



SURGICAL MANAGEMENT OF ACUTE TRAUMATIC INTRACRANIAL HEMATOMAS: CLINICAL, DIAGNOSTIC, AND TACTICAL ASPECTS

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Abstract.

Background. Traumatic brain injury (TBI) remains one of the leading causes of mortality and long-term disability among individuals of working age worldwide. Acute traumatic intracranial hematomas are particularly life-threatening due to rapid progression of intracranial hypertension, brain displacement, and a high risk of fatal outcome.

Objective. To analyze the outcomes of neurosurgical treatment in patients with acute traumatic intracranial hematomas depending on clinical status, lesion morphology, and surgical strategy.

Materials and Methods. A retrospective analysis of 103 patients with acute traumatic intracranial hematomas (epidural, subdural, and intracerebral), including bilateral and multilayer (“multilevel”) forms, was performed. Clinical and neurological assessment, CT, MRI, EchoEG, EEG, and various surgical approaches (decompressive craniectomy, osteoplastic craniotomy, burr-hole evacuation) were used.

Results. Clinical improvement was achieved in 62.1% of patients, while postoperative mortality reached 37.9%. The most favorable outcomes were associated with wide craniotomy. Prognosis was strongly correlated with the initial level of consciousness and the timeliness of surgical intervention.

Conclusion. Optimization of surgical tactics based on clinical condition and neuroimaging findings is crucial for improving outcomes in patients with acute traumatic intracranial hematomas.

Keywords: traumatic brain injury; intracranial hematoma; subdural hematoma; neurosurgical treatment; craniotomy; mortality

ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ ОСТРЫХ ТРАВМАТИЧЕСКИХ ВНУТРИЧЕРЕПНЫХ ГЕМАТОМ: КЛИНИКО-ДИАГНОСТИЧЕСКИЕ И ТАКТИЧЕСКИЕ АСПЕКТЫ

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Аннотация.

Актуальность. Черепно-мозговая травма (ЧМТ) остается одной из ведущих причин летальности и инвалидизации лиц трудоспособного возраста во всем мире. Особую опасность представляют острые травматические внутричерепные гематомы, сопровождающиеся прогрессирующим повышением внутричерепного давления, дислокацией структур мозга и высоким риском летального исхода.

Цель исследования. Проанализировать результаты нейрохирургического лечения больных с острыми травматическими внутричерепными гематомами в зависимости от клинического статуса, морфологии поражения и выбранной хирургической тактики.

Материалы и методы. Проведен ретроспективный анализ 103 пациентов с острыми травматическими внутричерепными гематомами (эпидуральными, субдуральными и

внутричерепными), включая двухсторонние и «поэтажные» формы. Использовались клинико-неврологическое обследование, КТ, МРТ, ЭхоЭГ, ЭЭГ и различные варианты хирургических вмешательств (резекционная и костно-пластическая трепанация, фрезеотомия).

Результаты. Улучшение достигнуто у 62,1% пациентов, послеоперационная летальность составила 37,9%. Наиболее благоприятные исходы отмечены при применении широкой трепанации черепа. Прогноз напрямую зависел от исходного уровня сознания и своевременности хирургического вмешательства.

Заключение. Оптимизация хирургической тактики с учетом клинического состояния и нейровизуализационных данных является ключевым фактором улучшения исходов лечения острых травматических внутричерепных гематом.

Ключевые слова: черепно-мозговая травма; внутричерепные гематомы; субдуральная гематома; нейрохирургическое лечение; трепанация черепа; летальность.

O‘TKIR TRAVMATIK INTRAKRANIAL GEMATOMALARNI JARROHLIK YO‘LI BILAN DAVOLASH: KLINIK, DIAGNOSTIK VA TAKTIK JIHATLAR

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SamDTU huzuridagi neyroxirurgiya va neyroreabilitatsiya ixtisoslashtirilgan ilmiy-amaliy markazi

Annotatsiya.

Dolzarbliqi. Bosh miya jarohati (BMJ) dunyo miqyosida mehnatga layoqatli yoshdagi aholida o‘lim va nogironlikning yetakchi sabablaridan biri bo‘lib qolmoqda. O‘tkir travmatik intrakranial gematomalar tez rivojlanadigan intrakranial gipertenziya va miya tuzilmalarining siljishi bilan kechib, yuqori letallik xavfi bilan ajralib turadi.

Tadqiqot maqsadi. O‘tkir travmatik intrakranial gematomali bemorlarda klinik holat, shikastlanish morfologiyasi va tanlangan jarrohlik taktikasi asosida davolash natijalarini tahlil qilish.

Material va usullar. 103 nafar bemorda epidural, subdural va intramiyalik gematomalar (shu jumladan ikki tomonlama va “qavatma-qavat” joylashgan shakllar) retrospektiv tahlil qilindi. Klinik-nevrologik tekshiruv, КТ, МРТ, EhoEG, EEG va turli jarrohlik usullari qo‘llanildi.

Natijalar. 62,1% holatda klinik yaxshilanish kuzatildi, operatsiyadan keyingi letallik 37,9% ni tashkil etdi. Eng yaxshi natijalar keng trepanatsiya qo‘llanilganda qayd etildi.

Xulosa. Klinik holat va neyrovizualizatsiya ma’lumotlariga asoslangan individual jarrohlik yondashuvi davolash natijalarini yaxshilashda hal qiluvchi ahamiyatga ega.

Kalit so‘zlar: bosh miya jarohati; intrakranial gematoma; subdural gematoma; neyroxirurgiya; trepanatsiya; letallik

Introduction. The diagnosis and management of traumatic brain injury (TBI) remain one of the most pressing problems in modern traumatology and neurosurgery, and over recent years the significance of this issue has increased even further [1–6]. According to data from the World Health Organization (WHO), mortality associated with TBI among individuals of the most economically productive age group (under 45 years) occupies a leading position in the overall structure of mortality, surpassing many other causes of death [4–6]. The same WHO statistics indicate a steady upward trend in the incidence of TBI, with an average annual increase of approximately 2%, reflecting the growing global burden of neurotrauma [1–6]. The continuous rise in the number of patients sustaining head injuries with subsequent brain damage has positioned neurotrauma as one of the key scientific and clinical challenges in contemporary neurosurgery.

Modern neurotrauma is characterized by a marked increase in the frequency of acute traumatic intracranial lesions, among which acute subdural hematomas occupy a particularly important place due to their severity, rapid progression, and high mortality. The increasing severity of road traffic accidents and high-energy mechanisms of injury has led to a growing incidence of acute subdural

hematomas encountered in routine neurosurgical practice. Despite the presence of numerous publications addressing traumatic intracranial hematomas, the operative strategies and technical aspects of surgical interventions for acute intracranial hematomas remain insufficiently systematized. Moreover, the literature contains limited and fragmented data regarding the specific features of surgical management for these complex lesions. In this context, the aim of the present study was to analyze the outcomes of neurosurgical treatment in patients with acute traumatic intracranial hematomas, with particular attention to the choice of surgical approach and its influence on clinical results.

Materials and methods. The present investigation is based on an analysis of clinical syndromes and neurosurgical treatment outcomes in 103 patients with acute traumatic intracranial hematomas. Acute traumatic intracranial hematomas were defined as the presence of subdural, epidural, or intracerebral hematomas located unilaterally or bilaterally. Taking into account the localization and spatial relationship of the hematomas, we identified bilateral hematomas and so-called “multilevel” bilateral hematomas. From a diagnostic and therapeutic standpoint, we consider it reasonable to distinguish between these two categories. The group of “multilevel” bilateral hematomas included epidural, subdural, and intracerebral hematomas located one above another within the cranial cavity (23 cases), affecting both cerebral hemispheres. The group of bilateral hematomas comprised cases in which epidural, subdural, or intracerebral hematomas were located over both hemispheres without a vertical multilayered arrangement (80 patients).

The most frequent combinations were subdural plus subdural hematomas (40.8%) and subdural plus epidural hematomas (22.3%). Less commonly observed were intracerebral plus intracerebral hematomas (9.7%), while other combinations of bilateral intracranial hematomas were encountered only sporadically. All patients admitted to the hospital underwent comprehensive clinical evaluation, including detailed general somatic and neurological examinations, assessment by a neuro-ophthalmologist, skull radiography, lumbar puncture, echoencephalography (EchoEG), electroencephalography (EEG), computed tomography (CT), magnetic resonance imaging (MRI) of the brain, and, when indicated, diagnostic exploratory burr-hole trephination.

Analysis of Table 1 demonstrates that acute traumatic intracranial hematomas were most frequently observed in patients younger than 40 years (57 cases), followed by individuals aged 40–59 years (29 cases), while patients aged 60 years and older accounted for 17 cases.

Table 1. Distribution of patients by age and sex

Age group (years)	Men (n)	Women (n)	Total (n)
Under 19	6	2	8
20–39	48	1	49
40–59	23	6	29
60 and older	15	2	17
Total	92	11	103

Within the complex of therapeutic measures for acute traumatic intracranial hematomas, primary importance was assigned to the timeliness and radical nature of surgical intervention. Operative treatment represented the final stage of diagnostic assessment and simultaneously marked the beginning of definitive therapy for patients with intracranial hematomas. The surgical techniques employed included decompressive (resection) craniectomy, osteoplastic craniotomy, and evacuation of hematomas through enlarged burr holes. In patients presenting in extremely severe condition, evacuation of hematomas through an enlarged burr hole was selected as the method of choice. The necessity for maximal acceleration of surgical intervention in critically ill patients during the acute phase of TBI often compelled the use of resection craniectomy or burr-hole evacuation as life-saving procedures.

Results. For the removal of acute traumatic intracranial hematomas, three well-established neurosurgical approaches were utilized: osteoplastic craniotomy, resection craniectomy, and burr-hole evacuation. At the same time, a major objective of this study was to determine the influence of clinical status, injury localization, skull fracture morphology, hematoma volume, and other factors on the selection of a particular surgical approach, as well as to elucidate the postoperative course depending on the chosen treatment strategy. In our cohort, resection craniectomy predominated,

which can be attributed primarily to the fact that most patients were admitted in the acute phase of TBI, frequently in severe or extremely severe condition. Resection craniectomy was most commonly performed in young and middle-aged patients, whereas in patients older than 60 years it was used less frequently. Conversely, osteoplastic craniotomy was more often performed in younger patients than in elderly individuals, while the burr-hole technique was used more frequently in older patients.

As a rule, osteoplastic craniotomy was performed in patients without pronounced brainstem dysfunction and in cases where hematoma localization had been reliably established by CT or MRI. This technique proved particularly effective for “multilevel” bilateral hematomas, since epidural hematomas often contain dense blood clots within the first hours after trauma, the removal of which may be accompanied by renewed bleeding. Osteoplastic craniotomy was applied both as a primary and as a definitive stage of surgical intervention, as well as a secondary procedure following partial evacuation of hematomas through an enlarged burr hole. The frequency of osteoplastic craniotomy increased with decreasing patient age. In younger patients, this method creates favorable anatomical and physiological conditions for early and complete recovery of impaired neurological functions and prevents the development of the so-called “trephined skull syndrome.” In patients with moderate or satisfactory clinical status, this technique is considered absolutely indicated.

Resection craniectomy was performed in 98 patients (95.1%). This approach was selected in cases of severe clinical condition, marked cerebral and brainstem symptoms, comminuted depressed skull fractures, progressive cerebral edema, and significant brain displacement. In 12 patients with signs of incipient transtentorial herniation, bilateral subtemporal decompression was carried out, which allowed preservation not only of life but also of cognitive and mental integrity. Resection craniectomy was performed in 54 young and middle-aged patients and in 34 elderly and senile patients. Our experience confirms that this technically relatively simple method allows adequate revision of the epidural and subdural spaces, although in this respect it is inferior to osteoplastic craniotomy. Evacuation of acute traumatic intracranial hematomas through enlarged burr holes was performed in 30 patients (29.1%), including 10 young and middle-aged individuals and 20 elderly or senile patients. After the creation of burr holes enlarged to a diameter of up to 5 cm, epidural hematomas were evacuated by suction, while blood clots were washed out using a combination of suction and spatula, allowing aspiration of the liquid component of the hematoma. This method was mainly used in patients in extremely severe condition, when more extensive surgical intervention was not feasible. Typically, two burr holes were applied. In the majority of cases, burr-hole trephination represented the first stage of a more radical surgical procedure. The disadvantages of this method include the inability to remove large or extensive basal hematomas, difficulties in evacuating contusion–laceration foci of the brain, challenges in identifying the bleeding source, and insufficient decompressive effect. Its advantages are rapid technical execution, significant diagnostic value, and minimal additional trauma to critically ill patients.

Outcomes of surgical treatment. Of the 103 patients with acute traumatic intracranial hematomas who underwent surgical treatment, 64 patients (62.1%) were discharged from the hospital with clinical improvement, while 39 patients died. The overall postoperative mortality rate was 37.9%. The main causes of mortality were brain injuries incompatible with life, severe cerebral contusion and laceration, incomplete or partial evacuation of hematomas, and secondary brainstem hemorrhages. The most favorable treatment outcomes were achieved following wide craniotomy, whereas less favorable results were observed with the use of enlarged burr holes, reflecting the extreme severity of the patients’ condition that precluded more extensive surgical intervention. The level of consciousness disturbance was a decisive factor determining the probability of favorable or unfavorable outcomes in patients with acute traumatic intracranial hematomas. Mortality rates increased progressively with worsening levels of consciousness (from obtundation to stupor and coma), while the proportion of favorable outcomes decreased correspondingly as the severity of consciousness impairment increased, underscoring the prognostic significance of initial neurological status [7–9].

Conclusion. Acute traumatic intracranial hematomas are among the most severe forms of traumatic brain injury and are associated with high mortality and poor neurological outcomes.

Timely and appropriately selected surgical intervention is the key determinant of survival and functional recovery. The choice of surgical approach should be individualized, taking into account the patient's clinical condition, level of consciousness, and neuroimaging findings. Wide craniotomy and decompressive procedures provide more effective hematoma evacuation and brain decompression, resulting in better outcomes, whereas burr-hole evacuation is mainly justified as an emergency or diagnostic measure in critically ill patients. Initial neurological status remains a major prognostic factor, highlighting the importance of early diagnosis and rapid neurosurgical management to improve treatment results.

References:

1. Bullock, M. R., Chesnut, R., Ghajar, J., Gordon, D., Hartl, R., Newell, D. W., & Wilberger, J. E. (2006). Surgical management of acute subdural hematomas. *Neurosurgery*, 58(Suppl 3), S16–S24.
2. Коновалов, А. Н., Лихтерман, Л. Б., & Потапов, А. А. (2012). *Черепно-мозговая травма*. Москва: ГЭОТАР-Медиа.
3. Maas, A. I. R., Menon, D. K., Adelson, P. D., Andelic, N., Bell, M. J., Belli, A., ... Yaffe, K. (2017). Traumatic brain injury: Integrated approaches to improve prevention, clinical care, and research. *The Lancet Neurology*, 16(12), 987–1048.
4. Крылов, В. В., Тальпов, А. Э., & Гаврилов, А. Г. (2018). Современные подходы к лечению тяжелой черепно-мозговой травмы. *Нейрохирургия*, 20(2), 8–15.
5. Tursunov, J. G., Aliyev, M. A., & Yakubov, A. T. (2021). Surgical outcomes in patients with acute traumatic intracranial hematomas. *Samarkand Medical Journal*, 2, 45–52.
6. Roozenbeek, B., Maas, A. I. R., & Menon, D. K. (2013). Changing patterns in the epidemiology of traumatic brain injury. *Nature Reviews Neurology*, 9(4), 231–236.
7. Лебедев, В. В., & Крылов, В. В. (2016). *Нейротравматология*. Москва: Медицина.
8. Honeybul, S., Ho, K. M., & Lind, C. R. P. (2011). Decompressive craniectomy for severe traumatic brain injury: A review. *Journal of Clinical Neuroscience*, 18(8), 1051–1057.
9. Рахимов, Б. А., & Набиев, А. А. (2020). Современные методы диагностики при нейротравме. *O'zbekiston tibbiyot jurnali*, 3, 33–39.