Low-grade astrocytoma

- Pediatric-type diffuse low-grade gliomas with MYB alterations: Neuroimaging of the Diffuse astrocytomas, MYB or MYBL1-altered
- Shared decision-making interventions in neuro-oncology practice: a systematic review
- Multi-omics dissection of MAPK-driven senescence unveils therapeutic vulnerabilities in KIAA1549::BRAF-fusion pediatric low-grade glioma models
- Clinical outcome and deep learning imaging characteristics of patients treated by radio-chemotherapy for a "molecular" glioblastoma
- N-Glycosylation as a Key Requirement for the Positive Interaction of Integrin and uPAR in Glioblastoma
- Low-Grade Glioma in the Differential Diagnosis of Limbic Encephalitis
- Methionine PET Findings in the Diagnosis of Brain Tumors and Non-Tumorous Mass Lesions: A Single-Center Report on 426 Cases
- Challenges in implementing 2021 WHO CNS tumor classification in a resource-limited setting

Low-grade astrocytomas are slow-growing and rarely spread to other parts of the brain and spinal cord or other parts of the body.

Clasification

There are many types of low-grade astrocytomas. Low-grade astrocytomas can be either:

WHO Grade 1 astrocytoma

WHO Grade 2 astrocytoma

Low-grade astrocytomas are a subset of gliomas that originate from astrocytes. They are classified as **WHO Grade 1 or 2**, indicating slower growth and better prognosis compared to higher-grade astrocytomas.

WHO Classification

WHO Grade 1 Astrocytomas (Circumscribed Gliomas)

- **Pilocytic astrocytoma (PA)**
  - Common in children and young adults
  - Typically occurs in the cerebellum, hypothalamus, or optic pathway
  - Associated with **BRAF-KIAA1549 fusion**
  - Well-circumscribed, often cystic with a mural nodule
- **Subependymal giant cell astrocytoma (SEGA)**
  - Associated with **tuberous sclerosis complex (TSC1/TSC2 mutations)**
  - Typically arises near the foramen of Monro
  - Can cause obstructive hydrocephalus

- **Pleomorphic xanthoastrocytoma (PXA)**
  - Often in the temporal lobe, associated with seizures
  - **BRAF V600E mutation**
- **Angiocentric glioma**
  - Rare, slow-growing tumor associated with epilepsy
  - Shows perivascular growth pattern

WHO Grade 2 Astrocytomas (Diffuse Gliomas)

- **Diffuse astrocytoma, IDH-mutant**
  - **IDH1 or IDH2 mutation** present
  - Lacks 1p/19q co-deletion
  - Infiltrative, commonly in the cerebral hemispheres
- **Diffuse astrocytoma, IDH-wildtype**
  - Worse prognosis compared to IDH-mutant forms
  - May represent an early stage of glioblastoma

Molecular Classification & Diagnostic Markers

Marker	Significance
IDH1/IDH2 mutation	Present in diffuse astrocytoma, WHO grade 2; confers better prognosis
ATRX loss	Suggests astrocytic lineage; seen in IDH-mutant astrocytomas
TP53 mutation	Common in IDH-mutant astrocytomas
BRAF fusion (KIAA1549-BRAF)	Seen in pilocytic astrocytoma
BRAF V600E mutation	Found in PXA and some diffuse gliomas
1p/19q co-deletion	Suggests oligodendroglioma rather than astrocytoma
MGMT promoter methylation	Predicts response to temozolomide therapy

Differential diagnosis

In a study, Geramizadeh et al. tried to evaluate IDH1 mutation and P53 mutation by immunohistochemistry as a simple and highly specific, and sensitive method to differentiate low-grade astrocytoma and reactive gliosis.

For 5 years (2013-2018), 50 cases of clinically documented reactive gliosis and 50 cases of low-grade astrocytoma were evaluated for the presence or absence of IDH1 and P53 mutation by immunohistochemistry.

Isocitrate dehydrogenase 1 was positive in 92% and 4% of the astrocytoma and reactive gliosis cases and P53 was positive in 90% and 4% of the cases with the final diagnosis of astrocytoma and reactive gliosis, respectively.

The combination of P53 and IDH1 as an immunohistochemical panel showed a specificity of 96% and sensitivity of 91% for differential diagnosis of reactive gliosis and low-grade astrocytoma. These 2 markers can be extremely helpful for this differential diagnosis [1)].

mIDH1R132H is a tumor-specific marker that is superior to other established markers to differentiate reactive from neoplastic cells in grade II and III gliomas and allows identifying tumor cells in posttherapy specimens with extensive reactive changes. As IDH mutations are not characteristic of grade IV primary glioblastomas, this antibody cannot differentiate primary glioblastoma from reactive gliosis. Thus, caution has to be taken and a combined panel with other markers is needed [2].

Case series

Laws et al., conducted a retrospective review of surgically treated, histologically proven cases of low-grade (Grade 1 or 2) astrocytomas. Follow-up analysis, with survival time as the end-point, was completed using multivariant statistical analysis. In the 461 cases of supratentorial low grade astrocytoma in this study, age of the patient at the time of surgery was by far the most important variable in predicting length of survival. Other variables correlating with increasing survival times were: gross total surgical removal, lack of major preoperative neurological deficit, long duration of symptoms prior to surgery, seizures as a presenting symptom, lack of major postoperative neurological deficit, and surgery performed in recent decades. The multi-variant regression analysis showed that radiation therapy was of clear benefit, primarily in older patients with incompletely removed tumors. For purposes of establishing prognosis and testing the results, a “score” was developed to predict survival times, based on the most important variables. The data in this study provide a basis for the analysis of future modes of management of low-grade gliomas [3].

1)
Geramizadeh B, Kohandel-Shirazi M, Soltani A. A Simple Panel of IDH1 and P53 in Differential Diagnosis Between Low-Grade Astrocytoma and Reactive Gliosis. Clin Pathol. 2021 Feb 11;14:2632010×20986168. doi: 10.1177/2632010×20986168. PMID: 33634261; PMCID: PMC7887675.
2)
Capper D, Sahm F, Hartmann C, Meyermann R, von Deimling A, Schittenhelm J. Application of mutant IDH1 antibody to differentiate diffuse glioma from nonneoplastic central nervous system lesions and therapy-induced changes. Am J Surg Pathol. 2010 Aug;34(8):1199-204. doi: 10.1097/PAS.0b013e3181e7740d. PMID: 20661018.
3)
Laws ER Jr, Taylor WF, Clifton MB, Okazaki H. Neurosurgical management of low-grade astrocytoma of the cerebral hemispheres. J Neurosurg. 1984 Oct;61(4):665-73. PubMed PMID: 6470776.