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FACTORS AFFECTING FATAL OUTCOME IN HEMORRHAGIC STROKE

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Abstract. Cerebrovascular lesions are one of the most pressing public health problems and significantly affect the social sphere. According to modern estimates, the number of patients with cerebrovascular diseases in the world reaches approximately 9 million people. Strokes occupy the most significant share among these diseases, affecting from 5.6 to 6.6 million people worldwide annually and leading to 4.6 million fatal outcomes. While previously the ratio of ischemic and hemorrhagic strokes was 5:1, it has now decreased to 4:1 due to an increase in the number of cases of hemorrhagic stroke (HS). According to a number of studies, mortality in hemorrhagic stroke ranges from 38% to 80%. For hypertensive intracerebral hemorrhages, the 30-day lethality rate is 44–52%, with approximately 50% of fatal outcomes occurring within the first three days from the onset of the disease. The results of our study indicate the multifactorial nature of the formation of an unfavorable outcome in hemorrhagic stroke. The greatest contribution to the risk of a fatal outcome is made by the indicators of neurological status and the characteristics of the hemorrhagic focus according to brain computed tomography data. The obtained data can be used for early prediction of hemorrhagic stroke outcomes, stratification of patients by risk degree, and optimization of treatment and diagnostic tactics in the acute period of the disease.

Keywords: hemorrhagic stroke, mortality, prognostic factors, outcome prediction, computed tomography, neurological status, intraventricular hemorrhage.

Relevance. Hemorrhagic stroke is one of the most severe and prognostically unfavorable forms of acute cerebrovascular disorders, characterized by high mortality, significant disability, and a substantial reduction in patients' quality of life. According to international studies, intracerebral hemorrhages account for approximately 10–20% of all strokes; however, they are responsible for a disproportionately high rate of fatal outcomes and severe neurological complications. Despite significant advances in modern medicine in the fields of diagnostics, neuroimaging, intensive care, and neurosurgical treatment, mortality rates in hemorrhagic stroke remain consistently high, especially during the acute period of the disease. Fatal outcome in hemorrhagic stroke is determined by a complex of interrelated factors, including demographic characteristics of the patient, severity of neurological deficit, level of consciousness upon admission, volume and localization of intracerebral hematoma, presence of intraventricular hemorrhage, degree of displacement of the brain midline structures, as well as concomitant somatic pathology. At the same time, the contribution of individual clinical, laboratory, and neuroimaging indicators to the development of an unfavorable prognosis continues to be actively studied, since the results of various investigations often remain contradictory. The search for reliable prognostic criteria of

mortality is of particular importance, as it allows an objective assessment of the severity of the patient's condition at the earliest stages of hospitalization, prediction of the risk of unfavorable outcome, and timely decision-making regarding the scope of diagnostic and therapeutic measures. Identification of factors most closely associated with fatal outcome contributes to the improvement of patient management algorithms, optimization of intensive care, and enhancement of the effectiveness of specialized medical care. In addition, under conditions of the continuing increase in the prevalence of arterial hypertension, diabetes mellitus, cardiovascular diseases, and other risk factors for cerebrovascular pathology, the problem of hemorrhagic stroke acquires particular medical and social significance. The study of factors associated with mortality in hemorrhagic stroke is of not only theoretical interest but also of great practical importance for the development of measures aimed at reducing mortality, improving prognosis, and enhancing the quality of medical care provided to this category of patients.

Objective: To conduct a comparative analysis of the combined influence of a number of studied factors on the probability of fatal outcome and to determine the priority of each factor.

Materials and Methods: Twenty-five patients with hemorrhagic stroke (HS) in the acute stage of the disease were observed and selected as a result of a screening retrospective analysis of more than 13 patients with clinical manifestations of hemorrhagic stroke.

Results: Analysis of variance was used as an instrumental method of comparison because the studied indicators had different dimensions. The analysis strategy consisted of identifying statistically significant relationships between each of the studied indicators and the outcome, as well as determining the parameters most responsive to the influence of the studied factors.

To objectively assess the severity of the condition and the extent of neurological impairment in patients, as well as to standardize the processing of clinical material and perform statistical analysis between groups, two complementary clinical rating scales were used: the Orgogozo Scale with a maximum score of 100 and the original scale (Gusev E.I., Skvortsova V.I., 1991) with a maximum score of 49. The degree of functional recovery was assessed using the Barthel Index with a maximum score of 100. The dynamics of neurological status were studied in patients with a favorable outcome (surviving patients) on days 1, 11, and 21 after the onset of hemorrhage.

The studied factors were divided into groups:

1. Demographic indicators (sex and age);
2. Characteristics of disease onset (time from disease onset to hospital admission, acute or subacute onset, as well as the time of day when the hemorrhage occurred);
3. Characteristics of complaints (presence of headache, its localization, presence of dizziness, nausea, and vomiting);
4. Presence of epileptic seizures, psychomotor agitation and/or loss of consciousness at disease onset;
5. Autonomic manifestations (systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, body temperature, hyperhidrosis);
6. Localization of hemorrhage (medial, lateral, lobar);
7. Characteristics of the hemorrhagic lesion according to brain CT findings (volume, density, displacement of midline structures, presence of blood breakthrough into the subarachnoid space and ventricular system — intraventricular, partial, total);
8. Complete blood count parameters;
9. Biochemical blood test parameters;
10. Coagulation profile parameters;

11. Results of fundus examination (presence of angiopathy, angiosclerosis, early development of optic disc edema);

12. Neurological status upon admission assessed using the original scale containing 13 parameters described in the chapter “Materials and Methods of the Study”.

With a probability of 94%, it can be assumed that the shorter the period from disease onset to hospitalization, the lower the risk of fatal outcome. However, the total contribution of all studied factors describing disease onset accounts for only 3.1% of the outcome variance and is not statistically significant.

The results of the analysis of the influence of hemorrhage localization on outcome demonstrated a statistically significant dependence of outcome on localization. With a high degree of significance, it can be assumed that patients with medial localization of hemorrhagic stroke have the highest risk of unfavorable outcome.

Based on the obtained data, with 95% confidence, it can be assumed that there is a clear relationship between profound disturbances of consciousness, pathological breathing patterns, and the risk of fatal outcome. With an even greater degree of confidence, a reliable association can be stated between the presence of meningeal syndrome upon admission and the risk of unfavorable outcome. A similarly statistically significant relationship was found between impaired oculocephalic reflexes and the risk of fatal outcome. In patients with unfavorable outcome, lesions of the cranial nerve systems occurred significantly more often. A strong statistically significant association was confirmed between impaired higher cortical functions and the risk of fatal outcome. At the same time, pyramidal tract lesions, changes in muscle tone, sensory disturbances, visual impairment, dysfunction of pelvic organs, and trophic disorders did not make a statistically significant contribution to the description of fatal outcome. As noted previously, we were unable to adequately assess cerebellar function.

Thus, the analysis demonstrated that the older the patient, the higher the risk of fatal outcome. There is a statistically significant relationship between age and disease outcome; however, the total contribution of demographic factors is small—2.8%—and not statistically significant. With a probability of 94%, it can be assumed that the shorter the time from disease onset to hospitalization, the lower the risk of fatal outcome, although the total contribution of all factors describing disease onset accounts for only 3.1% of the disease outcome and is not statistically significant. None of the complaints had statistically significant weight in describing disease outcome. The total contribution of this group of factors was 6.3% and was not statistically significant. The presence of epileptic seizures and loss of consciousness at disease onset was significantly higher in the group of patients with fatal outcome. The total contribution of these parameters, while statistically significant, amounted to 1.7%. Analysis of autonomic disorders revealed that among all studied parameters, only heart rate was significantly associated with fatal outcome. With more than 95% confidence, it can be stated that there is a relationship between the patient’s autonomic status and the risk of fatal outcome. The coefficient of determination of this parameter was 10.2%. The results of the analysis of the influence of hemorrhage localization on outcome demonstrated a statistically significant dependence of outcome on localization. With a high degree of significance, it can be assumed that patients with medial localization of hemorrhage have the highest risk of unfavorable outcome. Localization of intracerebral hematoma contributes 6% to disease outcome. Further analysis showed a significant statistically meaningful relationship between disease outcome and the volume of the hemorrhagic lesion, displacement of the brain midline structures, and total breakthrough of blood into the ventricular system. The combined contribution of factors characterizing the pathological process according to brain CT findings amounted to 50.4%. Investigation of the

contribution of complete blood count parameters showed that the greater the neutrophilic left shift, the higher the risk of fatal outcome, while a lower lymphocyte-leukocyte index was associated with a higher risk of unfavorable outcome. The combination of complete blood count parameters explained 23% of the variance in outcome indicators ($p<0.00001$). Among the studied biochemical blood parameters, serum urea level had a significant association with unfavorable outcome. As serum urea levels increased, the risk of fatal outcome increased and demonstrated a statistically significant relationship ($p<0.001$). It was established that the combined contribution of all studied biochemical blood parameters was 12%. Analysis of coagulation profile parameters revealed that only a positive ethanol gelation test had a minimal statistically significant association with fatal outcome. The variability coefficient of the total coagulation profile parameters was less than 5% and was not statistically significant. A reliable association was found between the presence of early optic disc edema and the risk of unfavorable outcome. The total contribution of all ophthalmological disorders to unfavorable outcome in hemorrhagic stroke was statistically significant and amounted to 12%. Analysis of neurological status upon admission demonstrated, with 95% confidence, a clear association between the risk of fatal outcome and the presence of pathological breathing patterns, meningeal syndrome, impaired oculocephalic reflexes, lesions of cranial nerve systems, and impaired higher cortical functions. The combination of symptoms constituting the neurological status of patients made a very substantial contribution—more than 51%—to the risk of unfavorable outcome in hemorrhagic stroke.

Conclusion: The results of the study indicate the multifactorial nature of unfavorable outcome formation in hemorrhagic stroke. The greatest contribution to the risk of fatal outcome is made by neurological status indicators and characteristics of the hemorrhagic lesion according to computed tomography of the brain. The most significant predictors of fatal outcome are medial localization of hemorrhage, large hematoma volume, displacement of the brain midline structures, total breakthrough of blood into the ventricular system, profound disturbances of consciousness, and severe neurological deficit.

The obtained data may be used for early prediction of outcomes in hemorrhagic stroke, risk stratification of patients, and optimization of diagnostic and therapeutic management during the acute stage of the disease.

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