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MORPHOMETRIC ANALYSIS OF SUBTENTORIAL TUMORS

Norkulov Nazhmiddin Uralovich, Aliev Mansur Abdukhalikovich.

Assistant at the Department of Neurosurgery, Samarkand State University.
Head of the Department of Neurosurgery at Samarkand State University.

Introduction. The low incidence of astrocytomas of subtentorial localization in adults is one of the main reasons that the clinical manifestations of these neoplasms are little known [8]. The diagnosis of "cerebellar tumor" is established when the first clinical symptoms appear. The most common symptoms accompanying a cerebellar tumor are ataxia, headache and nausea [8]. Astrocytic tumors of subtentorial localization are clinically and histologically heterogeneous. They can have predominantly expansive (due to the cystic component) and invasive-infiltrative growth. The tendency toward invasive growth is more pronounced in relapses, and the tumor in such cases usually has a higher grade of malignancy. Due to the heterogeneity of the tumor tissue structure, certain difficulties often arise when diagnosing astrocytomas.

The most characteristic feature of glial tumors is their invasive growth, during which their cells penetrate into the surrounding medulla to different depths and form a zone of infiltrative growth. The width of the latter depends on the histobiological properties of the tumor, including the degree of malignancy, topographical and anatomical features of the structures of this zone [10]. Since many researchers compare subtentorial gliomas with telencephalon gliomas, the conventional treatment for malignant cerebellar gliomas involves surgical resection, radiotherapy, and chemotherapy [1,8]. Survival in patients with cerebellar astrocytic gliomas is comparable to that in patients with cerebral gliomas and is 11 months for Grade IV and 32 months for Grade III [1]. Recurrences of astrocytomas of supratentorial localization are most common in the first year after removal [11]. With slow-growing gliomas of subtentorial localization, 20-year survival is noted in 79% of cases [3]. In some cases, the prognosis of the disease depends not only on the structural characteristics of the tumor and, accordingly, the morphologically determined degree of its malignancy, but also on the location, relationship with vital brain structures and the possibility of its radical removal [10]. Thus, pilocytic cerebellar astrocytomas in adults can be macroscopically completely removed during surgery [12]. In these cases, survival was greater. The authors point out that the degree of tumor resection is more prognostically important than the proliferation activity indicator - Ki-67. Work in recent decades has shown that patients with the LGGs (slow-growing gliomas) phenotype have a significantly higher survival rate than patients with HGGs (fast-growing gliomas). However, even LGGs are neoplasms with the potential for malignancy [13], and different growth factors may have different effects on the

potential for malignancy even among Grade I-II gliomas. According to some authors [14], the survival rate in patients with pilocytic astrocytoma decreased with age. The prognostic factor in this study was macroscopic total tumor resection. Patients treated with radiotherapy had shorter survival regardless of the extent of astrocytoma resection. This statement is inconsistent with other studies showing total resection and radiotherapy to be factors that prolong survival [1]. According to the WHO classification, pilocytic astrocytomas have the first degree of malignancy, which implies a benign course of the disease. However, some patients have an aggressive clinical course [15]. This is confirmed by cases of intratumoral hemorrhage in pilocytic astrocytomas, which is more often characteristic of poorly differentiated gliomas [16,17]. With subtentorial localization, astrocytomas affect not only the cerebellum. Brain stem astrocytomas are much less common in adults.With this localization, pilocytic astrocytomas (Grade I) are most often detected (41.4%), diffuse (Grade II) are less common (34.5%), and glioblastomas are extremely rare [18]. Nesmot Research objectives 1. To conduct a retrospective analysis of the treatment of adult patients with astrocytomas of subtentorial localization. 2. To study the clinical picture of astrocytomas of subtentorial localization in adults. 3. Conduct a morphological assessment of astrocytomas of subtentorial localization with low and high degrees of malignancy. 4. Assess data on continued tumor growth and the effect of radiation treatments for astrocytomas of subtentorial localization. Materials and methods A retrospective analysis of the results of treatment of 232 patients with astrocytomas of subtentorial localization of varying degrees of malignancy (Grade I-IV) aged over 18 years, who were treated in the department, was carried out. Part of the patients (n = 40) with partial or subtotal removal of the tumor after surgical treatment received a course of fractionated radiotherapy in the region of the posterior cranial fossa or craniospinal region, two of them, with continued tumor growth, received a second course of fractionated therapy. Therapy was carried out in the radiology departments of regional centers on average 35 (25–115) days after surgery. The average radiation dose was 45 Gy (range 20 to 80 Gy). Overall survival was calculated from the moment of the first operation until the last known day of clinical examination of the patient at the institute's clinic, the relapse-free period was calculated from the moment of operation until the appearance of continued tumor growth or enlargement of the tumor according to the results of neuroimaging examinations. Results and discussion Characteristics of patients. The age of patients is from 18 to 58 years (average age is 30 years). There were 127 women, 105 men (Table 2). The most common symptoms observed upon admission (Table 3): headache (94.4%) and static coordination disorders (88.8%). The average duration of the disease (from the onset of symptoms) was 20.7 months (range 1 to 206 months). The number of patients with 70 points or less on the Karnofsky scale was 16 (7.0%), 80 points – 210 (90.4%), 90 points – 6 (2.6%). Before surgery, patients were examined using brain neuroimaging methods (CT, MRI). Only CT was used in 94 patients, only MRI – in 123, both examination methods – in 15. The tumor had a midline location in 96 (41.4%) patients, lateralization in 136 (58.7%) patients. Hydrocephalus of the cerebral ventricles was detected in 156 (67.2%) patients (71 (30.6%) with midline tumor localization, 85 (36.6%) with lateralization of the tumor). Localization of the tumor.Conduct a morphological assessment of

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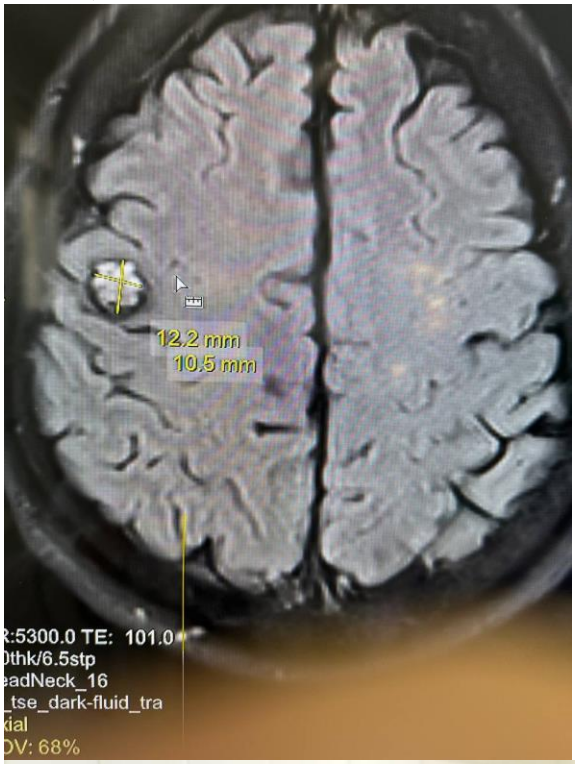

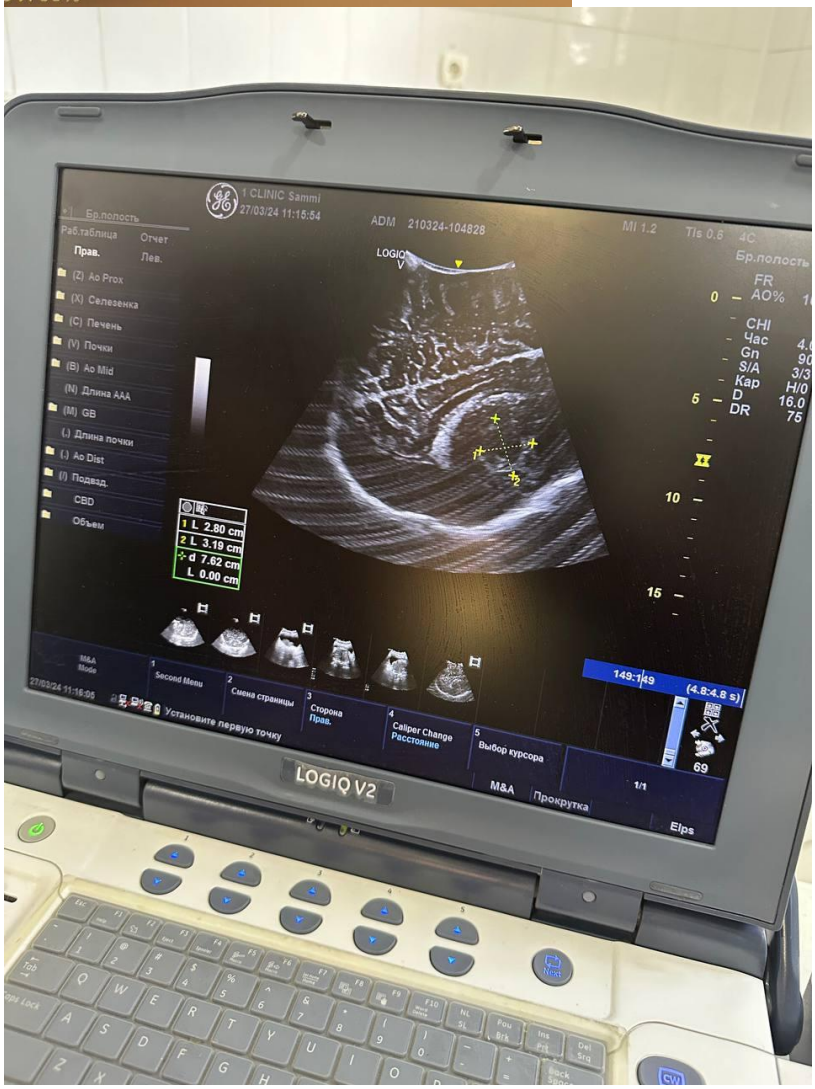

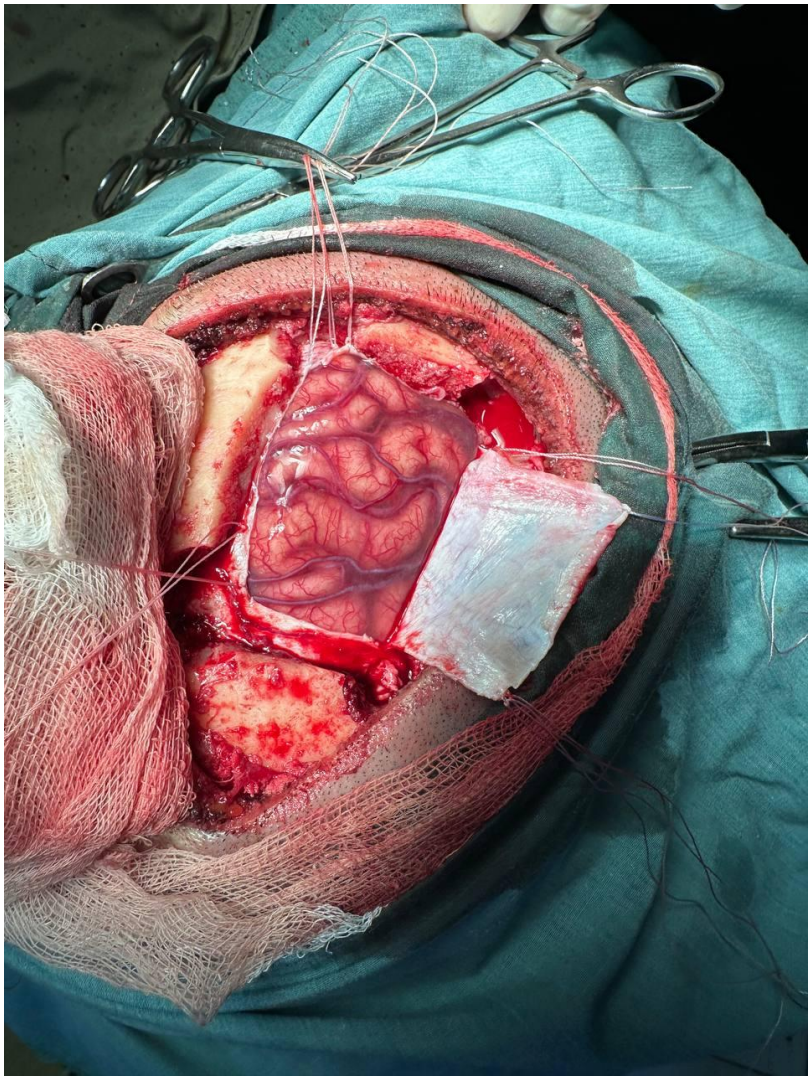

Depending on the predominant localization of the bulk of the tumor proliferation, the distribution of patients was as follows: only in the cerebellar hemisphere - 124 (53.5%), vermis and medial parts of the cerebellar hemispheres - 18 (7.8%), cerebellum with tamponade of the fourth ventricle - 48 (20.7%), growing into the brain stem or emanating from it - 28 (12%), craniospinal localization - 8 (3.4%), with predominant parastem growth into the cerebellopontine angle - 6 (2.6%). Surgical treatment. In 4 (1.7%) patients, ventriculoperitoneal shunting was performed as the first stage of treatment. In 20 (8.6%) cases, the operation was completed with ventriculocisternostomy with partial removal of the tumor. The tumor was removed from a suboccipital approach (depending on the predominant localization of the tumor, a median or mediodiagonal approach was used). The volume of tumor removal depended on many factors and was determined by the surgeon during the operation as the least dangerous for the patient. When determining the extent of removal, surgical marks in the surgical protocols and the results of postoperative CT and MRI were taken into account. Total tumor removal was performed in 97 (41.8%) patients, subtotal - in 51 (22.0%), partial - in 84 (36.2%). Perioperative mortality – 5 (2.2%) cases. A study of postoperative clinical status showed functional improvement in 208 patients, no changes in 12, deterioration in 6. Of 155 patients with subtentorial astrocytomas of Grade I and II, we selected 139 with a known follow-up for subsequent analysis. The duration of follow-up ranged from 6 to 444 months (on average 62.3 months). Of 139 patients, 21 (9.1%) underwent repeated

operations due to continued growth or tumor recurrence, of which 13 (5.6%) were operated twice, 6 (2.6%) three times, 2 (0.9%) %) – 4 times. According to the histostructure, the distribution of tumors was as follows: in 11 cases there was a diffuse astrocytoma (a different combination of fibrillar and protoplasmic components in the tissue architecture), in 1 case it was pilocytic, and in another case it was subependymal. In almost all cases during repeated operations, the histostructure of the tumor did not differ from the primary one. In one case of diffuse astrocytoma, tumor anaplasia was discovered during the third operation. The cystic nature of the tumor was observed in 18 cases (of which total removal was performed in 14, partial removal in 4). In the second group of patients, in which reoperations were not performed (n=118), the duration of the relapse-free period was studied depending on the volume of tumor removal and fractionated radiotherapy. In 58 cases with total removal of astrocytoma, the duration of the relapse-free period ranged from 6 to 144 months (average - 53.72 months), in 23 cases with subtotal removal of the tumor - from 18 to 192 months (average - 74.15 months), in 37 cases with partial tumor removal - from 5 to 204 months (average - 53.70 months). Thus, the average indicators as for total,and with partial removal of astrocytomas were almost the same and only in the group with subtotal removal were significantly higher. In 4 cases with subtotal removal and 11 with partial removal, patients after surgery underwent a course of fractionated radiotherapy in a dose of 45 to 80 Gy. The average duration of the relapse-free period in these patients was 78.0 months for subtotal removal, and 76.5 months for partial removal, that is, the duration of the relapse-free period when using fractionated therapy was higher than in similar groups without it. When comparing the duration of the relapse-free period depending on the histological structure of the tumor (Grade I-II), it was found that in 8 patients with pilocytic astrocytoma and 1 with subependymal astrocytoma it ranged from 12 to 132 months (on average 39.33 months), which is significantly less than in the group of patients with diffuse astrocytomas (on average 78.0 months). Of the 77 patients with anaplastic astrocytomas (Grade III) and glioblastomas (Grade IV), 42 with a known follow-up were selected for subsequent analysis. Due to continued growth or recurrence of the tumor, 15 patients were operated on twice, 6 – three times. The duration of the relapse-free period on average was 50 months for total removal, 56 months for subtotal removal, and 47 months for partial removal. 21 patients received fractionated radiotherapy, of which two with continued growth received 2 courses, one received 3 courses (Table 4). Repeated surgical interventions for continued growth of gliomas were accompanied by a number of difficulties that were not present during primary operations. Difficulties with anatomical orientation arose even at the stage of surgical access to the tumor due to pronounced scar changes in the soft tissues and hypertrophy of the dura mater. Scar-degenerative changes, as a rule, were also found in the brain tissue surrounding the tumor, which was manifested by reactive gliosis, subarachnoid and intracerebral cysts as a consequence of previous surgery and subsequent radiotherapy sessions [21]. Patients who underwent total (perifocal zone) or subtotal tumor removal had a longer duration of remission. This is explained by the provision of effective internal decompression and a large cytoreductive effect (removal of mutant cells resistant to adjuvant therapy) [22]. The possibilities of adjuvant chemotherapy and radiation therapy for recurrent

gliomas are limited. Microscopic examination. Microscopic examination of diffuse astrocytomas (depending on the zonality - different density of damage to the pathways) revealed structures of a predominantly fibrillar or protoplasmic structure. In different areas of the same tumor, the severity of fibrillar structures varied significantly according to tissue histo- and myeloarchitecture: thin, delicate fibrous or coarse tufts. In some cases they were arranged randomly, forming a loose reticulum, in others they formed parallel oriented bundles.In pilocytic astrocytomas, fibrous structures form acellular zones that form fibrous strands. The cells of neoplasms are heterogeneous in the molecular spectrum and demonstrate polymorphism not only in different observations. Conclusions: 1. The clinical picture of astrocytomas of subtentorial localization with varying degrees of malignancy is similar and is represented by cerebral, cerebellar, brainstem symptoms and hypertensive-hydrocephalic syndrome. 2. Cerebellar astrocytomas, regardless of the degree of malignancy, are characterized by a diffuse growth pattern (invasiveness), angiomatosis with significant changes in the vascular walls (fibrosis, hyalinosis with activation and hyperplasia of the endothelium). However, these characteristics of angioproliferation are not a reliable indicator of catplasia in astrocytomas of the cerebellar hemispheres. In the latter, pronounced dystrophic-degenerative changes are often noted with the formation of cystic cavities, the deposition of calcium salts, the presence of shadow cells, axonotomy, clasmatodendrosis and Rosenthal dystrophy of fibers, which is especially characteristic of pilocytic astrocytomas. 3. Continued tumor growth (or relapse) is noted at different times after surgery. It does not depend on the location of the tumor. 4. Conducting fractionated radiotherapy in the postoperative period with partial or subtotal tumor removal (even for Grade I and II) improves the prognosis of a relapse-free course. 5. Postoperative improvement of condition, regression of hypertension syndrome and neurological symptoms make it possible to carry out courses of radiation and chemotherapy after repeated surgery, increasing survival time and ensuring an improvement in the quality of life of patients with recurrent brain gliomas.Conducting fractionated radiotherapy in the postoperative period with partial or subtotal tumor removal (even for Grade I and II) improves the prognosis of a relapse-free course. 5. Postoperative improvement of condition, regression of hypertension syndrome and neurological symptoms make it possible to carry out courses of radiation and chemotherapy after repeated surgery, increasing survival time and ensuring an improvement in the quality of life of patients with recurrent brain gliomas.Conducting fractionated radiotherapy in the postoperative period with partial or subtotal tumor removal (even for Grade I and II) improves the prognosis of a relapse-free course. 5. Postoperative improvement of condition, regression of hypertension syndrome and neurological symptoms make it possible to carry out courses of radiation and chemotherapy after repeated surgery, increasing survival time and ensuring an improvement in the quality of life of patients with recurrent brain gliomas.

References

1. Babu R, Sharma R, Karikari IO, Owens TR, Friedman AH, Adamson C. Outcome and prognostic factors in adult cerebellar glioblastoma. J Clin Neurosci. 2013 Aug; 20(8):1117-21. doi: 10.1016/j.jocn.2012.12.006. PubMed PMID:23706183.

2. Louis DN, Perry A, Reifenberger G, von Deimling A, FigarellaBranger D,

Cavenee WK, Ohgaki H, Wiestler OD, Kleihues P, Ellison DW. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathol. 2016 Jun;131(6):803-20. doi: 10.1007/s00401-016-1545-1. PubMed PMID: 27157931.
3. Okamoto Y, Di Patre PL, Burkhard C, Horstmann S, Jourde B, Fahey M, Schüler D, Probst-Hensch NM, Yasargil MG, Yonekawa Y, Lütolf UM, Kleihues P, Ohgaki H. Population-based study on incidence , survival rates, and genetic alterations of lowgrade diffuse astrocytomas and oligodendrogliomas. Acta Neuropathol. 2004;108(1):49-56.. doi: 10.1007/s00401-004-0861-z. PubMed PMID:15118874
4. Kuroiwa T, Numaguchi Y, Rothman MI, Zoar ski GH, Morikawa M, Zagardo MT, Krist DA. Posterior fossa glioblastoma multiforme: MR findings. AJNR Am J Neuroradiol. 1995;16(3):583-9. PubMed PMID:7793385.
5. Matsumoto H, Yoshida Y. De novo cerebellar malignant glioma: A case report. Int J Surg Case Rep. 2016;22:28-31. doi: 10.1016/j.ijscr.2016.03.020. PubMed PMID: 27017277; PubMed Central PMCID: PMC4844666.
6. Nikiforov BM, Matsko DE. Special opukholey golovnogo mozga u detey. Neurokhirurgiya i nevrologiya detskogo vozrasta. Pediatric Neurosurgery and Neurology. 2002;(1). 21-7. Russian.
7. Viano JC, Herrera EJ, Suarez JC. Cerebellar astrocytomas: a 24-year experience. Childs Nerve Syst. 2001;17(10):607-10. doi: 10.1007/s003810100479. PubMed PMID:11685523.
8. Strauss I, Jonas-Kimchi T, Bokstein F, Blumenthal D, Roth J, Sitt R, Wilson J, Ram Z. Gliomas of the posterior fossa in adults. J Neurooncol. 2013 Dec;115(3):401-9. doi:10.1007/s11060-013-1231-2. PubMed PMID: 23979683. 9. Ulitin AIu, Oliushin VE, Poliakov IV. [Epidemiology of primary brain tumors in Saint Petersburg]. Zh Vopr Neirokhir Im NN Burdenko. 2005 Jan-Mar;(1):6-11; discussion 11-2. Russian. PubMed PMID: 15912862.
10. Khominskiy BS, Sham ayev MI, Rasheyeva IG. Patologicheskaya i topograficheskaya kharakteristika gliom mediannykh i paramediannykh otdelov bol'shogo mozga. Problemy neurosurgery. 1970;3:14-27. Russian.
11. Collins VP. Brain tumors: classification and genes. J Neurol Neurosurg Psychiatry. 2004 Jun;75 Suppl 2:ii2-11. doi: 10.1136/jnnp.2004.040337. PubMed PMID: 15146033; PubMed Central PMCID: PMC1765661.
12. Wade A, Hayhurst C, Amato-Watkins A, Lammie A, Leach P. Cerebellar pilocytic astrocytoma in adults: a management paradigm for a rare tumor. Acta Neurochir (Wien). 2013 Aug;155(8):1431-5. doi:10.1007/s00701-013-1790-1. PubMed PMID: 23793962.
13. Bagley JH, Babu R, Friedman AH, Adamson C. Improved survival in the largest national cohort of adults with cerebellar versus supratentorial low-grade astrocytomas. Neurosurg Focus. 2013;34(2):E7. doi:10.3171/2012.12.FOCUS12343. PubMed PMID:23373452.
14. Johnson DR, Brown PD, Galanis E, Hammack JE. Pilocytic astrocytoma survival in adults: analysis of the Surveillance, Epidemiology, and End Results Program of the National Cancer Institute. J Neurooncol. 2012 May;108(1):187-93. doi:10.1007/s11060-012-0829-0. PubMed PMID: 22367412.