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SURGICAL MANAGEMENT AND FUNCTIONAL OUTCOMES OF PARASAGITTAL MENINGIOMAS INVOLVING THE SUPERIOR SAGITTAL SINUS

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Abstract.

Background. Parasagittal meningiomas involving the superior sagittal sinus (SSS) remain one of the most challenging entities in neurosurgical oncology due to complex venous anatomy, high risk of neurological deficits, and significant recurrence rates. To date, no unified surgical standard exists for tumors invading a patent SSS.

Objective. To improve the effectiveness of surgical treatment of patients with parasagittal meningiomas involving the superior sagittal sinus through optimization of surgical tactics and postoperative rehabilitation, with assessment of neurological outcomes and quality of life.

Materials and Methods. Sixty-five patients with parasagittal meningiomas underwent surgical treatment. Neurological status, sensory and motor deficits, epileptic seizures, and quality of life (Karnofsky Performance Scale) were evaluated preoperatively, in the early postoperative period, and during long-term follow-up. Patients were divided into a comparison group treated with conventional surgical techniques and a study group treated using modified surgical approaches.

Results. Postoperative neurological deterioration was transient in both groups; however, statistically significant regression of motor deficits and improvement in quality of life were observed in the study group during long-term follow-up ($p < 0.05$). The Karnofsky index reached 81.34 ± 1.04 points in the study group versus 72.6 ± 1.68 points in the comparison group. Sensory disturbances were more persistent but showed no statistically significant intergroup differences.

Conclusion. Optimization of surgical tactics combined with comprehensive rehabilitation improves functional outcomes and quality of life in patients with parasagittal meningiomas involving the SSS. Histological and immunohistochemical verification remains crucial for accurate diagnosis, prognostication, and the development of targeted therapeutic strategies.

Keywords: parasagittal meningioma, superior sagittal sinus, neurosurgery, neurological outcomes, immunohistochemistry.

ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ И ФУНКЦИОНАЛЬНЫЕ ИСХОДЫ ПАРАСАГИТТАЛЬНЫХ МЕНИНГИОМ С ВОВЛЕЧЕНИЕМ ВЕРХНЕГО САГИТТАЛЬНОГО СИНУСА

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Аннотация.

Введение. Парасагиттальные менингиомы с вовлечением верхнего сагиттального синуса (ВСС) представляют одну из наиболее сложных форм опухолей головного мозга вследствие анатомических особенностей венозного оттока, высокого риска послеоперационного неврологического дефицита и частых рецидивов. Унифицированная хирургическая тактика лечения данной патологии до настоящего времени отсутствует.

Цель исследования. Повышение эффективности хирургического лечения пациентов с парасагиттальными менингиомами, распространяющимися на ВСС, на основе оптимизации хирургической тактики и послеоперационной реабилитации с оценкой неврологических исходов и качества жизни.

Материалы и методы. Обследованы 65 пациентов с парасагиттальными менингиомами. Оценивали очаговую неврологическую симптоматику, двигательные и чувствительные нарушения, эпилептические приступы и качество жизни по шкале Карновского в дооперационном, раннем и отдалённом послеоперационных периодах.

Результаты. В раннем послеоперационном периоде отмечалось транзиторное усиление неврологического дефицита в обеих группах. В отдалённом периоде в основной группе выявлено статистически значимое снижение частоты и выраженности двигательных нарушений и повышение качества жизни ($p < 0,05$).

Заключение. Оптимизированная хирургическая тактика в сочетании с комплексной реабилитацией способствует улучшению функциональных исходов и качества жизни пациентов с парасагиттальными менингиомами ВСС. Морфологическое и иммуногистохимическое исследование является ключевым элементом современной нейроонкологической практики.

Ключевые слова: парасагиттальная менингиома, верхний сагиттальный синус, нейрохирургия, качество жизни, иммуногистохимия.

YUQORI SAGITTAL SINUS ISHTIROKIDAGI PARASAGITTAL MENINGIOMALARNI JARROHLIK DAVOLASH VA FUNKSIONAL NATIJALAR

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Annotatsiya.

Kirish. Yuqori sagittal sinus (YSS) ishtirokidagi parasagittal meningiomalar murakkab venoz anatomiya, yuqori nevrologik asoratlar xavfi va qaytalanish ehtimoli bilan tavsiflanadi. Ushbu patologiyani davolashda yagona jarrohlik standarti mavjud emas.

Tadqiqot maqsadi. Yuqori sagittal sinusni jalb qiluvchi parasagittal meningiomali bemorlarda jarrohlik davolash samaradorligini oshirish, nevrologik natijalar va hayot sifatini baholash.

Materiallar va usullar. 65 nafar parasagittal meningiomali bemor tekshirildi. Operatsiyadan oldin, erta va kechki operatsiyadan keyingi davrlarda nevrologik holat, harakat va sezgi buzilishlari, epileptik tutqanoqlar hamda Karnofskiy shkalasi bo‘yicha hayot sifati baholandi.

Natijalar. Tadqiqot guruhida uzoq muddatli kuzatuvda motor buzilishlarning sezilarli regressiyasi va hayot sifati ko‘rsatkichlarining yaxshilanishi aniqlandi ($p < 0,05$).

Xulosa. Takomillashtirilgan jarrohlik yondashuvlari va kompleks reabilitatsiya parasagittal meningiomali bemorlarda funksional natijalar va hayot sifatini yaxshilaydi. Immunogistokimyoviy tekshiruvlar tashxis va maqsadli terapiya uchun muhim ahamiyatga ega.

Kalit so‘zlar: parasagittal meningioma, yuqori sagittal sinus, neyroxirurgiya, hayot sifati, immunogistokimyo.

Introduction. Meningiomas (M), according to the literature, account for 18-34% of primary brain tumors, second in frequency only to tumors of the neuroectodermal series [3]. The term "parasagittal meningiomas" was proposed by Cushing H. in 1922 to denote tumors located along the superior longitudinal sinus and originating from its walls. They can grow into its lumen, spreading in one or both directions. Parasagittal meningiomas also include M of the falciform process, which secondarily affect the walls of the superior sagittal sinus (SSS), and spread significantly along the dorsolateral surface near the midline. The incidence of parasagittal meningiomas (PSM) ranges from 20.5 to 40.0% of all cerebral M of the cerebral hemispheres [1]. In cases of meningioma with damage to the SCC, a study of the literature data allows us to conclude that there is currently no surgical standard for their treatment. Meningioma located in the middle third of the sinus are the most difficult to remove. This is due to the abundance of afferent veins, the occurrence of a serious neurological deficit associated with the localization of M, and a high risk of relapse [2]. According to the study of Tigliev G.S., Mozhaev S.V. and others, in 28.8-47.5% of

cases, patients experience neurological disorders after surgery, and in 18.6% of the total number, they remain profoundly disabled [5]. Until now, there is no clear surgical strategy for meningioma invasion of the SCC. Significant difficulties lie in the treatment of patients with a patent SCC. At the time of surgery, the surgeon sometimes finds it difficult to decide whether to remove the part of the tumor located in the sinus cavity. There are two surgical strategies for this: maximum safe removal of the tumor outside the sinus and aggressive surgical resection of part of the sinus followed by its reconstruction [4]. Thus, radical surgery for stenosis is possible only in cases of small marginal lesions of the sinus [2]. In all other situations (with rare exceptions), removal will not be radical [5]. Due to the limited capabilities of traditional methods of radical removal of SSM, a higher rate of recurrence and continued growth is observed than with M of any other localization, reaching 50% depending on the observation period [2].

Objective of the study. To improve the efficiency of surgical treatment of patients with diffuse toxic goiter by creating a system that includes modern preoperative preparation, modified/tactics of surgical intervention and correction of postoperative functional disorders.

Materials and methods of the study. To accomplish the set objective, we selected 65 patients with brain meningiomas and examined them.

Results of the study. The dynamics of focal neurological disorders was studied in 65 patients who underwent primary surgery for SSM. Before the operation, the majority of patients in both groups with focal symptoms were patients with SSM localization in the projection of the central gyrus (middle third of the SCC). They had focal motor neurological deficit. Thus, in the group where traditional surgical methods were used, it was diagnosed in 58.2%, and in the study group in 59.1% of people ($p = 1.0$). The performed operation led to a temporary increase in the number of patients with focal symptoms, regardless of the tumor removal technique, but these indicators between the groups were not statistically significant ($p = 0.7068$). Thus, in the comparison group, it increased to 77.6% and to 73.9% in the study group. Against the background of the conducted restorative therapy, in the late period, all patients noted regression of neurological impairments, but statistically better results were obtained in the study group. By this observation period, only 37.5% of people had motor disorders, mainly of mild severity, while in the comparison group they persisted in 55.2% of patients with a predominance of moderate and deep mono- and hemiparesis ($p = 0.0345$). Initially, sensory disorders in both groups did not differ statistically. The performed surgical intervention increased the incidence of these disorders: from 23.88% of cases to 43.28% in the comparison group and from 23.86% to 36.36% in the study group ($p = 0.4101$). Sensory disorders, despite comprehensive rehabilitation therapy, were more persistent and in the late postoperative period occurred in 18.2% of people in the study group and 22.39% of people in the comparison group ($p = 0.5480$). The conducted analysis of the quality of life of operated patients in both groups according to the Karnofsky scale showed that they were initially comparable in this indicator and did not differ statistically. In the study group, it was equal to 62.68 ± 0.62 points, in the comparison group - 61.71 ± 1.03 points. In the early postoperative period, against the background of restorative therapy, regression of neurological deficits occurred in all patients. The most pronounced and statistically significant regression was noted in the study group. Therefore, upon discharge from the hospital, the quality of life index in patients who underwent laser surgery was 70.26 ± 1.11 points. In the comparison group, it was 65.48 ± 1.28 points. In the late postoperative period, as a result of rehabilitation therapy, statistically significant regression of focal neurological symptoms and a decrease in the incidence of epileptic seizures in patients in the study group continued. In this regard, the average quality of life index in them increased to 81.34 ± 1.04 points, while in the comparison group it stabilized at 72.6 ± 1.68 points. Currently, the immunohistochemical method continues to actively develop, having taken a firm place among the diagnostic methods in oncology. Using immunostaining, a pathologist can not only determine the cytogenetic source and grade of tumor malignancy but also detect abnormal proteins—the transcription products of damaged DNA regions—and recommend targeted therapy. Modern neuro-oncology is unthinkable without pathological verification, and a patient's treatment plan is often determined through a comprehensive collaboration between a pathologist and a neurosurgeon. In many international clinics, a neurosurgeon independently examines the histological specimen and can confirm or challenge the

pathologist's conclusion. Histological and immunohistochemical aspects of meningiomas are a priority in studying the mechanisms of pathogenesis of this group of tumors and in the search for targets for targeted therapy, taking into account the synthesis of protein products resulting from molecular genetic damage. Significant progress in this area brings us closer to the time when targeted interventions at the molecular developmental stages of not only meningiomas but also other primary tumors of the central nervous system will significantly increase patient survival. Conclusion: Meningiomas exhibit a wide range of morphological characteristics, which ultimately determine the type and grade of malignancy in this group of brain tumors. Anaplastic meningiomas present particular challenges in their study. This type of tumor shares a number of similarities with soft tissue malignancies (cancer, sarcoma, melanoma), and distinguishing them from each other without immunohistochemistry is impossible. Currently, immunohistochemistry continues to rapidly develop, establishing a strong position among diagnostic methods in oncology. Using immunostaining, a pathologist can not only determine the cytogenetic source and grade of tumor malignancy but also detect abnormal proteins—the transcription products of damaged DNA regions—and recommend targeted therapy. Modern neuro-oncology is unthinkable without pathological verification, and a patient's treatment strategy is often determined through a comprehensive collaboration between a pathologist and a neurosurgeon. In many international clinics, a neurosurgeon independently examines the obtained histological material and can confirm or challenge the pathologist's conclusion. Histological and immunohistochemical aspects of meningiomas are a priority in studying the mechanisms of pathogenesis of this group of tumors and in the search for targets for targeted therapy, taking into account the synthesis of protein products resulting from molecular genetic damage. Significant progress in this area brings us closer to the time when targeted interventions at the molecular developmental stages of not only meningiomas but also other primary tumors of the central nervous system will significantly increase patient survival. Conclusion: Meningiomas exhibit a wide range of morphological characteristics, which ultimately determine the type and grade of malignancy in this group of brain tumors. Anaplastic meningiomas present particular challenges in their study. This type of tumor shares a number of similarities with soft tissue malignancies (cancer, sarcoma, melanoma), and distinguishing them from each other without immunohistochemistry is impossible.Currently, immunohistochemistry continues to rapidly develop, establishing a strong position among diagnostic methods in oncology. Using immunostaining, a pathologist can not only determine the cytogenetic source and grade of tumor malignancy but also detect abnormal proteins—the transcription products of damaged DNA regions—and recommend targeted therapy. Modern neuro-oncology is unthinkable without pathological verification, and a patient's treatment strategy is often determined through a comprehensive collaboration between a pathologist and a neurosurgeon. In many international clinics, a neurosurgeon independently examines the obtained histological material and can confirm or challenge the pathologist's conclusion. Histological and immunohistochemical aspects of meningiomas are a priority in studying the mechanisms of pathogenesis of this group of tumors and in the search for targets for targeted therapy, taking into account the synthesis of protein products resulting from molecular genetic damage. Significant progress in this area brings us closer to the time when targeted interventions at the molecular developmental stages of not only meningiomas but also other primary tumors of the central nervous system will significantly increase patient survival.

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