitting type with severe relapses (RRMS2), which were manifested by a slow rate of formation and regression of polysyndromic neurological symptoms, long course (3 or more months), the need to take glucocorticoids in the initial stages of relapse. There were 24 men in this group and 14 women.

To study the disorders of verbal memory, the method of A. R. Luria "Memorization of 10 words" was used, which allows to estimate such parameters as the amount of direct memory and the strength of delayed memory (i. e. indicators of short-term and long-term memory). The Schulte table method was used to study arbitrary attention disorders. This technique allows you to evaluate such characteristics of random attention as volume, functions of concentration distribution and switching of attention.

Student's t-test was used to compare the arithmetic mean values of any indicator measured in two independent groups.

### 3. Result

The study of memory features in the examined patients was carried out using the method of "Memorization of 10 words" by A. R. Luria. The obtained data indicate that, depending on the severity of relapses, there are significant differences in the course of mnestic processes. At easy and average degrees of severity of relapses (in the first group of patients) rather fast saturation and rather confident maintenance of stimulus material was noted both at the first five repetitions, and in 1 hour. Statistically significant ( $p < 0.01$ ) differences were observed starting from the fourth attempt. In patients with severe remissions, the amount of short-term memory was insufficient, and full saturation did not occur until the last attempt. One hour later, patients in the RRMS2 group played significantly fewer words ( $p < 0.05$ ).

In men with RRMS with mild and moderate recurrences, the saturation-depletion curves of short-term memory are almost identical to the third attempt. Then there is a discrepancy due to the negative dynamics of cognitive functions. Men in the first group (RRMS1) withstand the normative curve, approaching the reproduction of all ten stimulus words by the fifth attempt. In the second group, men with MS find an almost linear "plateau", reproducing the same number of words (slightly more than eight) in the third, fourth and fifth attempts. Statistically significant differences, according to table 2, were noted by the number of words reproduced in the fourth ( $p < 0.05$ ) and fifth attempts ( $p < 0.01$ ).

When reproducing verbal stimulus material in an hour, both groups showed virtually the same result (also about 8 words), but for the group with milder relapses it meant some exhaustion (which is observed in the norm), and for the group with more severe relapses – the ability to keep a fixed material.

The analysis of the obtained results also revealed differences in the indicators of the functional state of short-term memory in women with RRMS. Already in the first attempt, patients of the second group (RRMS2) contain significantly fewer stimulus words ( $p < 0.05$ ). Differences in the number of reproducible words gradually increase and become especially noticeable by the end of the test. In the fifth attempt and with delayed reproduction, women with more severe remissions RRMS are able to reproduce significantly fewer ( $p < 0.01$ ) stimulus words than the group with milder remissions. This indicates more exhaustion and reduced strength of short-term verbal memory. According to the obtained data, the differences are due to more severe neurodegeneration, which develops due to all known factors in severe remissions of RRMS.

Indicators of attention of patients with RRMS were investigated by finding numbers according to Schulte tables.

In all five attempts, the average time of Schulte tables is higher in patients with more severe types of remissions, and the differences (except for the third attempt) reach a degree of high statistical significance ( $p < 0.01$  in the first, second and fourth attempts and  $p < 0.05$  in the fifth attempt). Exhaustion and instability of attention is expressed approximately equally: the difference in speed of passing of the first and last tables in both groups makes, on the average, about 2 seconds though in separate cases it reached 25–30 seconds.

Multi-regression analysis of the results confirmed at the level of  $p < 0.01$  that the overall performance of the Schulte test is significantly higher in milder types of RRMS remissions, and in severe remissions it is significantly reduced.

In men, in the study of the functional state of attention, intergroup differences were as follows. Men with RRMS with

mild and moderate recurrences gradually reduce the pace of execution, i. e. the time of passage of Schulte tables gradually increases, which is characteristic of the predominance of symptoms of exhaustion. Men of the second group already in the first attempts show considerable excess of average normative indicators, remaining then approximately at one level of 46–47 seconds. This indicates a low ability to work and low concentration. The most significant differences were recorded in the speed of the first ( $p < 0.01$ ) and second ( $p < 0.05$ ) tables.

In both compared groups of women, the average time of passage of Schulte tables exceeds the norm, i.e. any severity of remissions in RRMS in women leads to attention dysfunction. However, the severity of this dysfunction at different degrees of severity of remissions differs significantly. Women in the RRMS2 group lag behind in performance in each attempt and generally less successfully cope with the Schulte test. In the RRMS1 group in women is dominated by instability of attention, the execution time from attempt to attempt changes chaotically, nonlinearly. With RRMS with severe remissions, there is an almost linear increase in time spent from the first to the fifth attempt.

The maximum differences were observed in the second ( $p < 0.05$ ) and especially in the last two attempts ( $p < 0.01$ ). Thus, in severe cases of remission of RRMS in women more pronounced than in men, there is a lack of ability to work and exhaustion.

### 4. Discussion

The obtained results confirm the existing paradigm of increasing cognitive deficit in patients with neurodegenerative pathology [1, 4]. The identified neurodynamic and operational disorders make it possible to draw conclusions about the severity of the neurodegenerative process and its nature of the prognosis, which coincides with the results of research by other scientists [8, 9]. Timely detection of cognitive and emotional-personal changes can not only improve the quality of life of patients with neurodegenerative diseases, but also act as an independent part of the psychoneurological model of adaptation of this category of patients [2, 3].

**Study limitations.** In the study of cognitive functions in patients with neurodegenerative pathology, 104 test sets were analyzed, which is a sufficient reference sample. However, it should be noted that the assessment of cognitive deficits out of connection with personal characteristics and emotional and volitional disorders significantly reduces the informativeness and ability to correct cognitive dysfunction.

**Prospects for further research.** Further study of the cognitive state and its comparison among patients with multiple sclerosis and hepatocerebral dystrophy is planned.

### 5. Conclusions

Thus, the obtained data indicate the steady formation of cognitive impairment in patients with neurodegenerative/demyelinating pathology. With mild remissions in patients regardless of gender, cognitive performance is maintained. In more severe variants of remissions in women with remitting type of multiple sclerosis revealed a more pronounced cognitive deficit compared to men. The obtained data must be taken into account when developing individual algorithms for psychoneurological adaptation of patients with neurodegenerative pathology.

### Conflict of interests

The author declares no conflict of interests.

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