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Pediatric High-Grade Astrocytoma With Piloid Features: A Comprehensive Literature Review

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Abstract

Background: High-grade astrocytoma with piloid features (HGAP) is a recently defined central nervous system (CNS) tumor, first introduced into the 2021 World Health Organization (WHO) classification. While predominantly observed in adults, pediatric cases remain rare and poorly characterized. This study aimed to review the epidemiology, clinical features, and molecular profile of pediatric HGAP.

Methods: A comprehensive review of studies published from 2018 to 2025 was performed to identify methylation-confirmed HGAP cases in patients aged 18 years or younger. Data extracted from studies included subject demographics, tumor location, histological features, molecular alterations, and the implemented treatment sequence.

Results: The search identified 17 pediatric cases meeting the inclusion criteria. The median age at diagnosis was 15 years (range: 4-18 years), and a male predilection of approximately twofold was observed. Tumors most commonly arose in the posterior fossa (56.3%). Recurrent molecular alterations included CDKN2A/B loss (75%), FGFR1 mutations or fusions (55.6%), and ATRX loss (45.5%).

Conclusion: This review did not identify definitive clinical or histomolecular differences between pediatric and adult HGAP, underscoring the need for further comparative studies. Pediatric HGAP may represent an underrecognized diagnostic entity within the glioma spectrum, emphasizing the critical role of methylation profiling for accurate diagnosis and classification. Retrospective reclassification of histologically and molecularly ambiguous gliomas is warranted and may reveal additional cases. Larger pediatric cohorts are urgently needed to inform clinical management and refine prognostic stratification.

Keywords: DNA methylation; MAPK pathway alteration; anaplastic astrocytoma; epigenetic tumor classification; high-grade astrocytoma with piloid features; pediatric glioma.