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GLIAL TUMORS OF THE BRAIN: A REVIEW OF THE LITERATURE AND PROSPECTS FOR TREATMENT

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Abstract. A broad review of literature data on the treatment of glial brain tumors is presented. Along with well-known approaches to surgical treatment, emphasis is placed on the effectiveness of local action on tumor tissue. Particular attention is paid to molecular genetic studies, the study of clinical and morphological features of glioma progression and the role of viruses in the development of the pathological process. The possibilities of therapy for glial tumors at the cellular level are considered.

Key words: glial tumors, neuroimaging, neurosurgical treatment, molecular virological direction.

The main methods of treating glial tumors currently include surgery, radiation therapy and chemotherapy. The goal of the surgical stage is the maximum possible removal of the neoplasm, taking into account the localization and prevalence of the pathological process, while it is extremely important to take into account the need to maintain the quality of life of patients in order to avoid persistent neurological deficit and severe disability. In this regard, the scope of surgical intervention can be complete, partial (with the presence of macroscopically visible residual tumor tissue), can be limited to biopsy (open or stereotactic) in order to obtain material for histological examination, as well as symptomatic operations (reducing the degree of mass effect and dislocation of structures in the cranial cavity, restoring cerebrospinal fluid outflow). It should also be noted that cytoreduction performed during partial removal can facilitate the effect of cytostatics in the future due to disruption of the blood-brain barrier [1, 2]. Thus, the performed operation can be of a therapeutic or diagnostic nature. However, the overall survival rate in patients with primary brain tumors is determined by the extent of microsurgical intervention performed [3, 4]. The choice of further treatment tactics depends on the histological picture of the tumor and the degree of its malignancy.

Removal of glial tumors should be performed in specialized neurosurgical and oncology clinics using high technologies, microsurgical equipment and observing the principles of anatomical and functional accessibility of the neoplasm [5, 6]. The possibilities of surgical removal have significantly expanded due to the improvement of neuroimaging techniques (functional MRI and MR tractography), neuronavigation and neuromonitoring, which help minimize the risks of developing postoperative neurological deficit. Neuronavigation ensures high accuracy when performing stereotactic biopsy, allows you to plan the course of the operation and choose the safest trajectory taking into account the location of the

tumor, the proximity of functionally significant areas and large vessels. To achieve the maximum effect of navigation, the integration of the navigation station and the surgical microscope is used. Neuromonitoring allows you to control the location and safety of the cranial nerves and pathways during surgery. At present, it has also become possible to perform electrophysiological mapping of the cortical regions of functionally significant zones and compare the obtained data with the results of fMRI. Conducting intraoperative mapping during neurosurgical operation requires periodic awakening of the patient to perform special tests, which, in turn, depends on the capabilities of anesthetic support [7, 8].

Since glial tumors are prone to continued growth, which most often occurs at the border of the cytoreduction area, methods of intraoperative local action on the perifocal zone and residual tumor tissue in the case of partial removal are relevant in treatment. Such methods include photodynamic therapy using modern photosensitizers and local chemotherapy with drugs on a biodegradable matrix [9, 10, 11].

An important role in the treatment of glial tumors is given to radiation therapy, which, according to the literature, increases the one-year survival rate of patients with high-grade gliomas by approximately 7% [12, 13]. After the postoperative wound has healed and in the absence of contraindications, patients are referred to a specialized oncological institution to decide on the issue of special treatment, which can be started within 2 to 8 weeks after surgery.

depending on the degree of tumor malignancy [14,15].

The newest and most promising method (requires further study) is boron neutron capture therapy. There are reports of the effectiveness of this type of treatment for oncological diseases, including gliomas, especially with a multifocal nature of the process. The essence of the method is that before irradiation, the patient is administered a boron-10 preparation, which selectively accumulates in tumor cells, and as a result of the reaction with neutrons forms lithium nuclei and alpha particles, selectively destroying cancer cells. Thus, the therapy is carried out at the cellular level [16].

An equally important component of complex treatment for glial tumors is chemotherapy (CT). Depending on the nosological form of the neoplasm, various types (systemic, intrathecal) and modes of CT (before, in combination with, and after radiation therapy) can be used. Determination of approaches to CT is also based on the general condition of the cancer patient, assessed according to the ECOG (Eastern Cooperative Oncology Group) scale from 0 to 4 points and the Karnofsky index (0-100%) [2].

The literature also contains data on the effectiveness of the use of specific antitumor immunotherapy based on autologous dendritic cells and locoregional autologous plasma chemotherapy [17,18].

Advances in modern neurooncology have improved the results of combined and comprehensive treatment of patients with glial tumors, however, despite advances in surgical techniques and radiation therapy, the development and introduction of new chemotherapy drugs, the median survival of this category of patients remains short-lived, and the level of disability also remains high. Mortality in this pathology is 4-7 and 3-5 cases per 100 thousand male and female population, respectively. Overall survival and relapse-free period rates remain low, especially in patients with high-grade gliomas. Thus, five-year survival in anaplastic astrocytomas is about 27%, while in glioblastoma this figure is significantly lower, only 10% [19, 20].

Unfortunately, the possibilities of neurosurgical treatment of glial tumors of the brain are often limited due to the prevalence and deep localization of gliomas, in this regard, much attention is currently paid to the search for new methods, in particular, the study of oncogenesis processes at the molecular and cellular level is of great interest. Thus, the course of the tumor process is significantly influenced by factors that can affect the mechanisms of cell division. Of particular interest is the viral-genetic theory of carcinogenesis, which originated in the 70s of the last century. Today, the ability of viruses to transform cells, thereby causing the formation of tumors, has been proven. In this case, it is necessary to isolate the herpes simplex virus (HSV), which has high neurotropism. Contamination with this virus is detected during histological examination of biopsy material from patients with glial tumors in 90% of cases. It was also found that the amount of anti-apoptotic factor of tumor cells (bcl-2) under the influence of HSV increases in low- and high-grade gliomas by 2 and 3 times, respectively. The duration of the relapse-free period in gliomas has been proven to be reduced against the background of exacerbation of chronic productive inflammation caused by HSV [21,22]. Based on the results of research in this area, a method of antiviral drug therapy of neuroepithelial tumors in combination with metronidazole has been proposed, which made it possible to increase the duration of the relapse-free period by 37% [23, 24].

Research in the field of studying the clinical and morphological mechanisms of glial tumor growth is relevant and promising. It has been proven that the acceleration of endothelial cell proliferation is the trigger mechanism for the progression of highly malignant tumors. This pattern has been confirmed experimentally in the case of the growth of C6 glioma cells [25]. Along with the study of the mitotic activity of tumor cells, innovative data have been obtained in the field of the possibility of regulating their apoptosis. The principles of apoptosis activation and inhibition of the BC1-2 factor can become the basis for the development of new antiviral and, accordingly, antitumor drugs. The development and

Many leading global clinics are currently studying antitumor vaccines [26, 27]. To achieve this goal, it is necessary to use a virus that has the ability to selectively affect tumor cells while remaining harmless to humans. There is evidence in the literature that the Newcastle

disease virus, whose oncolytic properties are currently being actively studied, meets these criteria [28, 29, 30].

Conclusion

Thus, glial tumors are a common pathology in the structure of oncological morbidity, their social and economic significance is due to the high level of disability and mortality of patients, while the number of newly identified cases of the disease increases annually, which is partly facilitated by diagnostic capabilities. Existing and proven methods of treating glial tumors do not provide the desired results. Molecular genetic aspects are becoming increasingly interesting in the development of new methods, and they formed the basis of the modern classification of CNS tumors from 2016. Research in this area requires high costs due to the complexity of the technologies and equipment used, but the development of cellular medicine can open new horizons in the treatment of malignant gliomas.

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