Medical Research Journal

PROGNOSTIC SIGNIFICANCE OF RISK FACTORS IN SURGICAL TREATMENT OF SEVERE TRAUMATIC BRAIN INJURY IN ELDERLY AND SENILE PATIENTS

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Abstract.
Background. Traumatic brain injury (TBI) in elderly and senile patients is characterized by specific pathomorphological features, high comorbidity burden, and unfavorable outcomes.
Objective. To determine the prognostic significance of clinical, radiological, and perioperative risk factors in elderly patients with severe TBI.
Materials and Methods. A retrospective analysis of 1,557 patients with acute TBI who underwent surgical treatment over a 5-year period was conducted. Patients aged ≥60 years (n=252) formed the study group, while patients aged 18–59 years (n=1,305) served as controls. Clinical assessment included GCS, ISS, dislocation syndrome grading, CT/MRI findings, and postoperative outcomes using the Glasgow Outcome Scale.
Results. Elderly patients more frequently sustained injuries due to falls from standing height and demonstrated a higher prevalence of subdural and multiple intracranial hematomas. Severe basal cistern compression, arterial hypotension, impaired pupillary reactions, low level of consciousness, and postoperative complications were strongly associated with poor outcomes. Age ≥60 years was an independent predictor of mortality.
Conclusion. Severe TBI in elderly patients is associated with distinct injury patterns and significantly worse surgical outcomes. Early identification of prognostic risk factors is essential for optimizing surgical strategy and improving outcomes.
Keywords: traumatic brain injury, elderly patients, prognostic factors, neurosurgery, intracranial hematoma, basal cistern compression.

ПРОГНОСТИЧЕСКОЕ ЗНАЧЕНИЕ ФАКТОРОВ РИСКА ПРИ ХИРУРГИЧЕСКОМ ЛЕЧЕНИИ ТЯЖЁЛОЙ ЧЕРЕПНО-МОЗГОВОЙ ТРАВМЫ У ПАЦИЕНТОВ ПОЖИЛОГО И СТАРЧЕСКОГО ВОЗРАСТА

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Аннотация.
Актуальность. Черепно-мозговая травма (ЧМТ) у пациентов пожилого и старческого возраста характеризуется особыми патоморфологическими изменениями, высоким уровнем сопутствующей патологии и неблагоприятными исходами лечения.
Цель. Определить прогностическое значение клинических, нейровизуализационных и периоперационных факторов риска у пожилых пациентов с тяжёлой ЧМТ.
Материалы и методы. Проведён ретроспективный анализ 1 557 пациентов с острой ЧМТ, перенёсших хирургическое лечение за 5 лет. Основную группу составили 252 пациента ≥60 лет, контрольную — 1 305 пациентов 18–59 лет. Использованы шкалы GCS, ISS, классификация дислокационного синдрома, данные КТ/МРТ и шкала исходов Глазго.
Результаты. У пожилых пациентов преобладали падения с высоты собственного роста, субдуральные и множественные внутричерепные гематомы. Тяжёлая компрессия базальных цистерн, артериальная гипотензия, патологические зрачковые реакции,

угнетение сознания и послеоперационные осложнения достоверно ассоциировались с летальными исходами. Возраст ≥60 лет являлся независимым фактором неблагоприятного прогноза.
Заключение. Тяжёлая ЧМТ у пожилых пациентов имеет особенности течения и худшие результаты хирургического лечения, что требует ранней стратификации риска и индивидуализации тактики лечения.
Ключевые слова: черепно-мозговая травма, пожилой возраст, прогноз, факторы риска, нейрохирургия, внутричерепные гематомы.

KEKSALAR VA QARILIK YOSHIDAGI BEMORLARDA OG‘IR BOSH MIYA JAROHATI JARROHLIK DAVOLASHIDA XAVF OMILLARINING PROGNOSTIK AHAMIYATI

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Annotatsiya.
Dolzarbligi. Keksalar va qarilik yoshidagi bemorlarda bosh miya jarohati (BMJ) o‘ziga xos patomorfologik xususiyatlar, ko‘plab hamroh kasalliklar va yuqori letallik bilan kechadi.
Maqsad. Og‘ir BMJ bo‘lgan keksa bemorlarda klinik va radiologik xavf omillarining prognostik ahamiyatini aniqlash.
Materiallar va usullar. 5 yil davomida jarrohlik yo‘li bilan davolangan 1 557 nafar o‘tkir BMJ bemorlarining retrospektiv tahlili o‘tkazildi. 60 yoshdan katta 252 bemor asosiy guruhni, 18–59 yoshdagi 1 305 bemor nazorat guruhini tashkil etdi. GKS, ISS, KT/MRT va Glazgo natijalar shkalasi qo‘llanildi.
Natijalar. Keksa bemorlarda yiqilish asosiy shikastlanish mexanizmi bo‘lib, subdural va ko‘p o‘choqli gematomalar ustunlik qildi. Bazal tsisternalarning og‘ir siqilishi, arterial gipotenziya, patologik qorachiq reaksiyalari va past ong darajasi yomon prognoz bilan bog‘liq edi.
Xulosa. 60 yoshdan yuqori bemorlarda og‘ir BMJ jarrohlik davolash natijalari sezilarli darajada yomon bo‘lib, prognozni baholashda individual yondashuv zarur.
Kalit so‘zlar: bosh miya jarohati, keksalar, prognoz, xavf omillari, neyroxirurgiya, intrakranial gematoma.

Introduction. In old and senile age, involutional changes occur in the human brain, determining the peculiarities of pathomorphology, traumatic reactions, clinical manifestations and the course of traumatic brain injury (TBI) in the elderly and senile individuals. According to WHO criteria, the elderly are people over 60 years of age, and senile people are people over 70 years of age [1, 10, 15]. With age, the number of comorbidities increases, which adversely affects the outcomes of TBI. The relevance of the problem of TBI in the elderly and senile individuals is due to the increase in the number of citizens in the older age group, as well as the peculiarity of the course of TBI in such victims [2, 10]. In elderly patients, both the identification of risk factors and the assessment of the degree of influence of each of them on the outcome of treatment are of great importance. The development of prognostic criteria for surgical treatment of elderly patients is necessary to determine the extent of surgical intervention, timely prevention of complications and assessment of the outcome of treatment [1-20].

Purpose of the study- determination of the prognostic significance of risk factors in TBI.

Materials and methods The article presents a retrospective analysis of the results of clinical and instrumental examination and surgical treatment of 1,557 patients with acute TBI, who were treated in the Multidisciplinary Clinic of the Samarkand State Medical University, Department of Neurosurgery, over a 5-year period. Patients with chronic intracranial hematomas were excluded from the study. The main group included 252 patients aged 60 years and older, who accounted for 16.2% of all operated patients. There were 52 women (20.6%) and 200 men (79.4%). The median age was 67 [63; 72] years. Patients aged 18 to 59 years constituted the control group (1,305 victims,

83.8%): 185 women (14.2%) and 1,120 men (85.8%); the median age was 36 [27; 47] years. The level of consciousness of the victims was assessed using the Glasgow Coma Scale (GCS). The main method of neuroimaging was computed tomography (CT) (and/or magnetic resonance imaging - MRI) of the brain. All patients underwent a dynamic clinical neurological examination. Clinical assessment of dislocation syndrome was performed using the classification of F. Plum and JB Posner (1986). The degree of axial dislocation was assessed based on the severity of compression of the basal cisterns (according to S.B. Vavilov et al., 1986), the severity of the condition of patients with extracranial injuries was determined according to the Injury Severity Score (ISS) classification. The outcome of surgical treatment in victims with severe TBI was assessed using the Glasgow Outcome Scale (GOS). Decompressive craniotomy (DC) was performed in 89 elderly patients (35.3%) and 504 young and middle-aged patients (38.6%). Osteoplastic craniotomy (OPC) was performed in 135 of 252 patients in the study group (53.6%) and 652 of 1,305 patients in the control group (50%).

Results and their discussion. Mechanism of injury. Elderly patients were more often injured by falling from standing height - 87 people (34.5%), mainly in the winter-spring period (among young victims, this mechanism of injury was observed in 204 patients, or 15.6%). A relationship between age and the mechanism of TBI was revealed. In young patients, criminal trauma (blow to the head) was most often noted, mainly in the summer - 359 patients (27.5%) (in the main group, such a mechanism was observed in 23 victims, or 9.1%). Road traffic accidents (RTA) were the cause of injury in both groups with the same frequency: in the main group, in 34 (13.5%) victims, in the control group - in 219 (16.8%). In 99 patients (39.3%) of the older age group and in 406 patients (31.1%) of the control group, the mechanism of injury remained unknown. Type of injury. Subdural hemorrhages were significantly more common in elderly patients: acute subdural hematomas (ASDH) - in 91 (36.1%), subacute subdural hematomas (SADH) - in 43 (17.1%). In the group of young patients, ASDH were found in 346 (26.5%), SADH - in 132 (10.1%). Epidural hematomas were significantly less common in elderly victims - in 8 (3.2%) patients in the main group, while in the control group they were found in 213 (16.3%) patients. Multiple intracranial injuries (mTBI) were more common in the main group - in 64 (25.4%) patients, in the control group - in 239 (18.3%) victims. Intracerebral hematomas (ICH) were present in 32 (12.7%) and 140 (10.7%) patients, respectively ($p<0.05$).

Multiple brain injuries (combinations of OSDH and VMG or subdural hematoma and contusion focus) were predominantly diagnosed in the study group - in 55 victims (70.3%), while in the control group - in 162 (50.9%) patients. Hematomas located in both hemispheres of the brain were detected in 9% of patients in the study group and in 5% of young victims. Probably, the noted differences in the structure of intracranial injuries (high frequency of subdural and small number of epidural hematomas) were due to the anatomical and physiological features of the brain and its membranes in elderly patients (calcification of the dura mater, its fusion with the bones of the skull, brain atrophy and a decrease in its volume, as well as changes in the viscoelastic properties of the brain) [8, 12]. Combined injury. Combined TBI was slightly more common in young patients - 290 (22.2%), and in the main group - 43 (17.1%) patients. In elderly victims, combined extracranial injuries were predominantly limb fractures and uncomplicated rib fractures. In the control group, where the main mechanisms of injury were road traffic accidents and criminal trauma, fractures of tubular bones of the skeleton, multiple and complicated rib fractures were more common. The severity of the condition of victims with combined TBI according to the ISS scale in the main group ranged from 29 to 68 points (on average 32 ± 7.3 points), in the control group - from 33 to 86 points (on average - 38.6 ± 8.4 points). In the presence of combined extracranial injuries, the outcomes of surgical treatment among elderly victims were worse than in the control group. Postoperative mortality among patients with combined TBI was 58.1% in the study group and 42.7% in the control group. With a combined injury severity of over 50 points on the ISS scale, postoperative mortality in the study group exceeded 80%, while in the control group it was 60%. Level of wakefulness. Significant differences were noted in the structure of wakefulness disturbances in young and elderly patients. Among hospitalized patients, the level of wakefulness was not impaired (GCS 14 points) in 23.4% of elderly patients and in 21% of young patients. Suppression of the level of wakefulness

to the point of obtundation (GCS 13-14 points) was noted in 33.8% of elderly patients and in 27.5% of young patients. Suppression of the level of wakefulness to the point of coma was registered in 27.4% of elderly patients and in 38.1% of young patients. In the younger group of patients, a strong correlation was found between the degree of preoperative arousal impairment and surgical outcome ($R=0.74$; $p<0.05$). A good or satisfactory outcome was possible only when the degree of arousal was no worse than stupor, corresponding to a GCS score of 13. The median degree of arousal impairment at death was significantly greater, reaching a GCS score of 8. Oculomotor nerve dysfunction.Disturbances of the oculomotor nerve function are one of the most important and frequent clinical symptoms of dislocation syndrome - displacement of the brain into the tentorium cerebelli. Anisocoria with preserved or impaired reactions to light has been noted by many authors as a highly significant prognostic sign of TBI outcome [11,13-15]. Pupil dilation occurs due to compression of the oculomotor nerve by the uncus of the hippocampus, wedging under the tentorium cerebelli. Anisocoria and dysfunction of the oculomotor nerve were equally common in both groups. In the presence of anisocoria, postoperative mortality in elderly patients was 79.7%, in the control group - 66.5%. With impaired photoreactions, postoperative mortality among older patients reached 90%, while in young victims - 75%. Arterial hypotension. A relationship was found between the presence of unstable hemodynamic episodes and the age of the victims. In our study, arterial hypotension (a decrease in systolic blood pressure of less than 100 mm Hg) was observed in 56 (23.6%) patients in the main group of victims and in 218 (16.1%) patients in the control group. Episodes of arterial hypotension were recorded significantly more often in older victims ($p < 0.05$, $R = 0.42$). The age of most patients with arterial hypotension exceeded 50 years. The age factor significantly influenced the outcome of surgical treatment of TBI complicated by the development of arterial hypotension. Mortality among patients with arterial hypotension in the main group was significantly higher than in the control group - 92.1 and 73.5%, respectively. Data of the CT scan of the brain. The prognostic value of such CT data of the brain as the volume of the intracranial lesion of the brain, the magnitude of the transverse dislocation, the degree of compression of the basal cisterns has been noted by many authors [4, 7, 11, 13-15]. In elderly patients, the volume of all types of intracranial hemorrhages was 10-20% higher than the volume of hemorrhages in young patients. Thus, the average volume of acute subdural hematomas in the main group was 100+20 cm3, poDSH - 97.5+10 cm3, EDH - 85±30 cm3, VMG - 60+25 cm3, multiple TBI - 100+25 cm3. In the control group, the average volume of OSDG was 85+25 cm3, poOSDG - 80+20 cm3, EDH - 60+20 cm3, VMG - 45+15 cm3, multiple TBI - 80+25 cm3. The volume of intracranial hematoma, as a factor in unfavorable outcome of surgical treatment, was the same for both groups of patients - the median hematoma volume for a good outcome was 50 cm3, for a lethal outcome - 80 cm3. The displacement of the midline structures with the same hematoma volume was less in patients of the main group. Thus, the displacement of the midline structures with a subdural hematoma volume from 90 to 100 cm3 in elderly patients was 8 mm, while in young patients it was 12 mm. The displacement of the midline structures, according to CT of the brain, was a significant risk factor for the outcome of surgical treatment of patients with TBI.In the group of young patients, we found a significant relationship between surgical outcome and the magnitude of lateral dislocation ($R=0.45$; $p<0.05$). The median for a good outcome was 6 mm, for a satisfactory outcome—7 mm, and for a fatal outcome—12 mm. Among elderly patients, no significant relationship was found between the magnitude of midline structure displacement and outcome. The median for a good and satisfactory outcome was 6 mm, and for a fatal outcome—7 mm. One of the highly significant prognostic factors for surgical outcome in patients with TBI was the degree of basal cistern compression according to CT data. In the group of elderly patients, this factor played a much greater role in the development of an unfavorable outcome than in younger patients. All elderly patients with a severe degree of basal cistern compression died (according to S.B. Vavilov et al., 1986), while among young patients, mortality with this type of compression ranged from 75% with multiple foci of injury to 83.3% with epidural hematomas. It should be noted that in elderly patients, compression of the basal cisterns with multiple hematomas was an extremely unfavorable prognostic factor. Postoperative mortality with a severe degree of cistern compression was 96%, with a severe degree - 97%. In younger patients, mortality was 42 and 68%, respectively. Brain

swelling during surgery was significantly more common in young patients - in 22 (8.3%) patients in the main group and in 210 (16.1%) young victims (Mann-Whitney test, p = 0.008, n = 150). With the development of intraoperative edema, the outcomes of surgical treatment in elderly victims were significantly worse, the postoperative mortality reached 93.5%, in young patients - 74.3% (Mann-Whitney test, p = 0.007, n = 150). Postoperative complications. A significant risk factor for an unfavorable outcome of severe TBI are postoperative complications. The development of pneumonia in victims with severe TBI leads to disruption of the external respiratory function and the occurrence of secondary ischemic brain damage. According to our study, pneumonia developed in 71 (28.2%) elderly and senile victims and in 271 (20.8%) young patients. Infectious complications in the form of meningitis and meningoencephalitis were observed with the same frequency in the main and control groups - 9.1 and 8.1% of patients, respectively. However, the development of infectious complications significantly worsened the prognosis of the outcome of surgical treatment in elderly patients. Postoperative mortality among patients with pneumonia in the study group reached 78%, compared to 61.8% in younger patients. For those developing meningitis, the rates were 73.9% and 55.7%, respectively. Another serious complication with a high risk of death is pulmonary embolism (PE). Risk factors for PE in neurosurgical patients include advanced age, prolonged bed rest, and a history of thromboembolic disease.Pulmonary embolism was the cause of death in 3.2% of patients in the main group and in 0.6% of patients in the control group.

Conclusion. The outcome of surgical treatment in elderly patients with severe TBI is influenced by the following factors: level of consciousness, degree of basal cistern compression, abnormal pupillary responses, intracranial pressure, and arterial hypotension. The predominant mechanism of TBI in elderly patients is a fall from a standing height, most often in the winter and spring. Age 60 years and older is a significant risk factor for an adverse outcome in severe TBI. Subdural hematomas and multiple brain injuries, as well as bilateral hematomas, are most common in elderly patients with severe TBI. Epidural hematomas are rare in elderly patients. ICP is significantly lower in elderly patients, even with large hematomas.

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