

# **SURGICAL TREATMENT OF NON-TRAUMATIC INTRACEREBRAL HEMORRHAGE (LITERATURE REVIEW)**

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## **Abstract**

This article discusses modern approaches to the diagnosis, classification and surgical treatment of intracerebral hematomas of non-traumatic origin. In addition, we highlighted the opinion of some authors on the prevalence of this pathology and mortality due to acute cerebrovascular accident. The advantages and possible complications of modern methods of treatment of non-traumatic intracerebral hemorrhages, as well as the outcome of the disease in various groups of patients are described.

*Keywords: non-traumatic intracerebral hematoma, surgical treatment, development mechanisms, prognosis, outcome.*

# **NOTRAVMATIK MIYA ICHI QON QUYILISHLARINI JARROHLIK YO'LI BILAN DAVOLASH (ADABIYOT SHARHI)**

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## **Annotatsiya**

Ushbu maqolada notravmatik miya ichi gematomalarini tashxislash, tasniflash va jarrohlik yo'li bilan davolashga zamonaviy yondashuvlar ko'rib chiqildi. Bundan tashqari, maqolada, ushbu patologiyani tarqalishi va o'tkir miya qon aylanishi buzilishi tufayli o'lim holatlari to'g'risida ayrim mualliflarning fikri o'rganildi. Turli guruhlardagi bemorlarning notravmatik miya ichi qon quyilishlarini davolashning zamonaviy usullarining afzalliklari va kelib chiqishi mumkin bo'lgan asoratlari, shuningdek kasallikning oqibatlari tasvirlangan.

*Kalit so'zlar: notravmatik miya ichi gematomalari, jarrohlik yo'li bilan davolash, rivojlanish mexanizmlari, prognoz, natija.*

# ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ НЕТРАВМАТИЧЕСКИХ ВНУТРИМОЗГОВЫХ КРОВОИЗЛИЯНИЙ (ОБЗОР ЛИТЕРАТУРЫ)

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## Аннотация

В данной статье рассмотрены современные подходы к диагностированию, классификации и хирургическому лечению внутримозговых гематом нетравматического генеза. Кроме того, освещены взгляды некоторых авторов по вопросам распространённости и смертности вследствие данной патологии. Описаны преимущества и вероятные осложнения современных методов лечения нетравматических внутримозговых кровоизлияний, а также исходы заболевания у различных групп больных.

*Ключевые слова: нетравматическая внутримозговая гематома, хирургическое лечение, механизмы развития, прогноз, исход.*

Non-traumatic intracerebral hemorrhage (hypertensive intracerebral hemorrhage, primary intracerebral hemorrhage) is a polyetiological disease that manifests itself as a hemorrhage in the brain tissue and is not associated with a tumor or injury [39].

The pathologies of the cerebral vessels, in particular, cerebral stroke, pose urgent socio-economic problems for the society that require solution, and the provision of neurological assistance to the contingent with this pathology needs further modernization. Cerebral strokes are the main cause of persistent disability and are the leading causes of death worldwide [27, 38]. In the context of the social and economic damage caused, non-traumatic hemorrhages occupy one of the first places among all the costs caused by the morbidity of the population.

Hemorrhagic stroke (HS), in particular, non-traumatic intracerebral hemorrhage, has become not only a medical, but also a social and economic problem, since acute cerebrovascular accidents rank third among the causes of death and first among the causes of disability - before 80% of stroke patients become disabled [8, 12].

The incidence of hemorrhagic stroke ranges from 0.13 to 0.271% and depends on many concomitant factors, such as climate, heredity, social and economic development of the region, local customs and the level of development of preventive medicine, in particular diseases of the cardiovascular system [14].

Arterial hypertension plays the main role in the occurrence of non-traumatic intracerebral hemorrhage. More than half of hemorrhages in the brain are directly related to it. In studies conducted in European countries, arterial hypertension is detected in

62-70% of patients with non-traumatic intracerebral hemorrhage in and in 100% of patients in Asian countries. A number of studies have been devoted to morphological changes in perforating vessels associated with the development of non-traumatic intracerebral hemorrhage [10].

The relationship between non-traumatic intracerebral hemorrhage and age has been proven. In persons over 25 years of age, the incidence and death rate increase 2-3 times with each subsequent decade [50]. At the same time, it is possible to determine the tendency towards stroke rejuvenation [37].

The most common cause of cerebral hemorrhage in young patients is intracranial arterial aneurysms, less often arteriovenous aneurysms [21, 24].

The relationship between the localization of hemorrhage and the etiology of non-traumatic intracerebral hemorrhage, with the exception of cases with cerebral amyloid angiopathy (CAA), has not been proven. CAA is characterized by lobar (subcortical) non-traumatic intracerebral hemorrhage [62]. The most frequent hematomas are located in the area of the basal ganglia, thalamus, and cerebellar pontine angle [3]. In 55-76%, hematomas are located in the area of the basal ganglia and thalamus, in 15-47% they have subcortical localization, in 4-13% - brainstem, in 5-10% - cerebellar, and in 1.5-2.8% there are multiple hemorrhages [14].

Despite the presence of a huge stock of knowledge about the pathological processes inherent in non-traumatic intracerebral hemorrhage, as well as the development of new technologies in neurosurgery, neuroimaging and intensive therapy, there is still no consensus on the choice of the method of treatment of non-traumatic intracerebral hemorrhage, and treatment recommendations are based in most cases on personal opinion authors [14, 20, 41].

The main argument against the operation is the similarity of the long-term results of surgical and conservative treatment. Patients in a compensated state are successfully treated with medication. The selection criteria for patients for surgical and conservative treatment, as a rule, are determined by the severity of the condition, the localization of the hemorrhage and its size [15, 18, 19].

Research is more often carried out to determine the effectiveness of certain methods of surgical intervention. Thus, unambiguous indications for surgical treatment have not been determined, while in the United States, on average, about 7000 operations are performed for stroke-hematoma [25]. With almost identical long-term results of conservative and surgical treatment of non-traumatic intracerebral hemorrhage, in the immediate period of the course of the disease, surgical methods of treatment significantly reduce the mortality index in a group of patients with certain indicators of the severity of the clinical course, localization and size of the hematoma, as well as the presence of concomitant pathologies and the age of patients [17]. Uncertainty in the choice of tactics, as well as the traditions of individual medical institutions, is reflected in the dif-

ferent surgical activity in stroke-hematoma, which is 2% in Hungary, 20% in the USA, 50% in Germany and Japan, and 90% in Lithuania [19].

Surgical treatment is considered indicated: for patients with cerebellar hemorrhages of medial localization with a diameter of 30–40 mm, a volume of 15–30 cm<sup>3</sup>, in the presence of occlusive hydrocephalus or compression of the brainstem [14]. In the case of a rapid increase in the symptoms of compression of the trunk, it is proposed to operate even hemorrhages less than 10 cm<sup>3</sup>, and in the choice of tactics to be guided not by the volume of non-traumatic intracerebral hemorrhage, but by the clinical picture and CT signs of axial dislocation [42]. Surgical activity with respect to cerebellar non-traumatic intracerebral hemorrhage is relatively high in comparison with non-traumatic intracerebral hemorrhage of other localization, which is explained by the frequent rapid clinical course of the disease and the efficiency of timely surgery even in patients in a coma [34, 39].

The indications for surgical treatment of supratentorial hemorrhages are not so obvious [10]. In determining the rationale for surgical treatment and the timing of intervention in these patients, the researchers were mainly based on knowledge about early disorders of regional and general cerebral blood flow, dynamics of cerebral edema, changes in intracranial pressure leading to damage to the pathways and neurological deficits [2, 19]. It was found that disturbances in the regional cerebral blood flow were observed even when the volume of non-traumatic intracerebral hemorrhage exceeded 15 cm<sup>3</sup> and increased maximally during the first 24 hours [27]. Changes in intracranial pressure depended on the volume of hemorrhage and the duration of the disease - the larger the volume of non-traumatic intracerebral hemorrhage and the longer the time passed from the onset of stroke, the higher the intracranial pressure (ICP) and the worse the prognosis. However, there are opponents of early surgical treatment, indicating a high risk of recurrence of hemorrhage and difficulty of intraoperative hemostasis during intervention in the first 4–12 hours from the onset of the disease [20, 32, 35].

Surgical treatment in the terminal state of patients, depression of consciousness to deep coma, absence of stem reflexes, flaccid tetraplegia, unstable hemodynamics, the presence of neuroimaging signs of pronounced destruction of the brain stem, regardless of the location and volume of hemorrhage, is not recommended by most researchers [33, 34]. If we take into account the patients operated on in a state of moderate coma, it is possible to achieve a decrease in the number of deaths, but the results in the follow-up remain unsatisfactory [41].

Surgical treatment is justified in case of lateral and lobar non-traumatic intracerebral hemorrhages with a volume of 30 cm<sup>3</sup>, depression of consciousness from stupor and higher, pyramidal insufficiency, signs of dislocation or occlusive hydrocephalus, the patient's age is not older than 70 years [8]. It should be noted that the results of the

operation were often better among those operated on at a later date, since the condition of these patients at the time of the operation was less severe than among those operated on in the acute period [13, 41]. Some authors propose to determine the indications for surgical intervention not so much on the basis of the nature of the hemorrhage, but depending on the safety of the pathway response after anti-edema therapy [11, 29].

With the significant development of minimally invasive surgery and an increase in surgical activity, there is an opinion that the only indication for surgical treatment of subcortical and medial hemorrhages is the threat of death [38]. However, N. Niizuma et al., Report on operations performed in patients with medial hemorrhages with a volume of 8 cm<sup>3</sup> or more [38]. According to V.A. Ponomarev, in patients with supratentorial localization with a volume of less than 30 cm<sup>3</sup>, the lethality in surgical treatment is higher than in conservative treatment; with non-traumatic intracerebral hemorrhage more than 50 cm<sup>3</sup>, the mortality rates are significantly higher with conservative treatment, and with a volume of 30 to 50 cm<sup>3</sup>, there is no significant difference between the mortality rates for surgical and conservative treatment [29].

Among the supratentorial non-traumatic intracerebral hemorrhage, subcortical ones are most often operated on. This is due to the superficial localization of the hematoma and more favorable results of surgical treatment. Often a contraindication to surgery is the age of the patients and the risk of recurrence associated with CAA [35, 36].

With respect to hemorrhages of deep localization, which make up the majority of the non-traumatic intracerebral hemorrhage, the opinions are contradictory. Thus, according to I. Miyai, with a lateral non-traumatic intracerebral hemorrhage with a volume of 40 cm<sup>3</sup> or more, emergency surgery can reduce mortality and disability, while the volume of putamenal hemorrhage of 30 cm<sup>3</sup> increases the risk of an unfavorable outcome [38].

There are five types of surgery for non-traumatic intracerebral hemorrhages:

1. craniotomy with open removal of intracerebral hemorrhage,
2. simple puncture aspiration,
3. endoscopic removal of hematoma,
4. local fibrinolysis of hemorrhage,
5. external ventricular drainage.

Each of them or their combination is assigned a certain area of application today, depending on the type of hemorrhage and the clinical course of the disease [1, 9].

Exodus. According to J.P. Broderick et al., Patients with depression of consciousness less than 8 points according to GCS and a hemorrhage volume of more than 60 cm<sup>3</sup>, mortality during the first month is 90-91%, and in patients with depression of consciousness of 9 points or more, the volume of non-traumatic intracerebral hemorrhage is less than 30 cm<sup>3</sup>, mortality - 17-19% [27, 28]. Only 15% of patients with a hemorrhage volume above 30 cm<sup>3</sup> were able to fully rehabilitate and return to normal

life.

M. Castellanos et al., I. Miyai et al., Prognostically negative factors include a breakthrough of a hematoma into the ventricular system of the brain, a median location of hemorrhage, the presence of signs of dislocation, a large volume of non-traumatic intracerebral hemorrhage, and vice versa - a subcortical location of a hematoma, a relatively high level of consciousness and a low concentration of blood fibrinogen - to prognostically favorable factors [29, 38]. Mortality in medial non-traumatic intracerebral hemorrhage is largely due to the localization of hemorrhage in the thalamus. With the posterolateral type of hemorrhage, it is the highest - over 68%, with anterolateral hemorrhage - 16%, medial - 8%, and dorsal - 8% [30].

According to the data given by S. Juvela, the lobar and cerebellar localization of hemorrhage are the risk factors for an unfavorable outcome [35].

According to Y. Lampl et al., The functional outcome 6 months after the onset of the disease in lobar and putamenal, in contrast to thalamic hematoma, depended on the volume [36].

It should be noted that age is the most important factor influencing outcome [30]. Among the contingent under the age of 60, the mortality rate was 28%, at the age of 60-69 years - 45%, and among the contingent over 69 years old - 57%.

Prognostically, recurrent hemorrhage is considered an extremely unfavorable factor [16]. The mortality rate in patients with a single hemorrhage is less than in those who have had a second one (34 and 44%, respectively), and the number of favorable outcomes is higher - 37–55 and 27%, respectively [20]. The risk of recurrent hemorrhage or increase in the size of non-traumatic intracerebral hemorrhage increases with the use of fibrinolytics, anticoagulants and antiplatelet agents [12, 23].

Based on the above, we can draw some conclusions:

1. There is no consensus on the indications for surgical treatment of non-traumatic intracerebral hemorrhage.
2. It is not possible to determine reliable information on the mortality and disability rates of conservative and surgical treatment among people of different age groups.
3. When determining the tactics of treatment, one should take into account the localization and volume of intracerebral hematoma, the degree of impairment of consciousness, the patient's age and the presence of concomitant pathologies.

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