Astrocytoma

- Optimizing GBM organoid construction with hydrogel-based models: GelMA-HAMA scaffold supports GBM organoids with clonal growth for drug screening
- Ultrasound-Mediated Drug Diffusion, Uptake, and Cytotoxicity in a Glioblastoma 3D Tumour Sphere Model
- O⁶-Methylguanine-DNA Methyltransferase (MGMT) Promoter Methylation Analysis in Glioblastoma Patients
- Profiling Glioma Stem Cell Dynamics via 3D-Based Cell Cycle Reporter Assays
- Patient-Derived Glioblastoma Explants Empower Rapid and Personalized Drug Assessment: Harnessing the Potential of 3D Perfusion Bioreactors in Glioblastoma Drug Discovery
- A Toolkit for Single-Nucleus Characterization of Glioblastoma
- Modeling Glioma Stem Cell-Mediated Tumorigenesis Using Zebrafish Patient-Derived Xenograft Systems
- An In Vivo Model of Recurrent Glioblastoma

Roughly 50% of Adult-type diffuse gliomas harbor isocitrate dehydrogenase mutations. According to the 2021 WHO classification guideline, these gliomas are diagnosed as astrocytomas

This classification introduces substantial changes, especially within the glial tumor category, and separates adult-type and pediatric-type glial tumors into different categories for the first time. In addition, another category of glial tumors, “Circumscribed Astrocytic Gliomas” was also created. This group includes pilocytic astrocytoma, pleomorphic xanthoastrocytoma, subependymal giant cell astrocytoma, chordoid glioma, astroblastoma, and the highly nebulous novel entity high-grade astrocytoma with piloid features [1].

Classification

Astrocytoma IDH-mutant

Diffuse astrocytoma MYB or MYBL1 altered

Circumscribed astrocytic gliomas

Pilocytic astrocytoma

High-grade astrocytoma with piloid features

Pleomorphic xanthoastrocytoma

Subependymal giant cell astrocytoma

Desmoplastic infantile ganglioglioma / desmoplastic infantile astrocytoma

OLD

see also Cerebellar astrocytoma

Diffuse astrocytic tumor and oligodendroglial tumor

see Diffuse astrocytic tumor and oligodendroglial tumor.

Other astrocytic tumors

see Other astrocytic tumors.

Old classification

see Diffuse astrocytoma

see Pilocytic astrocytoma 9421/11

see Pilomyxoid astrocytoma 9425/3*

see Subependymal giant cell astrocytoma 9384/1

see Pleomorphic xanthoastrocytoma 9424/3

see Fibrillary astrocytoma 9420/3

see Gemistocytic astrocytoma 9411/3

see Protoplasmic astrocytoma 9410/3

see Anaplastic astrocytoma 9401/3

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see Low-grade Astrocytoma.

Pathogenesis

These tumors are characterized by a significant heterogeneity in terms of cytopathological, transcriptional and (epi)genomic features. This heterogeneity has made these cancers one of the most challenging types of cancers to study and treat. To uncover these complexities and to have better understanding of the disease initiation and progression, identification and characterization of underlying cellular and molecular pathways related to (epi)genetics of astrocytic gliomas is crucial [2)].

Differential diagnosis

Oligodendroglioma, and glioblastoma.

Glioma is the most common primary brain tumor in adults. The diagnosis and grading of different pathological subtypes of glioma are essential in treatment planning and prognosis.

To propose a deep learning-based approach for the automated classification of glioma histopathology images. Two classification methods, the ensemble method based on 2 binary classifiers and the multiclass method using a single multiclass classifier, were implemented to classify glioma images into astrocytoma, oligodendroglioma, and glioblastoma, according to the 5th edition of the World Health Organization classification of central nervous system tumors, published in 2021.

Jose L et al. tested 2 different deep neural network architectures (VGG19 and ResNet50) and extensively validated the proposed approach based on The Cancer Genome Atlas data set (n = 700). We also studied the effects of stain normalization and data augmentation on the glioma classification task.

With the binary classifiers, the model could distinguish astrocytoma and oligodendroglioma (combined) from glioblastoma with an accuracy of 0.917 (area under the curve [AUC] = 0.976) and astrocytoma from oligodendroglioma (accuracy = 0.821, AUC score = 0.865). The multiclass method (accuracy = 0.861, AUC score = 0.961) outperformed the ensemble method (accuracy = 0.847, AUC = 0.933) with the best performance displayed by the ResNet50 architecture.

With the high performance of the model (>80%), the proposed method can assist pathologists and physicians to support examination and differential diagnosis of glioma histopathology images, with the aim to expedite personalized medical care [3)]

1)
Köy Y, Tihan T. Circumscribed astrocytic gliomas: Contribution of molecular analyses to histopathology diagnosis in the WHO CNS5 classification. Indian J Pathol Microbiol. 2022 May;65(Supplement):S33-S41. doi: 10.4103/ijpm.ijpm_1019_21. PMID: 35562132.
2)
Khani P, Nasri F, Khani Chamani F, Saeidi F, Sadri Nahand J, Tabibkhooei A, Mirzaei H. Genetic and epigenetic contribution to astrocytic gliomas pathogenesis. J Neurochem. 2018 Oct 22. doi: 10.1111/jnc.14616. [Epub ahead of print] Review. PubMed PMID: 30347482.
3)
Jose L, Liu S, Russo C, Cong C, Song Y, Rodriguez M, Di Ieva A. Artificial Intelligence-Assisted Classification of Gliomas Using Whole-Slide Images. Arch Pathol Lab Med. 2022 Nov 29. doi: 10.5858/arpa.2021-0518-OA. Epub ahead of print. PMID: 36445697.