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## PECULIARITIES OF NEUROCOGNITIVE STATUS OF PATIENTS IN THE ACUTE ISCHEMIC STROKE PHASE OF DIFFERENT HEMISPHERIC LOCALIZATION

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The article considers the peculiarities of neurocognitive status in patients after acute ischemic stroke of different hemispheric localization. Left-sided hemispheric stroke revealed a higher frequency and higher degree of cognitive impairment (mean score for Mini Mental State Examination was  $21.3 \pm 0.61$ , for Montreal Cognitive Assessment –  $18.22 \pm 0.9$ ) compared with right-sided hemispheric localization of ischemic focus (mean score for MMSE –  $24.05 \pm 0.52$ , for MoCa –  $21.35 \pm 0.84$ ) with a statistically significant difference between groups of patients as a whole and by specific blocks of subtests. It was also found that right-sided hemispheric strokes were characterized by a higher frequency and higher degree of anxiety and depressive disorders (mean score for Beck Depression Inventory was  $15.1 \pm 0.87$ , for the state anxiety scale –  $37.6 \pm 1.71$ , for the trait anxiety scale –  $36.55 \pm 1.73$ ) compared with the left-sided hemispheric localization of acute cerebrovascular accident (mean score for BDI was  $11.61 \pm 0.71$ , for the state anxiety scale –  $29.78 \pm 0.95$ , for the on the Spielberger-Khanin trait anxiety scale –  $30.87 \pm 1.0$ ) with a statistically significant difference between the groups.

**Key words:** brain infarction, ischemic stroke, acute period, hemispheric peculiarities, neurocognitive disorders.

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According to the World Health Organization, stroke is a clinical syndrome of the rapid development of signs of focal or total loss of brain function that lasts 24 hours and more or leads to death in the absence of non-vascular causes. Every year, more than 16 million stroke cases and more than 5 million fatal cases from the disease are registered in the world, and according to experts, by 2030 is expected about 23 million strokes and about 7.8 million fatal cases [2, 7].

For today, ischemic stroke is an important and complex medical and social problem, as post-stroke disability is one of the leading causes of disability in the adult population of most countries. The main components of the clinical evidence of ischemic stroke are movement, sensory processing, mental and cognitive disorders. According to a number of sources, about 80% of people who have suffered a stroke remain disabled, and about a quarter of them need constant care. Cerebrovascular pathology in general occupies one of the first places in the structure of morbidity and mortality of the population in developed countries and occupies a prominent place among the causes of acquired cognitive deficiency, especially multi-infarct dementia. Problems of neurocognitive deficiency in patients with acute focal brain lesions are still insufficiently considered [4, 11, 12, 14].

In recent years, there has been an increase in the prevalence of post-stroke cognitive impairment [1, 6]. Prospective studies show an increase in the risk of developing dementia after stroke by almost 10 times [3, 13].

Impaired right-sided hemispheric activation is associated with depression, which is accompanied by high levels of anxiety, while low levels of anxiety and depression are more typical for left-sided hemispheric dysfunction [5, 9]. Observations of patients after stroke (ischemic and/or hemorrhagic) revealed worse dynamics of recovery of speech and cognitive functions in left-sided hemispheric stroke localization and more pronounced disorders of social adaptation in patients with right-sided hemispheric localization of the focus [8, 10].

The **purpose** of the study was to identify and evaluate the hemispheric peculiarities of neurocognitive status of patients in the acute ischemic stroke phase in one of the carotid arterial system.

**Materials and methods.** 43 patients (27 men and 16 women) with a diagnosis of acute hemispheric ischemic stroke were examined during the study. The mean age was  $59.81 \pm 1.28$  years. Right-sided hemispheric ischemic stroke was observed in 20 patients (46.5%, Group 1), left-sided hemispheric – in 23 patients (53.5%, Group 2). Control group consisted of 16 apparently healthy individuals (10 men and 6 women, CG). The mean age was  $59.5 \pm 1.74$  years.

The study was performed on the basis of the Municipal Enterprises “M.V. Sklifosovsky Poltava Regional Clinical Hospital” and “1st Poltava City Clinical Hospital”.

Study entry criteria: the presence of clinically and neuroimagingly confirmed non-lacunar hemispheric ischemic stroke and a signed form of informed consent to participate in the study. Exclusion criteria from the study were: the presence of clinically and neuroimagingly confirmed intracranial hemorrhage, lesions of two or more systems; global aphasia, decompensated psychopathological syndrome, the presence of somatic disease in the decompensation phase and oncological pathology.

All patients underwent comprehensive neuropsychological testing. The examination period was 3-7 days of the studied cerebrovascular accident. Assessment of neurocognitive status was performed using a short scale of mental status assessment (Mini Mental State Examination, MMSE; Folstein M., 1975), Montreal scale of cognitive assessment (Montreal Cognitive Assessment, MoCa; Nasreddine Z., 1996, 2005), Beck Depression Inventory scales (Beck Depression Inventory, BDI; Beck A., 1961), Spielberger-Khanin state and trait anxiety questionnaire (SA and TA, respectively) (STAI, Spielberger C., 1983). According to the results of MMSE, 28-30 scores were evaluated as the absence of cognitive impairment (CI), 24-27 – precognitive impairment (PCI), 20-23 – mild cognitive impairment, 11-19 – moderate cognitive impairment. For MoCa, less than 26 scores were assessed as manifestations of cognitive impairment. According to BDI, 0-9 scores were interpreted as the absence of depressive symptoms (DS), 10-15 – mild depressive symptoms (subdepression), 16-19 – moderate depressive symptoms, 20-29 – severe depressive symptoms, 30 or more scores – severe depression. According to STAI, 0-30 scores were assessed as mild anxiety, 31-45 – as moderate anxiety, 46 or more scores – as severe anxiety.

Statistical processing of the obtained data was performed using the software package "SPSS", "Statistica 6.0", methods of descriptive statistics and statistical analysis. In particular, descriptive statistics are presented as the mean±standard error of the mean; the Mann-Whitney U-test was used to assess intergroup differences. Differences were considered statistically significant at  $p < 0.05$ .

The study was complied with the Rules of Humane Treatment of Patients in accordance with the requirements of the Tokyo Declaration of the World Medical Assembly, the requirements of the International Recommendations of the Declaration of Helsinki of Human Rights, "Council of Europe Convention on Human Rights and Biomedicine", the Law of Ukraine "Fundamentals of the legislation of Ukraine on Health Care" as amended, Orders of the Ministry of Health of Ukraine, the Code of Ethics of Physicians of Ukraine and the Code of Ethics of Scientists of Ukraine.

**Results of the study and their discussion.** Comparing groups by age and sex, no statistically significant differences were found.

Studying the neurocognitive status by the Mini Mental State Examination in the control group, the mean score was  $28.19 \pm 0.25$ , whereas in patients with right-sided hemispheric stroke –  $24.05 \pm 0.52$  ( $p < 0.01$ ), with left-sided hemispheric stroke –  $21.3 \pm 0.61$  ( $p < 0.01$ ) with a statistically significant difference between Groups 1 and 2 ( $p < 0.05$ ).

Analyzing the structure of cognitive disorders on a short scale of mental status assessment, it was found that in the group with right-sided hemispheric ischemic stroke, normal cognitive indices was observed in 5% of patients, precognitive impairment – in 45%, mild cognitive impairment – in 45%, moderate cognitive impairment – in 5%; in the group with left hemispheric localization of the ischemic focus, normal indices of the cognitive sphere were absent, precognitive impairment was observed in 22%, mild cognitive impairment – in 61%, moderate cognitive impairment – in 17%, whereas in the control group precognitive impairment was observed in 25%, and in 75% of individuals there were normal indices of the cognitive sphere. The distribution of patients by the degree of cognitive impairment is shown in fig. 1.

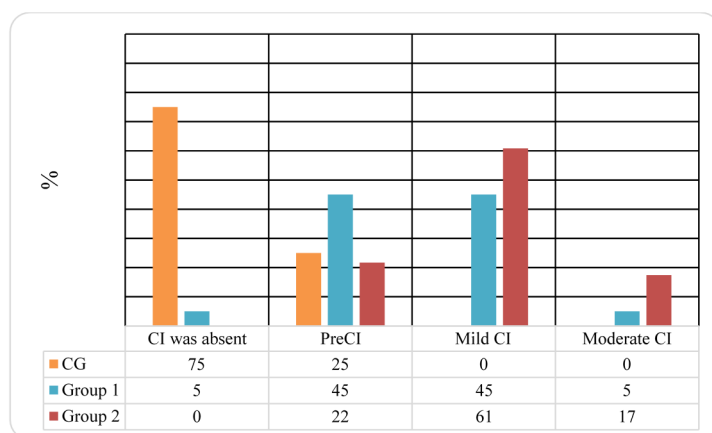


Fig. 1. MMSE: distribution of patients by the degree of cognitive impairment.

The most significant differences were found between the groups of right- and left-sided hemispheric ischemic stroke on the "Attention and calculation", "Execution of a 3-stage command" subtests of the MMSE scale, which indices were significantly lower in the group with right-sided hemispheric stroke, while in the group with left-sided hemispheric ischemic stroke the lowest score was observed for the "Memory" and "Language" subtests. The obtained data are shown in fig. 2a.

Between patients with right-sided hemispheric stroke and the control group, a statistically significant difference was found in the "Attention and calculation" ( $2.35 \pm 0.22$  vs.  $4.56 \pm 0.16$ ), "Memory" ( $2.95 \pm 0.05$  vs.  $2.56 \pm 0.16$ ), "Execution of a 3-stage command" ( $3.4 \pm 0.27$  vs.  $5.56 \pm 0.13$ ) subtests of the MMSE scale ( $p < 0.05$ ), whereas in the group with left-sided hemispheric stroke and control group – all of them were statistically significantly different ( $p < 0.05$ ), except for the "Attention and calculation" subtest ( $p = 0.08$ ).

According to the Montreal Cognitive Assessment scale, the mean score in the control group was  $27.56 \pm 0.29$  scores, while in patients with right-sided hemispheric stroke –  $21.35 \pm 0.84$  ( $p < 0.01$ ), with left-

sided hemispheric stroke –  $18.22 \pm 0.9$  ( $p < 0.01$ ) with a statistically significant difference between groups of patients with right- and left-sided hemispheric ischemic stroke ( $p < 0.05$ ).

There were also statistically significant differences between the groups of right- and left-sided hemispheric ischemic stroke for all subtests of the MoCa scale, while between patients with right-sided hemispheric stroke and the control group the most significant difference was found in the “Visuospatial/executive” ( $2.25 \pm 0.22$  vs.  $4.81 \pm 0.1$ ), “Attention” ( $2.9 \pm 0.28$  vs.  $5.06 \pm 0.14$ ), “Abstraction” ( $1.15 \pm 0.15$  vs.  $2.0$ ) ( $p < 0.01$ ) subtests, and was not detected in the “Naming” ( $p = 1$ ) subtest. In the group with left-sided hemispheric stroke and control group – by the “Language” ( $0.91 \pm 0.17$  vs.  $2.13 \pm 0.13$ ), “Delayed recall” subtests ( $0.96 \pm 0.19$  vs.  $4.56 \pm 0.13$ ) ( $p < 0.01$ ) and was not detected in the “Abstraction” subtest ( $p = 0.14$ ). The obtained data are shown in fig. 2b.

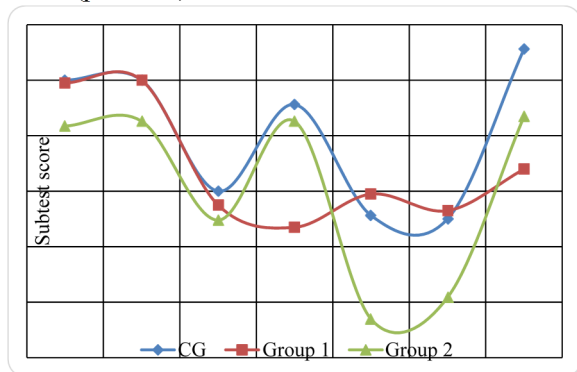


Fig. 2a. MMSE: distribution by subtests: 1 – orientation to time, 2 – orientation to place, 3 – registration, 4 – attention and calculation, 5 – recall, 6 – language, 7 – execution of a 3-stage command. Note: \* – index of the level of statistical significance between Groups 1 and 2  $p < 0.05$ .

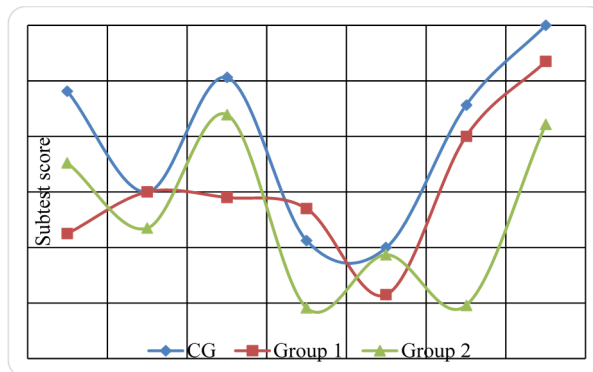


Fig. 2b. MoCa: distribution by subtests: 1 – visuospatial/executive, 2 – naming, 3 – attention, 4 – language, 5 – abstraction, 6 – delayed recall, 7 – orientation. Note: \* – index of the level of statistical significance between Groups 1 and 2  $p < 0.05$ .

In the study of anxiety and depressive disorders on the Beck Depression Inventory scale in patients of the control group, the mean score was  $7.75 \pm 0.69$ , whereas in patients with right-sided hemispheric stroke –  $15.1 \pm 0.87$  ( $p < 0.01$ ), with left-sided hemispheric stroke –  $11.61 \pm 0.71$  ( $p < 0.01$ ) with a statistically significant difference between Groups 1 and 2 ( $p < 0.01$ ).

Analyzing the structure of depressive symptoms on the Beck Depression Scale, it was found that in the group with left-sided hemispheric ischemic stroke depressive symptoms were absent in 30%, mild depressive symptoms were observed in 48%, moderate – in 22% of patients. In the group with right-sided hemispheric ischemic stroke depressive symptoms were absent in 10%, mild depressive symptoms were observed in 30%, moderate – in 55%, severe depressive symptoms – in 5%, while in the control group mild depressive symptoms were observed in 25%, and in 75% of patients depressive symptoms were absent. The distribution of patients by the degree of depressive symptoms is shown in fig. 3.

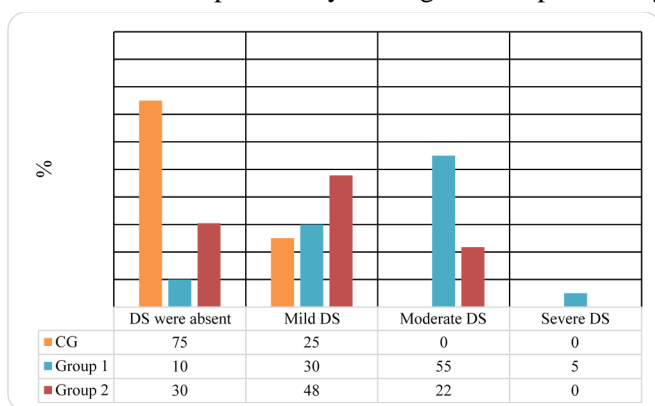


Fig. 3. BDI: distribution of patients according to the degree of depressive symptoms.

$37.6 \pm 1.71$  and  $36.55 \pm 1.73$ , respectively, which was statistically significantly different from the control group ( $p < 0.01$ ), with a statistically significant difference between patients in the right- and left-sided hemispheric ischemic stroke groups ( $p < 0.05$ ).

Analyzing the anxiety syndrome structure on the Spielberger-Khanin state and trait anxiety scale, it was found that in the group with right-sided hemispheric ischemic stroke the state (situational) anxiety was mild in 35% of patients, moderate – in 45%, severe – in 20%, as well as the trait anxiety level (35%, 45%, 20%, respectively). In the group with left-sided hemispheric ischemic stroke, state anxiety was mild

There were also statistically significant differences in the structure of the anxiety syndrome between the groups of right- and left-sided hemispheric stroke. According to the results of Spielberger-Khanin state and trait anxiety questionnaire, the mean score for state anxiety in the control group was  $28.19 \pm 0.73$ , and for trait anxiety it was  $29.06 \pm 0.53$ . In patients with left-sided hemispheric stroke, the mean score was  $29.78 \pm 0.95$  on the scale of state (situational) anxiety ( $p = 0.23$ ) and  $30.87 \pm 1.0$  scores on the trait anxiety scale ( $p = 0.16$ ), whereas in the group with hemispheric stroke –

in 52% of patients, moderate – in 48%; mild level of trait anxiety was found in 74%, moderate – in 22%, high – in 4% of patients with left-sided hemispheric localization of the ischemic focus, while in the control group a mild level of state anxiety was observed in 75%, moderate – in 25%, and trait anxiety was moderate in 12.5%, mild – in 87.5% of patients. The distribution of patients according to the degree of state and trait anxiety is shown in fig. 4a and fig. 4b, respectively.

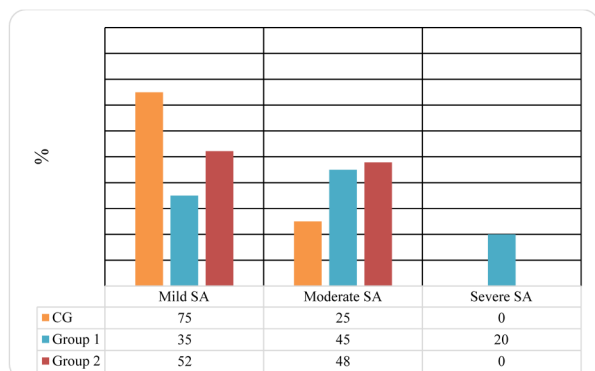


Fig. 4a. STAI: distribution of patients according to the degree of state anxiety.

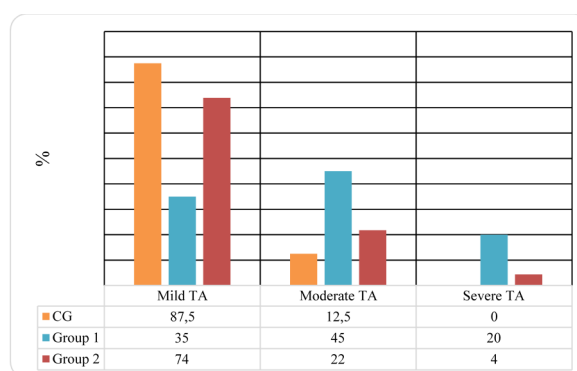


Fig. 4b. STAI: distribution of patients according to the degree of trait anxiety.

The analysis of the obtained results shows that in patients with left-sided hemispheric ischemic stroke there is probably a higher frequency and higher degree of post-stroke cognitive impairment with speech dysfunction, memory impairment, compared with the right-sided hemispheric localization of the ischemic focus, which is characterized by cognitive dysfunction with a predominant impairment of attention, abstract thinking, visuospatial/executive skills and a higher frequency and higher degree of anxiety and depressive disorders [5, 6, 9, 10].

The concept of stroke lateralization can play a key role in optimizing therapeutic and rehabilitation measures in patients with hemispheric ischemic stroke to achieve maximum recovery.

These results do not claim priority, are preliminary in nature and require further study.

## Conclusion

The acute phase of hemispheric ischemic stroke is characterized by neurocognitive disorders of varying severity. Right-sided hemispheric ischemic stroke is significantly more often associated with varying degrees of anxiety and depressive disorders and cognitive dysfunction with a predominant impairment of attention, abstract thinking, executive skills, which significantly complicates their social adaptation, while the left-sided hemispheric localization of acute cerebrovascular accident significantly more often leads to cognitive impairment with speech dysfunction, memory impairment.

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## Реферати

**ОСОБЛИВОСТІ НЕЙРОКОГНІТИВНОГО СТАТУСУ ПАЦІЄНТІВ У ГОСТРОМУ ПЕРІОДІ МОЗКОВОГО ІШЕМІЧНОГО ІНСУЛЬТУ РІЗНОЇ ПІВКУЛЬОВОЇ ЛОКАЛІЗАЦІЇ**

Пушко О.О., Литвиненко Н.В.

У статті розглянуто особливості нейрокогнітивного статусу пацієнтів після перенесеного гострого ішемічного інсульту різної півкульової локалізації. При лівопівкульовому інсульті виявлено більшу частоту й вищий ступінь когнітивних порушень (середній бал за Mini Mental State Examination 21,3±0,61, за Montreal Cognitive Assessment 18,22±0,9) порівняно з правопівкульовою локалізацією ішемічного вогнища (середній бал за MMSE 24,05±0,52, за MoCa 21,35±0,84) зі статистично значимою різницею між групами пацієнтів у цілому та за окремими блоками субтестів. Також виявлено, що для правопівкульових інсультів характерна більша частота й вищий ступінь тривожно-депресивних порушень (середній бал за Beck Depression Inventory 15,1±0,87, за шкалою реактивної тривожності 37,6±1,71 та 36,55±1,73 за шкалою особистісної тривожності) порівняно з лівопівкульовою локалізацією гострого порушення мозкового кровообігу (середній бал за BDI 11,61±0,71, за шкалою реактивної тривожності 29,78±0,95 та 30,87±1,0 за шкалою особистісної тривожності Спілбергера-Ханіна) зі статистично значимою різницею між групами.

**Ключові слова:** інфаркт мозку, ішемічний інсульт, гострий період, півкульові особливості, нейрокогнітивні порушення.

Стаття надійшла 31.07.2019 р.

**ОСОБЕННОСТИ НЕЙРОКОГНИТИВНОГО СТАТУСА ПАЦИЕНТОВ В ОСТРОМ ПЕРИОДЕ МОЗГОВОГО ИШЕМИЧЕСКОГО ИНСУЛЬТА РАЗЛИЧНОЙ ПОЛУШАРНОЙ ЛОКАЛИЗАЦИИ**

Пушко А.А., Литвиненко Н.В.

В статье рассмотрены особенности нейрокогнитивного статуса пациентов после перенесенного острого ишемического инсульта различной полушарной локализации. При левополушарном инсульте выявлено большую частоту и большую степень когнитивных нарушений (средний балл по Mini Mental State Examination 21,3±0,61, по Montreal Cognitive Assessment 18,22±0,9) по сравнению с правополушарной локализацией ишемического очага (средний балл по MMSE 24,05±0,52, по MoCa 21,35±0,84) со статистически значимой разницей между группами пациентов в целом и по отдельным блокам субтестов. Также выявлено, что для правополушарных инсультов характерна большая частота и более высокая степень тревожно-депрессивных нарушений (средний балл по Beck Depression Inventory 15,1±0,87, по шкале реактивной тревожности 37,6±1,71 и 36,55±1,73 по шкале личностной тревожности) по сравнению с левополушарной локализацией острого нарушения мозгового кровообращения (средний балл по BDI 11,61±0,71, по шкале реактивной тревожности 29,78±0,95 и 30,87±1,0 по шкале личностной тревожности Спилбергера-Ханина) со статистически значимой разницей между группами.

**Ключевые слова:** инфаркт мозга, ишемический инсульт, острый период, полушарные особенности, нейрокогнитивные нарушения.

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**FEATURES OF LONG-TERM MENTAL DISORDERS IN THE VICTIMS OF CHERNOBYL ACCIDENT**

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The purpose of the work was to study the features of the clinical structure, the pathopsychological and pathophysiological mechanisms of mental disorders formation in the victims of the Chernobyl accident in the long term. The study of the mental status in the liquidators - III groups of complex survey - 202 persons – liquidators of the Chernobyl disaster, that worked in 1988 in 30 – kilometer zone, the radiation level ranged from 0.2 to 25 Gy - took into account the system of risk factors, which included social, radiological, medical aspects, social factors including hypokinesia, unsustainable diet, smoking, alcohol consumption and radiological factors. In the affected by the Chernobyl accident in 1986 long-term consequences for mental health were revealed, mental disorders were found to be dependent on the dose and the relationship between the severity of lesions and radiation symptoms. The study of the liquidators' health can extend the understanding of the relationship between PTSD, depression, risk of internal diseases and recovery. According to our data, the central element in the structure of psychopathological manifestations is psycho-vegetative syndrome with affective accompaniment. Thus, the conclusion was made that psychosocial effects of stress as a result of Chernobyl disaster shows how important it is to continue monitoring of the mental health in the population to establish the relationship between mental well-being, physical illness and mortality.

**Key words:** Chernobyl catastrophe, liquidators' health status, radiation damage, mental disorders due to irradiation.

The work is a fragment of the research project "Scientific substantiation of diagnostic and therapeutic rehabilitation measures for endogenous and exogenously-organic psychotic and non-psychotic mental disorders", state registration No. 0116U000856.

In the twentieth century, the most frightening and stigmatizing of all technogenic disasters were the nuclear bombings in Hiroshima and Nagasaki and the catastrophes at nuclear power plants at Three Mile Island and Chernobyl. After them revealed the changes in the psyche, such as stigmatization, anxiety, depression and the manifestations of post-traumatic stress disorder (flashbacks and psychic numbing), that lasted sufficiently long, and were associated with a sense of risk for the health, independently of the