ECRONICON OPEN ACCESS

EC PSYCHOLOGY AND PSYCHIATRY
Research Article

Structure of Cognitive Disorders in Patients Operated for Non-Traumatic Intracranial Hemorrhage

NE Ivanova[1]*, M Yu Efimova[1,2], AO Makarov[2], AE Tereshin[2], MV Karyagina[2], DA Reshetnik[2] and A Yu Ivanov[3]

[1]*"National Medical Research Center Named After V.A. Almazov" Ministry of Health of the Russian Federation, Saint-Petersburg, Russia*

[2]*"Nikolaev Hospital", Saint-Petersburg, Peterhof, Russia*

[3]*"St. Petersburg State Pediatric Medical University" Ministry of Health of the Russian Federation, Saint-Petersburg, Russia*

***Corresponding Author:** NE Ivanova, "National Medical Research Center Named After V.A. Almazov" Ministry of Health of the Russian Federation, Saint-Petersburg, Russia.

Received: August 26, 2019; **Published:** September 16, 2019

Abstract

The article is devoted to the peculiarities of cognitive status in patients operated for non-traumatic intracranial hemorrhages. An assessment of the structure and severity of cognitive impairment was carried out in the observations of different etiology hemorrhages. An analysis of the relationship between the localization and the hematoma, and the severity of disorders of higher cortical functions was carried out. Understanding the cognitive deficiency patterns in neurosurgical patients is important for effective rehabilitation measures.

Keywords: *Non-Traumatic Intracranial Hemorrhage; Cognitive Impairment; Aneurysmal Disease; MMSE*

Topicality

The problem of diagnosis of cognitive impairment - one of the actual problems of neurorehabilitation after neurological and neurosurgical diseases. Neurosurgical diseases of the brain (brain injury, neurooncology, cerebrovascular pathology) are the most important cause of disability in the population of developed countries, leading not only to paresis, hypesthesia, discoordination, but also cognitive disorders. The role of the etiology of the pathological process in the formation of cognitive deficiency in focal brain lesions has not been definitively determined yet.

Blood stroke is the most important cause of disability occurrence in the population of developed countries. Non-traumatic intracranial hemorrhages compose 10 to 20% of cerebral circulation disorders [1]. Only 12% - 39% of patients can subsequently return to full-fledged life after a blood stroke [2]. One of the adverse effects of non-traumatic intracranial hemorrhage is the impairment of higher cortical functions. Post-stroke cognitive disorders are moderately pronounced in 37 - 71% of cases, and they reach the degree of dementia in 4 - 40% of cases [3]. At that, they are heterogeneous in a pathogenic and clinical way, which affects their curability and prognosis.

Objective of the Study

This study objective is to assess the structure and severity of cognitive impairment in patients operated for non-traumatic intracranial hemorrhages of different etiology and localization.

Materials and Methods

The study was based on the results of cognitive rehabilitation of 54 patients (18 men and 36 women, mean age of 47.56 ± 13.54 years old) operated for non-traumatic intracranial hemorrhage. Among them, 16 patients underwent aneurysm clipping (29.63%), 9 ones (16.67%) - aneurysm embolization, 18 ones (33.33%) - hematoma removal at hypertensive hemorrhage, 1 patient (1.85%) - angioma removal, and 10 ones (18.52%) - embolization of arteriovenous malformation (AVM). The patients who had an acute cerebral circulation disorder of cerebrovascular type were directed for rehabilitation treatment at different times from the moment of cerebral vascular accident: 26 (48.15%) patients entered at the early recovery period of hemorrhagic stroke, 10 (18.52%) - at the late recovery period, 18 (33.33%) - at the period of residual phenomena.

The structure and severity of higher brain function disorders were evaluated. The state evaluation of higher cortical functions was carried out by a neuropsychologist applying MMSE, FAB scales on the day of admission. Continuous quantitative values were analyzed using the concepts of median (Me) and quartiles (25%, 75%). The test of significance was the Mann-Whitney test (U).

Results and Discussion

The MMSE scale testing revealed that patients scored from 28 to 30 points (normal variant) in 9 (16.67%) cases, from 24 to 27 points (predementing violations) in 23 (42.59%) cases, from 20 to 23 points (mild dementia) in 8 (14.81%) cases, and, finally, from 11 to 19 points (dementia of moderate severity) in 14 (25.93%) cases. The average MMSE score demonstrated 23.04 ± 6.15 points.

When assessing the degree of frontal dysfunction using the FAB scale, the following results were obtained: 21 (38.89%) subjects of the study scored from 16 to 18 points, which corresponded to the norm value, 19 (35.19%) subjects of the studied scored from 12 to 15 points, which corresponded to moderate frontal dysfunction, 14 (25.93%) subjects scored less than 12 points, which corresponded to severe frontal dysfunction. The average FAB score totaled 13.91 ± 3.98 points.

A detailed analysis of the cognitive deficits structure of the subjects undergoing a cerebral circulation disorder of cerebrovascular type brought about the following results. The most common symptoms of cognitive deficits were identified: fixation hypomnesia (detected in 52 (96.30%) patients), pathological inertia of thinking (observed in 30 (55.56%) subjects), and decreased attention (recorded in 41 (75.93%) ones). Reproductive hypomnesia was recorded in 36 (66.67%) patients. A decrease in the level of generalization was recorded in 35 (64.81%) cases. In addition, 2 (3.70%) subjects demonstrated inconsistency of judgments, and "associations derailment" was revealed in 3 (5.56%) subjects. Errors in the serial counting were detected in 31 (57.41%) patients, while difficulties in solving arithmetic problems were in 35 (64.81%) people.

When assessing the gnosis and praxis of patients after a hemorrhagic stroke, kinesthetic apraxia was detected in 12 (22.22%) cases, kinetic one in 33 (61.11%) cases, and spatial one in 21 (38.89%) cases. Visual agnosia was observed in 4 (7.41%) cases, auditory one in 23 (42.59%) cases, and optical and spatial one in 40 (74.07%) cases.

The interrelation of the right-hand localization of the lesion with emotional and personal disorders and disorders of spatial thinking, left - hand localization-with violations of verbal and logical thinking was clarified ($p < 0.05$).

Like for any focal brain lesion, in case of non-traumatic intracranial hemorrhage, the presence and localization of intracerebral hematoma plays an important role in the formation of cognitive deficiency. In this study, intracerebral hematoma occurred in 44 (81.48%) cases, and isolated subarachnoid hemorrhage occurred in 10 (18.52%) cases. Chart 1 reflects the testing results for the patients with non-traumatic intracranial hemorrhage of different localization.

The chart 1 shows that the most pronounced cognitive impairment was observed in patients with thalamic and subcortical hemorrhages. Subcortical hemorrhages affect the tertiary zones of the cortical representation of higher brain functions, while thalamic ones, appa-

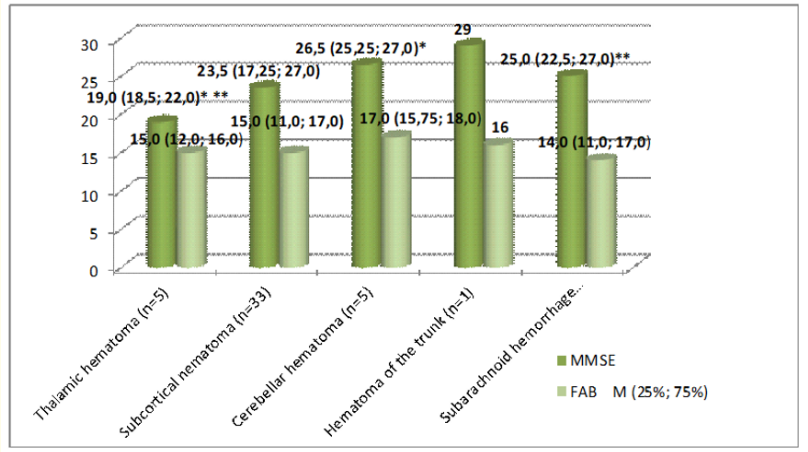

Chart 1: *The cognitive status of patients operated for non-traumatic intracranial hemorrhage, upon admission, depending on its location.*
*Note: * **: Reliability of statistical differences (p < 0.05).*

rently, have a negative impact on cognitive functions, both due to the separation of cortical-subcortical structures, and due to the damage of specific thalamic nuclei [4]. Hemorrhages in the cerebellum were accompanied by the least cognitive impairment. The pathophysiological aspects of the cognitive deficiency formation in the event of cerebellum structure damage have not been studied to date. The literature describes the so-called „cerebellar cognitive affective syndrome" represented mainly by secondary impairment of executive functions [5]. However, disorders of higher brain functions reaching the degree of dementia have been described only at extensive pathological processes affecting, in addition to the cerebellum, other brain structures as well [6].

Let's consider the clinical observation of cognitive rehabilitation of a patient with a thalamus hematoma (Figure 1).

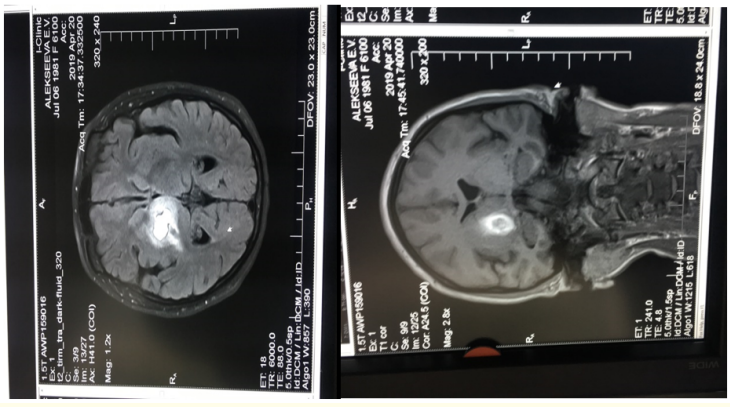

Figure 1: *Magnetic resonance imaging of patient A. A subacute thalamus hematoma on the right is visualized.*

Patient A. 38 years old. She was admitted to the rehabilitation department with complaints of difficulty in reading, writing, errors in performing a complex sequence of actions, memory loss of current events. The assessment of cognitive impairment at admission: 24 points on the MMSE scale, 15 points on the FAB scale.

Table 1 presents a comprehensive assessment of impaired cognitive functions of Patient A. by the International Classification of Functioning (ICF).

ICF domains	Interpretation
b1260.2	Moderate introversion
b1265.2	Moderate decrease in emotional background
b1301.3	Accentuated lack of impulse
b1400.1	Light attention instability
b1403.1	Slightly reduced focus
b1440.2	Moderate decrease in short-term memory
b1441.1	Slight decrease in long-term memory
b1601.1	Light passivity of thinking
b1643.1	Slight decline of cognitive flexibility
b16701.2	Moderate impaired perception of written language
b16711.1	Slight difficulty in expression through written language
b1721.1	Slight difficulty in complex calculations
b176.1	Light kinetic apraxia

Table 1: *The main ICF domains in the assessment of cognitive impairment of Patient A.*

As can be seen from table 1, Patient A. suffered from severe emotional and volitional disorders that affected the course of cognitive rehabilitation adversely, from neurodynamic disorders (decreased concentration, short-term and long-term memory), had difficulty in communicating through sign language. In addition, there was a slight kinetic apraxia.

Against the neuropsychological correction measures taken, positive dynamics were noted: By the time of discharge, the test result corresponded to 29 points on the MMSE scale and 17 points on the FAB scale. A detailed analysis of the recovery of certain cognitive functions is shown in figure 2.

Figure 2 demonstrates that despite the emotional and volitional disturbances, neuropsychological correction has led to significant results. Teaching the patient compensatory strategies allowed to cope with a decrease in memory; attention parameters, reading and writing skills were restored almost to the normal level. At the time of discharge, there was a slight inertia in the processes of thinking and a slight decrease in motivation. The described example clearly confirms the effectiveness of cognitive rehabilitation of patients after non-traumatic intracranial hemorrhage.

Chart 2 shows the results of the cognitive status comparison of patients with different etiologies of non-traumatic intracranial hemorrhages.

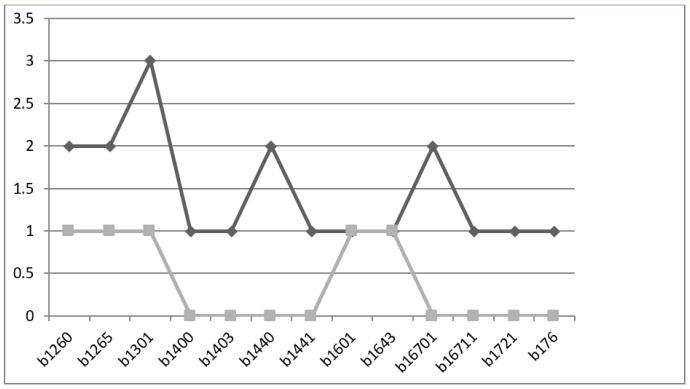

Figure 2: *Dynamic pattern of restoration of Patient A impaired cognitive functions after neuropsychological correction measures as per ICF.*
Note: b1260-b176 - ICF domains (See table 1), 0-3.5 - ICF scores, the upper graph is cognitive impairment at admission, the lower graph is cognitive impairment at discharge.

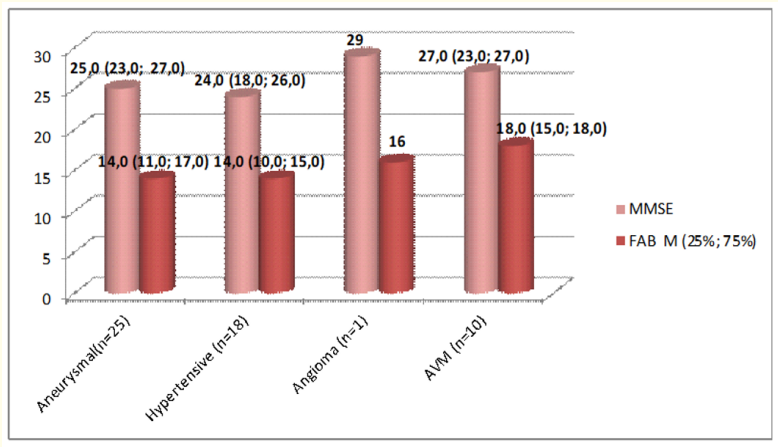

Chart 2: *Cognitive status of patients with different etiologies of non-traumatic intracranial hemorrhages during admission.*

As can be seen from chart 2, the mildest cognitive deficiency was described in those who underwent hemorrhage from AVM. This is consistent with literature data, according to which a more favorable outcome for hemorrhages from AVM compared with those with aneurysmal and hypertensive disease can be explained by a slight pressure inside the vascular formation, the presence of factors contributing to thrombosis, and a low frequency of vasospasm [7]. The most pronounced cognitive impairment was accompanied by hypertensive hemorrhage. The severity and disabling consequences of hypertensive hemorrhage are largely due to the high incidence of dislocation syndrome. In addition, hypertension with poorly controlled high blood pressure numbers is an independent risk factor for cognitive de-

ficiency. In patients with aneurysmal hemorrhages, moderate impairments of higher brain functions were found during the admission, corresponding, on average, to the level of predementing disorders.

The severity of the patient's condition, as well as the incidence of dislocation syndrome in the presence of hematoma, is largely determined by its volume. According to the literature, hematoma volume in excess of 30 cm3 is an adverse prognostic factor [2]. Table 2 shows the results of the cognitive status comparison of subjects with intracerebral hematomas of different volume.

Assessment of cognitive status by scale methods M (25%; 75%)	Hematoma volume		
	< 20 cm^3 (n = 24)	20 - 50 cm^3 (n = 12)	> 50 cm^3 (n = 8)
MMSE	27.5 (25.5; 28.0)*	25.0 (24.0; 26.5)	24.0 (22.5; 24.0)*
FAB	18.0 (16.5; 18.0)	14.0 (14.0; 16.5)	13.5 (13.0; 15.0)

Table 2: *Cognitive status of patients depending on intracerebral hematoma volume.*
*Note: *: Reliability of statistical differences (p < 0.01).*

As table 2 demonstrates, there is a fairly clear relationship between hematoma volume and cognitive impairment severity. Hematomas of small volume were accompanied by a significantly less pronounced cognitive deficiency than hematomas with a volume of more than 50 cm3. When comparing the volume of hematomas with the test indicators, a strong positive correlation was found: r =+ 0.83.

When comparing the scoring indicators of patients with different time remoteness periods of non-traumatic intracranial hemorrhage, it was found that cognitive deficits achieved maximum in the observations of the early recovery period (MMSE test result was 25.5 (18.0; 27.0) points, FAB was 14.5 (10.75; 17.0) points), and it was minimally expressed in those studied with residual phenomena of a hemorrhagic stroke (MMSE score was 27.0 (23.25; 28.25) points, FAB was 16.5 (14.75; 13.0) points, respectively). This is consistent with the literature, according to which the state of cognitive function improves within 10 months after surgery in most patients operated for non-traumatic hemorrhage [8].

Conclusion

Thus, the structure and severity of cognitive impairment in non-traumatic intracranial hemorrhages are affected by a number of factors, including the etiology of hemorrhage, localization and size of hematoma, and the hemorrhage time remoteness. The results can be used to determine the rehabilitation prognosis.

Bibliography

1. Liu S., *et al*. "Neutrophil-lymphocyte ratio predicts the outcome of intracerebral hemorrhage: A meta-analysis". *Medicine (Baltimore)* 98.26 (2019): e16211.

2. An SJ., *et al*. "Epidemiology, risk factors, and clinical features of intracerebral hemorrhage: an update". *Journal of Stroke* 19.1 (2017): 3-10.

3. Cai Z., *et al*. "Cerebral small vessel disease and Alzheimer's disease". *Clinical Interventions in Aging* 10 (2015): 1695-1704.

4. Fisher CM. "The pathologic and clinical aspects of thalamic hemorrhage". *Transactions of the American Neurological Association* 84 (1959): 56-59.

5. Ladurner G., *et al*. "Neuroprotective treatment with cerebrolysin in patients with acute stroke: a randomised controlled trial". *Journal of Neural Transmission* 112.3 (2005): 415-428.

6. Hier DB and Cummings JL. "Rare acquired and degenerative subcortical dementias". Subcortical dementia/Ed. by J.L. Cummings. New York: Oxford University Press (1990).

7. Hartmann A., *et al*. "Morbidity of intracranial hemorrhage in patients with cerebral arteriovenous malformation". *Stroke* 29.5 (1998): 931-934.

8. Ding X., *et al*. "A metabonomic investigation on the biochemical perturbation in post-stroke patients with depressive disorder (PSD)". *Metabolic Brain Disease* 31.2 (2016): 279-287.

Volume 8 Issue 10 October 2019