Molecular Markers in Gliomas: A Practical Review and Algorithm Proposal

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Background

CNS tumors are among the top ten global causes of death, with gliomas comprising 26.3% of all CNS tumors and 80% of malignant brain tumors. Glioblastoma, the most common and aggressive primary brain tumor, accounts for 14.2% of CNS tumors, with an incidence of 3.27 per 100,000 individuals. While most gliomas occur sporadically, familial syndromes such as Turcot, Li-Fraumeni, neurofibromatosis, and others are linked to gliomagenesis. Survival rates vary widely, with WHO grade 1 gliomas having a survival rate over 90% at 10 years, while grade 4 gliomas have a survival rate of less than 5%.

The classification of CNS tumors has undergone significant transformation, culminating in the recent WHO CNS5 edition. This latest classification integrates cutting-edge histological and molecular techniques, offering a deeper understanding of tumor biology and enabling more accurate diagnoses. By incorporating molecular profiling and genomic analysis, the CNS5 classification surpasses traditional methods, providing a robust framework for tailoring therapeutic strategies

Figure 1. Diagnostic algorithm for the integrated classification of adult-type diffuse gliomas
The presence and absence of the most relevant diagnostic mutations are presented in green (non-altered) and red (altered) boxes.

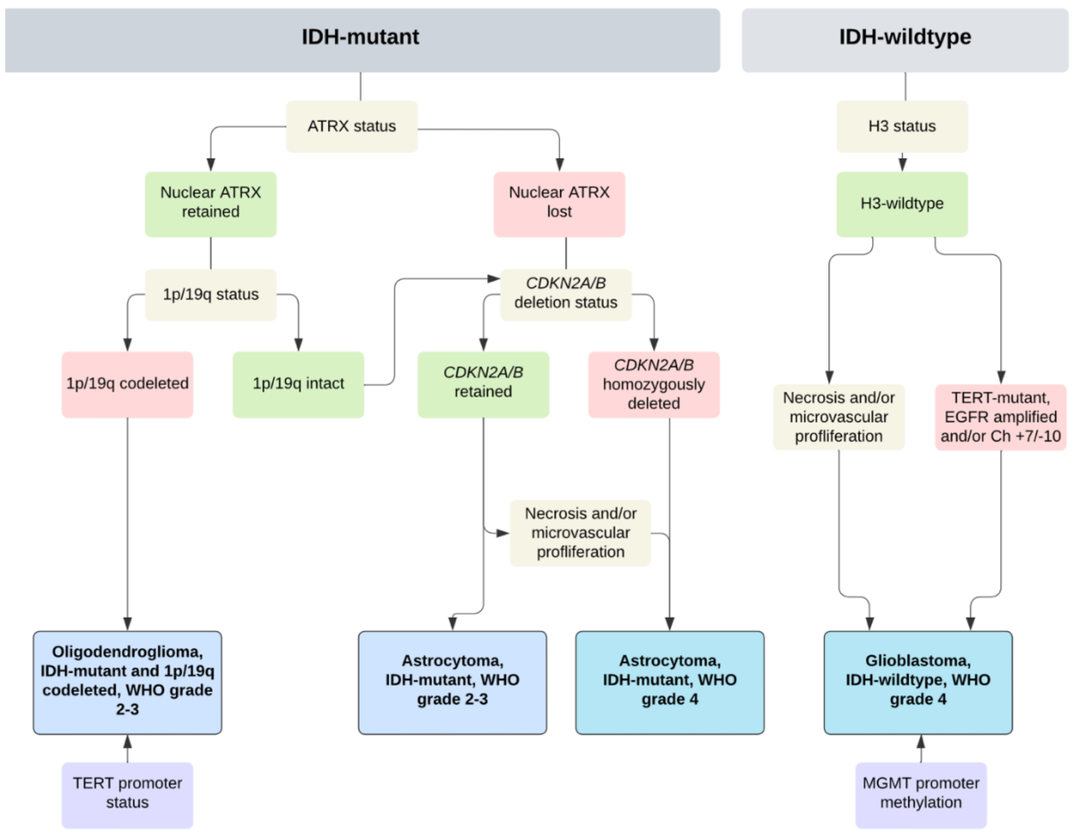


Figure 2. Diagnostic algorithm for the integrated classification of pediatric high-grade diffuse gliomas
Age and location should be considered. H3: Histone-3, IDH: isocitrate dehydrogenase, * These types of tumors do not have an established CNS WHO grade yet.

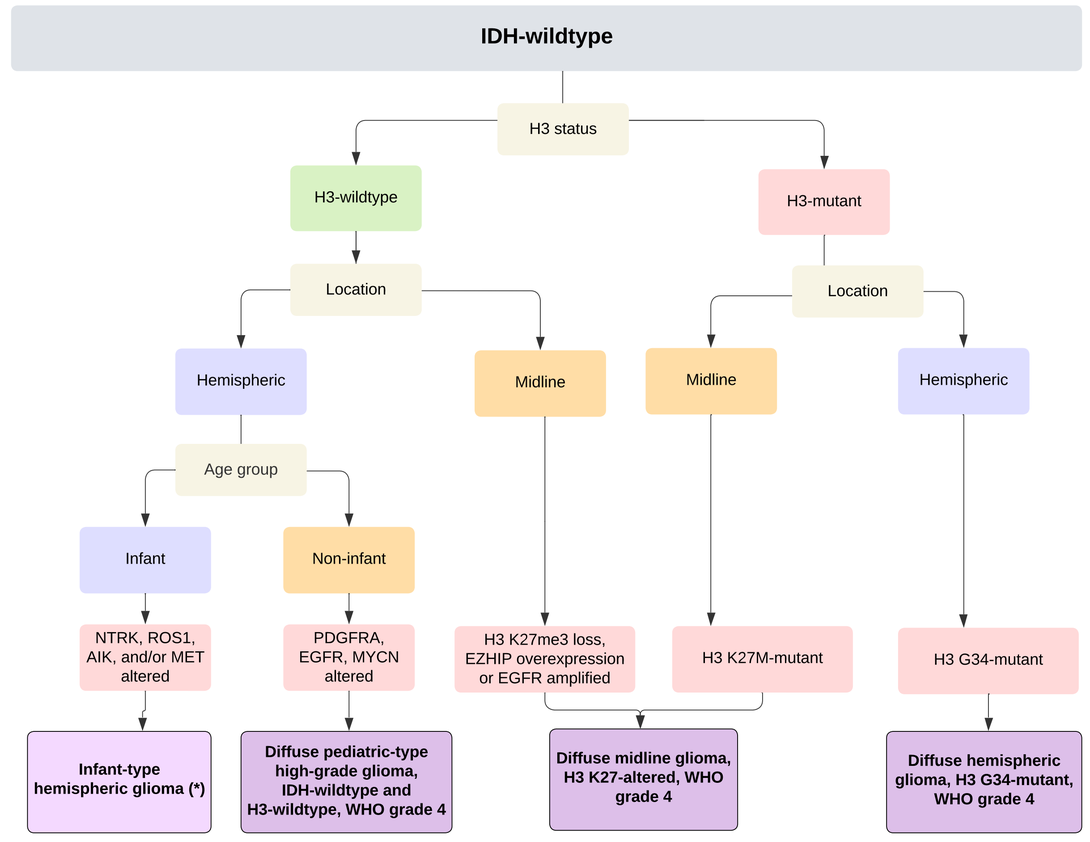
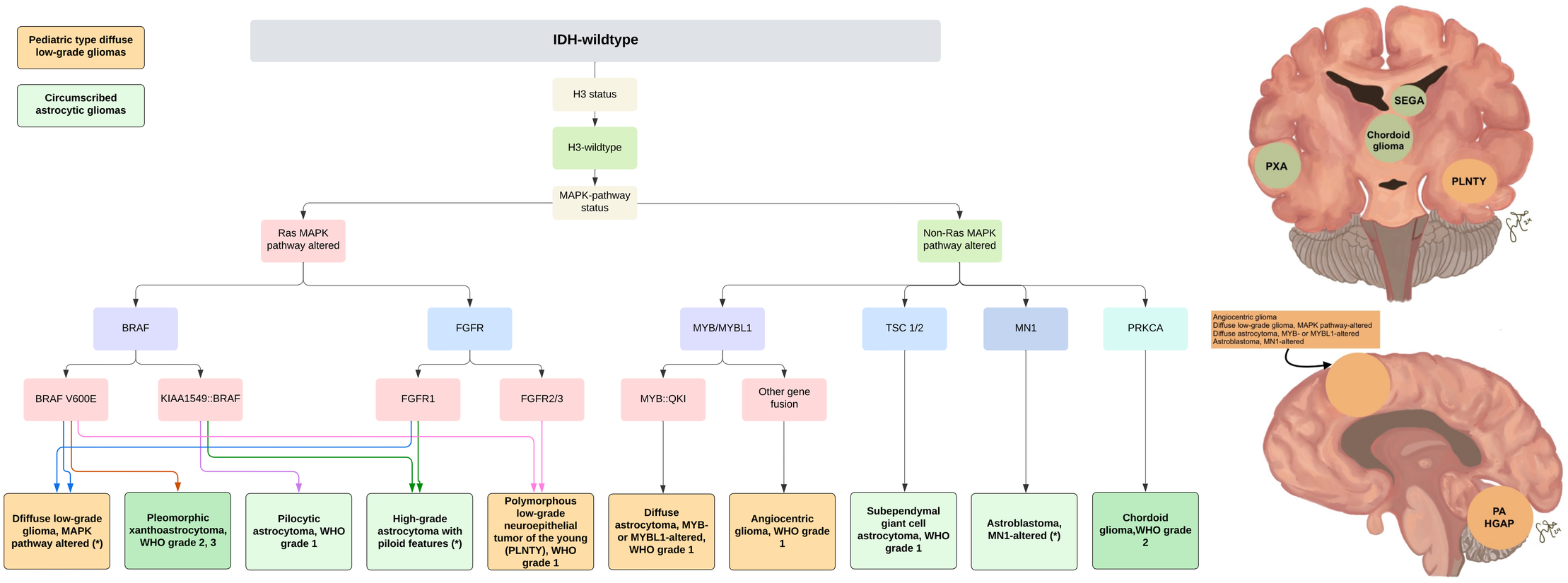


Figure 3. Frequent locations and diagnostic algorithm for the integrated classification of pediatric low-grade diffuse gliomas and circumscribed astrocytic gliomas
Pediatric type low-grade diffuse gliomas are shown in the orange boxes and circumscribed astrocytic gliomas are depicted in the green boxes. Some of the gliomas with MAPK-pathway alterations present more than one characteristic mutation, the color of the arrows indicates the most frequent mutations presented in each glioma type. H3: Histone-3, IDH: isocitrate dehydrogenase, MAPK: ras-mitogen activated protein kinase, FGRF: Fibroblast growth factor receptor, * These types of tumors do not have an established CNS WHO grade yet.



Conclusions

Molecular markers have revolutionized glioma diagnosis, offering unprecedented insights into tumor classification, prognosis, and treatment response. This allows to tailor personalized treatment strategies, improving patient outcomes and quality of life. However, as we continue to uncover the complexities of glioma biology, it becomes evident that a multidisciplinary approach integrating molecular diagnostics with clinical and radiological observations is crucial for accurate diagnosis and effective management. Moving forward, ongoing research efforts should focus on the standardization of molecular markers.

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Access QR code for: complete references list, tables and figures.

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