Pediatric diffuse low-grade glioma with oligodendroglioma-like features: A case report

PENGWEI HOU[1], CHENGZHU CAI[1], MEIYAN LIU[2], XIELI GUO[1] and MINGFA CAI[1]

[1]Department of Neurosurgery, Shanghai Sixth People's Hospital Fujian, Jinjiang, Fujian 362200, P.R. China;
[2]Intensive Care Unit, Mengchao Hepatobiliary Hospital of Fujian Medical University, Fuzhou, Fujian 350025, P.R. China

Received February 4, 2025; Accepted August 13, 2025

DOI: 10.3892/etm.2025.12985

Abstract. The present case report presents the diagnostic challenges of pediatric diffuse low-grade glioma (pDLGG) with oligodendroglioma-like features. The patient, an 11-year-old girl, presented with refractory epilepsy and brain imaging did not provide a clear diagnosis. Intraoperatively, the tumor appeared gray-yellow to gray-red, with moderate texture and unclear borders, consistent with LGG. Postoperative pathology showed diffuse infiltrative growth of the tumor, with pleomorphic cell morphology and oligodendroglioma-like gliocyte proliferation. Staining was positive for markers such as glial fibrillary acidic protein and Olig-2. Genomic analysis revealed BRAF V600E, fibroblast growth factor receptor (FGFR)1 and FGFR4 mutations, but no IDH mutations or other related mutations. The final diagnosis was pDLGG with alterations in the MAPK pathway. The present case underscores the importance of molecular and histological features in the diagnosis of pDLGG, especially when clinical and imaging characteristics are atypical, as molecular diagnostics provide key insights for disease classification.

Introduction

Diffuse gliomas are a type of neuroepithelial tumor characterized by astrocytic or oligodendrocytic morphology and diffuse infiltrative growth patterns (1). Although rare in children compared with adults (6 per 100,000 vs. 29 per 100,000, respectively), they represent the most common solid tumors in pediatric patients globally (1). The World Health Organization (WHO) guidelines for the 'Classification of Tumors of the Central Nervous System (CNS)' introduced molecular and histological/phenotypic information for the first time in 2016 (2). However, with advancements in molecular research, notable differences between adult and pediatric diffuse glioma have been identified in their pathogenesis, development, molecular variations and epigenetics (3). Consequently, the 2016 WHO CNS classification has limitations.

In response, the 2021 fifth edition of the WHO CNS tumor classification guidelines (4) incorporated molecular and histopathological criteria with distinct guidelines that could categorize and diagnose diffuse glioma into adult and pediatric types. Despite histopathological similarities, these types exhibit distinct genetic and molecular profiles, treatments and prognoses (4). The fifth edition further subdivided pediatric diffuse low-grade glioma (pDLGG) into four categories: i) Diffuse astrocytoma, MYB- or MYBL1-altered; ii) angiocentric glioma (AG); iii) polymorphous low-grade neuroepithelial tumor of the young (PLNTY) and iv) DLGG, MAPK pathway-altered. Accurate tumor classification is crucial for guiding precise treatment, assessing clinical prognosis and developing new therapies.

LGG is the most common pediatric brain tumor; however, DLGG with infiltrative margins is relatively rare, accounting for only 8% of cases (5). Genetic alterations such as BRAF p.V600E mutations, fibroblast growth factor receptor (FGFR) modifications, and MYB or MYBL1 rearrangements are common in pDLGG (6,7). Diagnostic classification becomes challenging when there is an overlap of histopathological and genetic features, especially in tumors without characteristic histopathological or radiological findings. Differential diagnosis is particularly difficult with pilocytic astrocytoma (PA), the glial component of ganglioglioma, pleomorphic xanthoastrocytoma (PXA) and dysembryoplastic neuroepithelial tumor (DNT).

The current study presents a case of pDLGG with oligodendrocyte-like components that was challenging to diagnose. This case emphasizes the importance of integrating clinical, histopathological and molecular features for guiding the management of pediatric diffuse gliomas.

Case report

Patient details. The patient was an 11-year-old girl who was diagnosed with generalized epilepsy at 1-year-old. The patient presented to the Shanghai Sixth People's Hospital (Jinjiang, China) in July 2024 for evaluation and treatment due to

Correspondence to: Dr Mingfa Cai, Department of Neurosurgery, Shanghai Sixth People's Hospital Fujian, 16 Luoshan Section, Jin Guang Road, Jinjiang, Fujian 362200, P.R. China
E-mail: caimingfa0412@163.com

Key words: diffuse low-grade glioma, pediatric brain tumors, MAPK pathway-altered, pathology, long-term epilepsy-associated tumors

symptoms of intracranial hypertension, including headache and vomiting. The patient presented to Jinjiang Municipal Hospital for further treatment in August 2024. Despite long-term use of antiepileptic drugs, the patient experienced 4-5 seizures per month. The patient had no history of brain trauma, central nervous system infection or cerebrovascular disease, and no family history, and the neurological examination did not reveal any abnormalities.

Cranial MRI (Fig. 1) revealed a large lesion (6.9x9.6x6.4 cm) in the left temporo-parieto-occipital region, predominantly in the parietal lobe. The lesion exhibited low T1-weighted imaging and high T2-weighted imaging signals, with fluid-attenuated inversion recovery showing hyperintensity and diffusion-weighted imaging showing predominantly hypointense signals. Peripheral enhancement was observed, along with marked compression of sulci and ventricles. Cranial CT showed resorptive bone loss in the left parietal bone without calcification (Fig. 1). Due to the mass effect of the lesion, ventricular compression and midline shift to the right, the patient developed consciousness disturbances and coma (Glasgow coma scale, E1V1M4=6) 2 days after admission (8). Symptoms of brain herniation, including anisocoria and absent light reflex in the left pupil, were noted.

Emergency surgery and intraoperative findings. Intraoperatively, the central portion of the craniotomy window appeared outwardly protruded and thinned due to tumor compression, with multiple areas of bone destruction (Fig. 2A). The tumor protruded onto the cortical surface with the dura mater intact (Fig. 2B and C), the surrounding cortical gyri were swollen and the sulci were shallow. The tumor was resected in segments and appeared grayish yellow and grayish red, with a moderately soft and fibrous consistency (Fig. 2D). The tumor lacked a well-defined capsule and exhibited unclear boundaries with the surrounding brain tissue. The tumor was highly vascularized, with areas of necrosis and hemorrhage (Fig. 2D), and cystic degeneration was observed in the central portion. The tumor extended medially to the ventricular trigone, the body of the lateral ventricle, the internal capsule and the thalamus, and its dimensions were ~6.5x7.0x10.0 cm. Intraoperative pathological evaluation suggested features consistent with a LGG.

Postoperative course and complications. Postoperative cranial MRI confirmed complete tumor resection (Fig. 3A-C). The patient was transferred to the intensive care unit (ICU) for observation. On day 2 post-operation, the patient developed a fever, with a peak temperature of 40.3˚C. Cerebrospinal fluid (CSF) appeared yellow and slightly turbid, with a notable elevated white blood cell count, glucose and lactate levels (Fig. 4). To identify the causative pathogen, cerebrospinal fluid bacterial culture was performed. The culture results confirmed *Staphylococcus aureus* as the etiological agent of the intracranial infection. The patient was treated with a regimen of antibiotics, including piperacillin-tazobactam (120 mg/kg, every 8 h), vancomycin (20 mg/kg, every 12 h) and meropenem (40 mg/kg, every 8 h). By postoperative day 11, the condition of the patient had stabilized and they were consequently transferred out of the ICU.

Histopathological examination. The excised tumor tissue was fixed using 10% neutral buffered formalin, with fixation performed at room temperature for 24-48 h. After fixation and paraffin embedding, the tissue blocks were sectioned into slices with a thickness of 4 μm. Hematoxylin and eosin staining was conducted at room temperature with a staining duration of 5-10 min for hematoxylin and 1-3 min for eosin. The staining revealed that the tumor cells exhibited diffuse infiltrative growth with low to moderate cellular density (Fig. 5). The tumor showed polymorphic cellular morphology and architecture, forming microcystic and oligodendroglioma-like astrocytic proliferations. Some areas displayed spindle-shaped cells, mucinous degeneration, epithelial-like features and perivascular arrangements. Notable findings included prominent microvascular proliferation, focal areas of clear cytoplasm, necrosis and calcification. The tumor demonstrated moderate cellular proliferation, with mitotic figures observed at a rate of 2-3 per 10 high-power fields. Focal regions resembling oligodendroglioma were observed; however, hallmark features such as Rosenthal fibers, perivascular pseudorosettes and eosinophilic granular bodies were absent. The morphological characteristics were consistent with diffuse astrocytoma (9).

Immunohistochemical (IHC) staining and molecular analysis. For the IHC analyses of the tumor tissue involved in the present study, the following experimental details were conducted in accordance with standard pathological procedures and the information documented in the study. For detecting specific molecular markers (including glial fibrillary acidic protein, microtubule-associated protein 2, Olig-2, S-100, vimentin, ATRX, CD34, and Ki-67), IHC staining was performed at room temperature for 60 min. All stained sections were observed and analyzed under a light microscope. Initial IHC staining, including analysis for GFAP, Ki-67, S-100, Vimentin and CD34, was performed by the Department of Pathology Service at Jinjiang Municipal Hospital. Due to the diagnostically challenging nature of the case, an independent expert consultation was sought from the Pathology Department of The First Affiliated Hospital of Fujian Medical University (Fuzhou, China). This secondary consultation encompassed additional IHC staining for MAP2, Olig-2, and ATRX, as well as high-throughput tumor sequencing. IHC staining was performed on formalin-fixed (10% neutral buffered formalin), paraffin-embedded tissue sections (4-μm thick) as previously described (10). The staining process was conducted at room temperature for a duration of 60 min. Primary antibodies included glial fibrillary acidic protein (GFAP), microtubule-associated protein 2 (MAP2), Olig-2, S-100, vimentin, ATRX, CD34 and Ki-67 (Dako, Abcam, and Millipore; dilutions 1:100-1:500) as previously described (10). Appropriate antigen retrieval and detection procedures were applied. Negative and positive controls were included in each run.

Tumor cells showed positive staining for GFAP, MAP2, Olig-2, S-100, vimentin and ATRX, CD34 exhibited focal positivity, and the Ki-67 proliferation index was ~10%. Analysis by tumor cell genetic sequencing demonstrated the absence of 1p/19q co-deletion and chromosome +7/-10 alterations but confirmed the presence of mutations in BRAF p.V600E, FGFR1 and FGFR4.

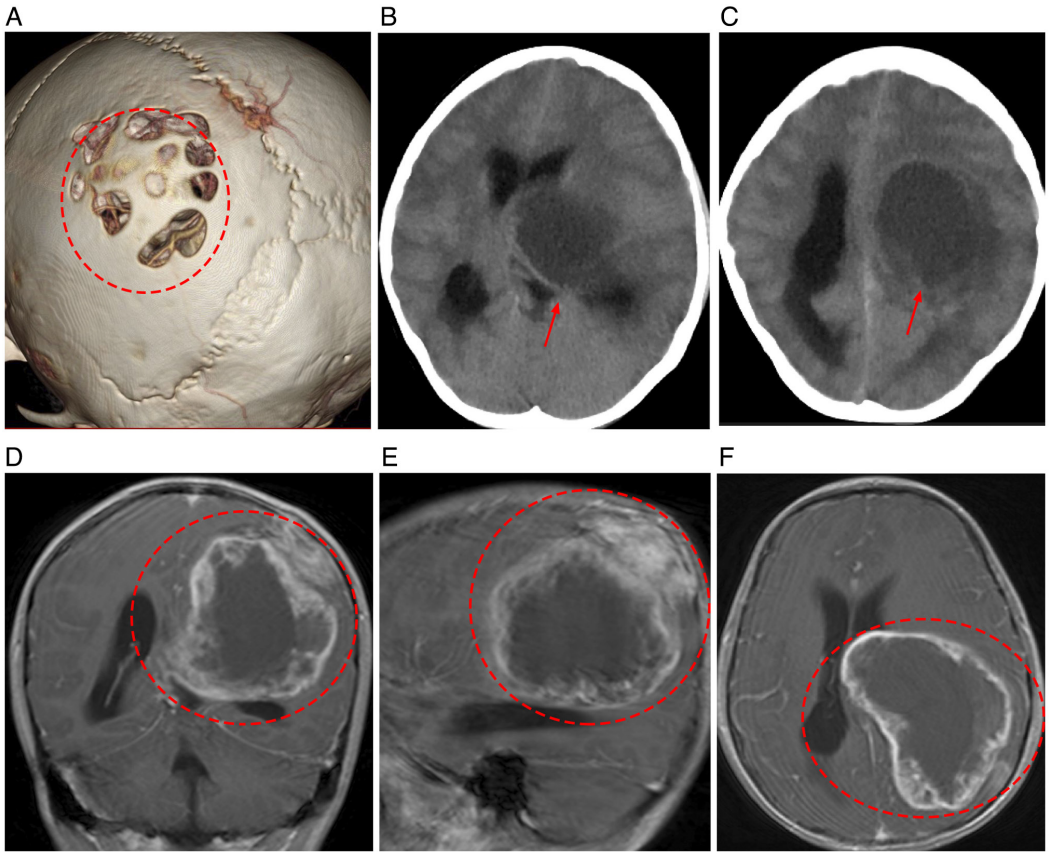

Figure 1. Preoperative cranial imaging. (A) Cranial CT showed resorptive bone loss in the left parietal bone (processed by 3D Slicer 5.7.1; https://slicer.org). (B-F) MRI imaging was performed. (B) A large space-occupying lesion is observed in the left parietal lobe, with associated compression of the contralateral ventricle. (C) The lesion results in significant distortion of the surrounding brain tissues and a rightward shift of the midline structures. (D) Coronal view showing a lesion predominantly in the left temporo-parieto-occipital region, with the parietal lobe as the main site. (E) Sagittal view revealing peripheral enhancement and compression of adjacent sulci and ventricles. (F) Axial view demonstrating the mass. Red arrows and circles indicate the precise location of the mass.

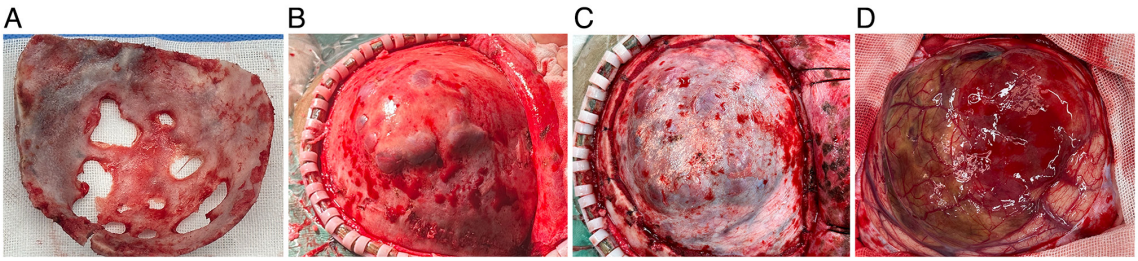

Figure 2. Intraoperative findings during resection of a large intracranial mass. (A) Resected skull showing partial resorptive bone loss in the parietal bone. (B) After scalp elevation, part of the tumor was seen protruding through the bone defect. (C) Intact dura mater observed after craniotomy. (D) The tumor is a reddish, soft, uncapsulated and poorly demarcated lesion with high vascularity.

Molecular testing. Genomic DNA was extracted from FFPE tumor tissue using the MagMAX™ FFPE DNA/RNA Ultra Kit (cat. no. A31881; Thermo Fisher Scientific, Inc.). DNA purity and integrity were assessed by spectrophotometry (NanoDrop 2000; A260/A280 and A260/230 ratios; NanoDrop Technologies; Thermo Fisher Scientific, Inc.) and microcapillary electrophoresis (DNA Integrity Number; Agilent 2100 Bioanalyzer; Agilent Technologies, Inc.). Sequencing libraries were prepared using the ThruPLEX DNA-seq Kit (cat. no. R400406; Takara Biotechnology Co., Ltd.) and quantified by qPCR (KAPA Library Quantification Kit; cat. no. KK4824; Kapa Biosystems; Roche Diagnostics) to a final loading concentration of 1.2-1.8 nM. High-throughput sequencing was performed on an Illumina platform with paired-end 150 bp reads (2x150 bp).

High-throughput sequencing of brain tumor-related genes revealed mutations in the following genes: ALK, BRCA2, DAXX, FAT1, FGFR1, FGFR4, MSH2, NRAS, SMO and TSC2 (Table I). Although ATRX IHC staining was positive, no ATRX mutation was detected via genetic analysis. Given the higher specificity and reliability of genetic testing, the IHC finding was considered less definitive. Based on the morphological and IHC features, the pathology department initially diagnosed the tumor as a PLNTY. However, considering the

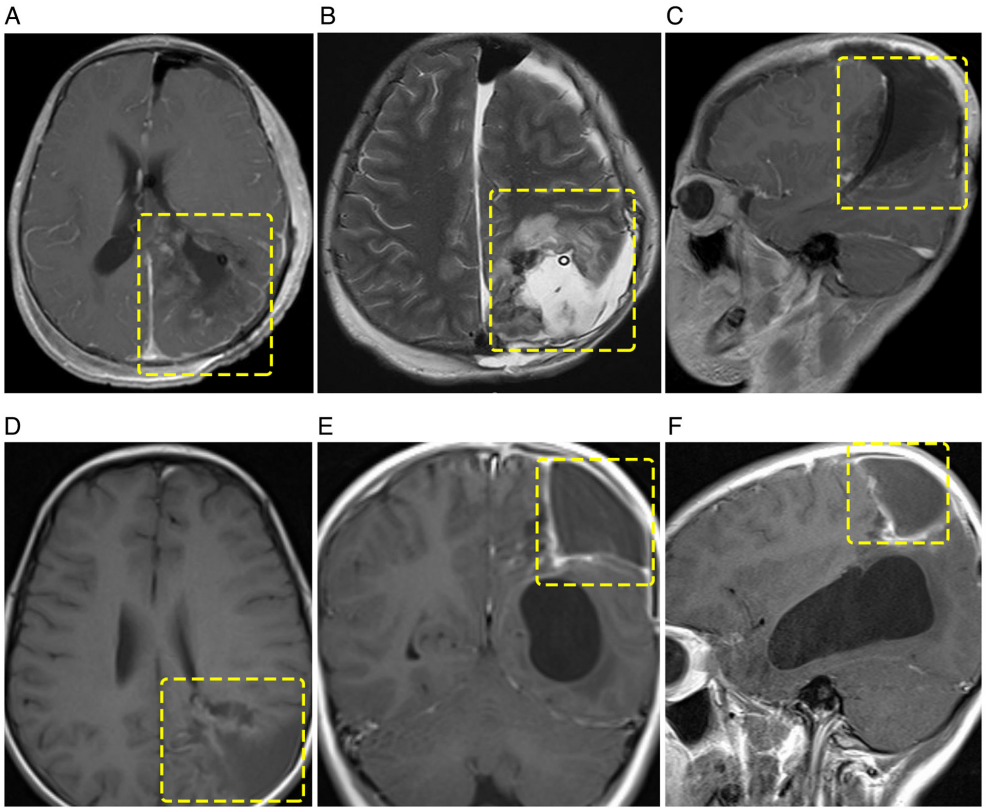

Figure 3. Cranial MRI images at 3 days and 3 months post-surgery. (A) Axial T1-weighted image without contrast. (B) Axial T2-weighted image. (C) Sagittal T1-weighted image. MRI performed 3 days post-operation showed complete tumor resection, with notable improvement in brain sulci and ventricular compression compared with preoperative imaging. The midline had largely returned to normal, with some residual fluid collection in the surgical area and partial brain tissue expansion. (D) Axial T1-weighted image. (E) Coronal T1-weighted image. (F) Sagittal T1-weighted image Postoperative MRI at 3 months showed no signs of tumor recurrence. Edema in the surgical area gradually subsided, and ventricular expansion was noted. The yellow dashed box indicates the surgical region.

genetic analysis results, the diagnosis of the tumor was revised to a pDLGG with MAPK pathway alterations.

Follow-up 3 months post-surgery. During the 3-month post-operative follow-up period, the frequency of seizures in the patient decreased to 1-2 per month, with periods of no seizures. Therefore, the dosage of antiepileptic medications was gradually reduced. Repeat contrast-enhanced MRI showed no residual or recurrent lesions (Fig. 3D-F).

Discussion

DLGG is the most common brain tumor in children and adolescents (11,12). When these tumors are located in the temporal lobe, patients often experience difficult-to-control seizures, which are resistant to anti-epileptic drugs (13). Since Hughlings Jackson's classic study in the late 19th century (14), the association between brain tumors and epilepsy has been well recognized. In 2003, Luyken *et al* (15) referred to these tumors as 'long-term epilepsy-associated tumors' (LEATs). LEATs differ from traditional brain tumors in that they tend to present at a younger age (seizures are typically the primary and often the only neurological symptom), grow slowly, are localized to the neocortex and are often predominantly found in the temporal lobe (16); seizure control is closely associated with the tumor subtype and the timing of intervention. In most cases, surgical resection of LEATs yields favorable outcomes in terms of both seizure reduction and tumor management (17). Differential diagnoses include ganglioglioma, DNT, desmoplastic infantile ganglioglioma, papillary glioneuronal tumor, PA, PXA, AG and PLNTY (18). The patient in the current case study presented in a similar manner, with seizures as the initial symptom. The condition was not clearly diagnosed and the patient suffered from drug-resistant epilepsy for >10 years. Preoperative imaging did not provide a clear diagnosis, and the postoperative tumor histopathological features were not characteristic enough to definitively identify the type of glioma. Thus, imaging and histopathological features alone could not establish the definitive glioma type. The importance of immunohistochemistry and molecular genetic testing is increasingly apparent in characterizing and refining tumor classification. In particular, whole-genome DNA methylation analysis and identification of recurrent genomic alterations (such as mutations, rearrangements and copy number abnormalities) are essential for describing biologically distinct disease entities and fine-tuning tumor classification.

CD34 is a single-chain transmembrane glycoprotein that is primarily expressed on immature hematopoietic stem cells, myeloid cells and endothelial cells. It is commonly used as a marker for certain tumor cells and is widely used to assess LEATs, glioneuronal lesions and dysplastic cells (19). CD34 is also associated with the diagnosis of epilepsy-associated tumors (19). CD34 expression is observed in 80% of gangliogliomas and 84% of PXA cases (18,19). BRAF p.V600E is an

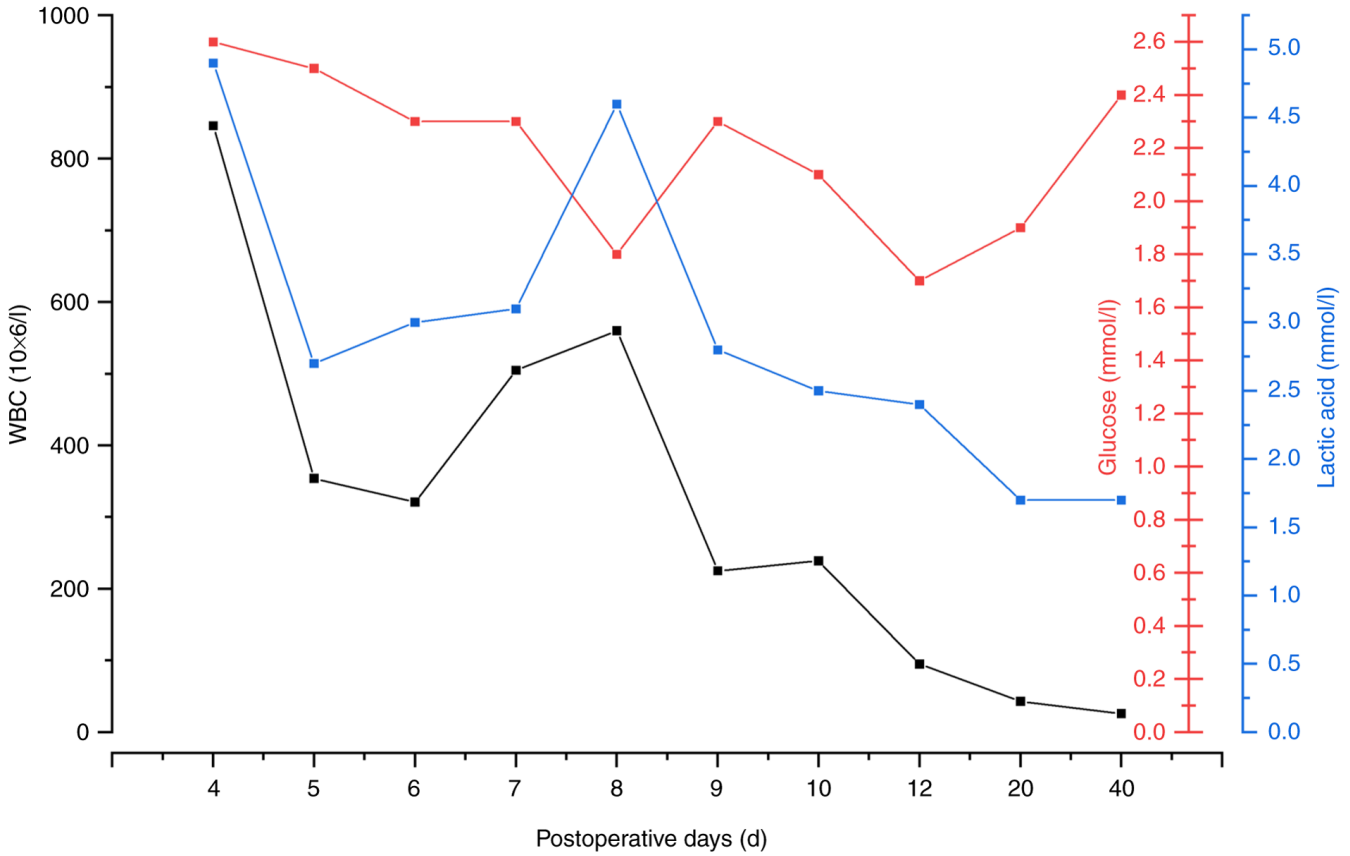

Figure 4. Postoperative trends in CSF parameters. T indicates postoperative days. The black curve represents changes in CSF WBC count, the blue curve represents changes in lactate levels and the red curve represents changes in glucose levels. Postoperative intracranial infection was observed, with a peak in CSF parameters shortly after surgery. Following treatment with vancomycin and meropenem, the curves for WBC count, lactate, and glucose levels demonstrated a downward trend. By T 11, the patient's temperature had returned to normal. CSF, cerebrospinal fluid; WBC, white blood cell; d, days.

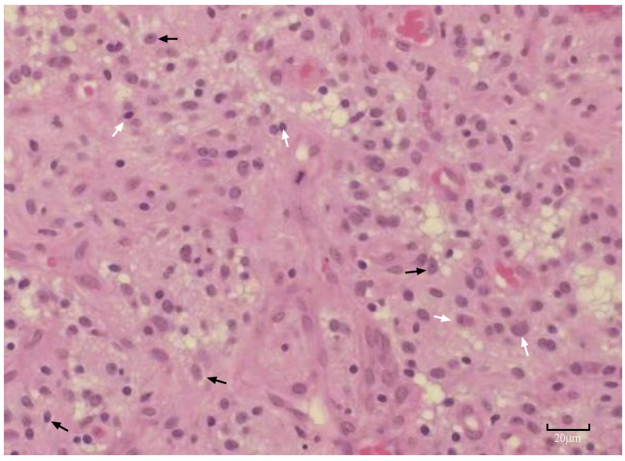

Figure 5. Histopathology of the tumor. The tumor tissue was histologically stained using hematoxylin and eosin (x200 magnification). The image demonstrated a diffuse infiltrative growth pattern characterized by low to moderate cellular density, along with polymorphic cellular morphology and architectural heterogeneity. Within the tumor, oligodendroglioma-like cells exhibiting mild nuclear atypia (indicated by white arrows) and perinuclear halos (black arrows) were observed.

important member of the MAPK pathway that influences cell proliferation, and BRAF p.V600E mutations, especially BRAF p.V600E, are commonly seen in glioma subgroups, including ganglioglioma, PXA, DNT and a subgroup of PA (20,21). The FGFR family consists of transmembrane tyrosine kinase receptors (FGFR1-4). Among these, fusions involving FGFR2 and FGFR3 are the most frequently observed in PLNTY, with FGFR3::TACC3, FGFR2::SHTN1 (KIAA198) and FGFR2::INA fusions being specifically identified (22).

The case described in the present study was histologically diagnosed as a diffuse astrocytoma, although despite improving molecular phenotyping, it was still difficult to definitively categorize the tumor as a specific LGG. The molecular markers included Olig-2 positivity, BRAF p.V600E mutation, FGFR1 mutation, FGFR4 mutation and focal CD34 positivity. Notably, there were no IDH mutations or 1p/19q co-deletions, which led to differential considerations including oligodendroglioma, PA, PXA, clear cell ependymoma, ganglioglioma, DNT and PLNTY. Oligodendrogliomas are typically CD34-negative and exhibit IDH mutations and 1p/19q co-deletions, which were absent in the tumor. Oligodendroglioma was initially considered in the differential diagnosis due to the tumor's low-grade neuroglial morphology; however, it was ruled out as the tumor lacked the defining IDH mutation and 1p/19q co-deletion, and was positive for CD34. PA was excluded due to the lack of Rosenthal fibers and the presence of focal CD34 expression. PXA and clear cell ependymoma were excluded based on the positive Olig-2 expression. Diffuse astrocytoma usually expresses CDKN2A/B, which was absent in the present case. Ganglioglioma is characterized by MAPK pathway

Table I. High-throughput sequencing of mutated brain tumor-related genes.

Mutated gene	Mutation type and location	Mutation abundance, %
ALK	Missense mutation in exon 9	45.52
BRCA2	Missense mutation in exon 11	3.92
DAXX	Missense mutation in exon 5	46.7
FAT1	Missense mutation in exon 19	40.36
FGFR1	Insertion mutation in exons 9-18	20.72
FGFR4	Missense mutation in exon 16	52.82
MSH2	5' untranslated region mutation in exon 1	63.24
NRAS	Mutation at splice site in intron 3	49.87
SMO	Missense mutation in exon 12	51.0
TSC2	Missense mutation in exon 34	45.46

These mutations reflect notable alterations in the genetic profile of the tumor, with certain genes exhibiting high mutation abundance.

activation gene alterations, and in high-grade forms, TERT mutations, TP53 mutations, ATRX loss and H3K27M mutations may be detected.

DNT and PLNTY were the most difficult to differentiate from the tumor in the present case. CD34 may be positive in the FGFR1 tyrosine kinase fusion or mutation subtype, but this positivity is limited to a few cells, not as diffuse as in PLNTY and PLNTY typically shows a Ki-67 expression of <5% (23). DNT often shows calcifications on CT, no mass effect or edema, and histologically, it exhibits oligodendroglioma-like cells arranged in columns with a microcystic structure, mucinous matrices and scattered dysmorphic neurons that appear to 'float' within the mucinous microcysts. DNT commonly exhibits FGFR1 gene fusions and BRAF p.V600E mutations (24). DLGG with MAPK pathway alterations share similarities with PLNTY, as both are classified under childhood DLGG. However, in MAPK pathway-altered glioma, CD34 does not show strong diffuse positivity, which differentiates DLGG from PLNTY (25). Yang *et al* (26) categorized DLGG with MAPK pathway alterations and BRAF p.V600E mutations as intermediate risk tumors with a high risk of recurrence and progression. Therefore, based on this information, the current case was diagnosed as a pDLGG with MAPK pathway alterations. This diagnosis encourages more frequent follow-up and heightened vigilance in monitoring for potential changes or complications. Therefore, in future follow-ups, potential biological evolution should be assessed in combination with clinical manifestations, imaging changes and molecular retesting when necessary.

In recent years, with the rapid advancement of molecular biology techniques, research on pDLGG has shifted its focus from conventional histopathological classification toward more refined molecular subtyping (23). The majority of pediatric LGG cases harbor distinct driver alterations that commonly lead to activation of the MAPK pathway, along with downstream activation of the mammalian target of rapamycin (mTOR) signaling cascade (27-29). The MAPK pathway, mediated through receptor tyrosine kinases (RTK) and downstream metabolic and transcriptional effectors, plays a central role in cellular signal transduction (30). In addition to canonical alterations, such as the BRAF p.V600E mutation (6,30) and FGFR fusions (19,31), studies have identified other genetic events. These events, include TERT promoter mutations, CDKN2A/B deletions, MYB/MYBL1 rearrangements, and alterations in NTRK, KRAS and IDH1, also play a notable role in a subset of pediatric patients with LGG (7,27-28,32). The role of IDH1 mutations in the formation of pDLGG remains unclear; however, a recent case series demonstrated that while patients with IDH1-mutant pDLGG exhibited good short-term survival, the 5-year progression-free survival rate was 42.9%, and glioma-related mortality emerged at the 10-year mark (33).

These molecular alterations not only facilitate precise tumor classification but are also closely associated with patient prognosis (23,34). Molecular targeted therapies for patients with pDLGG represent a promising frontier in pediatric neuro-oncology. Targeting hyperactivation of the Ras-MAPK pathway has been a major focus of recent research, with Raf and MEK inhibitors either already approved by the US Food and Drug Administration or currently under investigation in clinical trials for patients with pLGG (35,36). Current research is also investigating the role of mTOR inhibitors and RTK inhibitors as monotherapies or in combination with other treatment modalities (37).

In addition, increasing attention has been directed toward the study of the tumor immune microenvironment (38-41). Targeted therapies against BRAF-altered tumors have proven to be highly effective; Sievert *et al* (42) demonstrated that second-generation BRAF p.V600E inhibitors, such as PLX PB-3, can successfully target the KIAA1549-BRAF p.V600E fusion, a result of the 7q34 tandem duplication, which is particularly dominant in pediatric PA. This provides a novel therapeutic opportunity for tumors with BRAF p.V600E mutations, with efficacy dependent on the level of Ras activation in tumor cells (43). In the future, multi-omics approaches integrating techniques such as genetic testing, single-cell RNA sequencing and genomic structural variations may become crucial for precise tumor classification and personalized treatment strategies.

Meanwhile, the application of BRAF p.V600E or FGFR inhibitors (such as vemurafenib, dabrafenib and trametinib)

in pDLGG is being explored in clinical trials and has shown promising efficacy (35-37,43,44). Immunotherapy and small-molecule targeted therapies are expected to offer new treatment options for these tumors, warranting further attention and investigation.

In conclusion, the present case highlights the importance of enhancing the recognition of potential low-grade tumors in pediatric and adolescent patients with temporal lobe epilepsy in clinical practice, and emphasizes the need for timely molecular testing to achieve precise diagnosis since histopathological classification can be challenging. The diagnosis of DLGG with MAPK pathway alterations, in cases such as that presented in the present study, remains controversial and additional evidence-based research is needed to establish risk stratification and intervention guidelines for these tumors. With the advancement of targeted therapies, such as those targeting BRAF p.V600E and FGFR, the treatment of these tumors will become more precise and individualized, and recognizing molecular abnormalities will ensure targeted treatment options for future rare cases of malignant transformation or epilepsy control.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The sequencing data generated in the present study may be found in the SRA database at the following URL: https://www.ncbi.nlm.nih.gov/sra/PRJNA1330527. The other data generated in the present study may be requested from the corresponding author.

Authors' contributions

PWH conceived the study, and analyzed and interpreted imaging data. CZC and MYL collected and analyzed clinical data, and drafted the manuscript. XLG and MFC contributed to the analysis and interpretation of data, and revised the manuscript for important intellectual content. All authors reviewed, discussed, read and approved the final manuscript. CZC and MYL confirm the authenticity of all the raw data.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Written informed consent was obtained from the patient's parents for the publication of this case report.

Competing interests

The authors declare that they have no competing interests.

References

1. Ferris SP, Hofmann JW, Solomon DA and Perry A: Characterization of gliomas: From morphology to molecules. Virchows Arch 471: 257-269, 2017.
2. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, Ohgaki H, Wiestler OD, Kleihues P and Ellison DW: The 2016 World Health Organization classification of tumors of the central nervous system: A summary. Acta Neuropathol 131: 803-820, 2016.
3. Purkait S, Mahajan S, Sharma MC, Sarkar C and Suri V: Pediatric-type diffuse low grade gliomas: Histomolecular profile and practical approach to their integrated diagnosis according to the WHO CNS5 classification. Indian J Pathol Microbiol 65 (Suppl): S42-S49, 2022.
4. Patel T, Singh G and Goswami P: Recent updates in pediatric diffuse glioma classification: Insights and conclusions from the WHO 5th edition. J Med Life 17: 665-670, 2024.
5. Lassaletta A, Zapotocky M, Bouffet E, Hawkins C and Tabori U: An integrative molecular and genomic analysis of pediatric hemispheric low-grade gliomas: An update. Childs Nerv Syst 32: 1789-1797, 2016.
6. Ellison DW, Hawkins C, Jones DTW, Onar-Thomas A, Pfister SM, Reifenberger G and Louis DN: cIMPACT-NOW update 4: Diffuse gliomas characterized by MYB, MYBL1, or FGFR1 alterations or $BRAF^{V600E}$ mutation. Acta Neuropathol 137: 683-687, 2019.
7. Suh YY, Lee K, Shim YM, Phi JH, Park CK, Kim SK, Choi SH, Yun H and Park SH: MYB/MYBL1::QKI fusion-positive diffuse glioma. J Neuropathol Exp Neurol 82: 250-260, 2023.
8. Teasdale G and Jennett B: Assessment of coma and impaired consciousness. A practical scale. Lancet 2: 81-84, 1974.
9. Wirsching HG, Galanis E and Weller M: Glioblastoma. Handb Clin Neurol 134: 381-397, 2016.
10. Hu Y, Zhang S, Ye H, Wang G, Chen X and Zhang Y: Lateral ventricle chordoid meningioma presenting with inflammatory syndrome in an adult male: A case report. Exp Ther Med 25: 236, 2023.
11. Pallud J and McKhann GM: Diffuse low-grade glioma-related epilepsy. Neurosurg Clin N Am 30: 43-54, 2019.
12. PDQ Pediatric Treatment Editorial Board. Childhood astrocytomas, other gliomas, and glioneuronal/neuronal tumors treatment (PDQ®): Health professional version. In: PDQ Cancer Information Summaries [Internet]. Bethesda (MD): National Cancer Institute (US), 2002.
13. Lombardi D, Marsh R and de Tribolet N: Low grade glioma in intractable epilepsy: Lesionectomy versus epilepsy surgery. Acta Neurochir Suppl 68: 70-74, 1997.
14. Hughlings-Jackson J: Observations on the physiology and pathology of hemi-chorea. Edinb Med J 14: 294-303, 1869.
15. Luyken C, Blümcke I, Fimmers R, Urbach H, Elger CE, Wiestler OD and Schramm J: The spectrum of long-term epilepsy-associated tumors: Long-term seizure and tumor outcome and neurosurgical aspects. Epilepsia 44: 822-830, 2003.
16. Thom M, Blümcke I and Aronica E: Long-term epilepsy-associated tumors. Brain Pathol 22: 350-379, 2012.
17. Baticulon RE, Wittayanakorn N and Maixner W: Low-grade glioma of the temporal lobe and tumor-related epilepsy in children. Childs Nerv Syst 40: 3085-3098, 2024.
18. Giulioni M, Marucci G, Cossu M, Tassi L, Bramerio M, Barba C, Buccoliero AM, Vornetti G, Zenesini C, Consales A, *et al*: CD34 expression in low-grade epilepsy-associated tumors: Relationships with clinicopathologic features. World Neurosurg 121: e761-e768, 2019.
19. Huse JT, Snuderl M, Jones DTW, Brathwaite CD, Altman N, Lavi E, Saffery R, Sexton-Oates A, Blumcke I, Capper D, *et al*: Polymorphous low-grade neuroepithelial tumor of the young (PLNTY): An epileptogenic neoplasm with oligodendroglioma-like components, aberrant CD34 expression, and genetic alterations involving the MAP kinase pathway. Acta Neuropathol 133: 417-429, 2017.
20. Schindler G, Capper D, Meyer J, Janzarik W, Omran H, Herold-Mende C, Schmieder K, Wesseling P, Mawrin C, Hasselblatt M, *et al*: Analysis of BRAF V600E mutation in 1,320 nervous system tumors reveals high mutation frequencies in pleomorphic xanthoastrocytoma, ganglioglioma and extra-cerebellar pilocytic astrocytoma. Acta Neuropathol 121: 397-405, 2011.
21. Vuong HG, Altibi AMA, Duong UNP, Ngo HTT, Pham TQ, Fung KM and Hassell L: BRAF mutation is associated with an improved survival in glioma-a systematic review and meta-analysis. Mol Neurobiol 55: 3718-3724, 2018.

22. Louis DN, Perry A, Wesseling P, Brat DJ, Cree IA, Figarella-Branger D, Hawkins C, Ng HK, Pfister SM, Reifenberger G, *et al*: The 2021 WHO classification of tumors of the central nervous system: A summary. Neuro Oncol 23: 1231-1251, 2021.
23. Orhan O, Eray HA, Alpergin BC, Zaimoglu M, Ozpiskin OM, Aras N, Heper A and Eroglu U: Polymorphous low-grade neuroepithelial tumor of the young (PLNTY): A case report with surgical and neuropathological differential diagnosis. Clin Neuropathol 43: 83-91, 2024.
24. Surrey LF, Jain P, Zhang B, Straka J, Zhao X, Harding BN, Resnick AC, Storm PB, Buccoliero AM, Genitori L, *et al*: Genomic analysis of dysembryoplastic neuroepithelial tumor spectrum reveals a diversity of molecular alterations dysregulating the MAPK and PI3K/mTOR pathways. J Neuropathol Exp Neurol 78: 1100-1111, 2019.
25. Ryall S, Zapotocky M, Fukuoka K, Nobre L, Guerreiro Stucklin A, Bennett J, Siddaway R, Li C, Pajovic S, Arnoldo A, *et al*: Integrated molecular and clinical analysis of 1,000 pediatric low-grade gliomas. Cancer Cell 37: 569-583.e5, 2020.
26. Yang RR, Aibaidula A, Wang WW, Chan AK, Shi ZF, Zhang ZY, Chan DTM, Poon WS, Liu XZ, Li WC, *et al*: Pediatric low-grade gliomas can be molecularly stratified for risk. Acta Neuropathol 136: 641-655, 2018.
27. Zhang J, Wu G, Miller CP, Tatevossian RG, Dalton JD, Tang B, Orisme W, Punchihewa C, Parker M, Qaddoumi I, *et al*: Whole-genome sequencing identifies genetic alterations in pediatric low-grade gliomas. Nat Genet 45: 602-612, 2013.
28. Jones DTW, Hutter B, Jäger N, Korshunov A, Kool M, Warnatz HJ, Zichner T, Lambert SR, Ryzhova M, Quang DA, *et al*: Recurrent somatic alterations of FGFR1 and NTRK2 in pilocytic astrocytoma. Nat Genet 45: 927-932, 2013.
29. Bandopadhayay P, Ramkissoon LA, Jain P, Bergthold G, Wala J, Zeid R, Schumacher SE, Urbanski L, O'Rourke R, Gibson WJ, *et al*: MYB-QKI rearrangements in angiocentric glioma drive tumorigenicity through a tripartite mechanism. Nat Genet 48: 273-282, 2016.
30. Manoharan N, Liu KX, Mueller S, Haas-Kogan DA and Bandopadhayay P: Pediatric low-grade glioma: Targeted therapeutics and clinical trials in the molecular era. Neoplasia 36: 100857, 2023.
31. Rivera B, Gayden T, Carrot-Zhang J, Nadaf J, Boshari T, Faury D, Zeinieh M, Blanc R, Burk DL, Fahiminiya S, *et al*: Germline and somatic FGFR1 abnormalities in dysembryoplastic neuroepithelial tumors. Acta Neuropathol 131: 847-863, 2016.
32. Qaddoumi I, Orisme W, Wen J, Santiago T, Gupta K, Dalton JD, Tang B, Haupfear K, Punchihewa C, Easton J, *et al*: Genetic alterations in uncommon low-grade neuroepithelial tumors: BRAF, FGFR1, and MYB mutations occur at high frequency and align with morphology. Acta Neuropathol 131: 833-845, 2016.
33. Yeo KK, Alexandrescu S, Cotter JA, Vogelzang J, Bhave V, Li MM, Ji J, Benhamida JK, Rosenblum MK, Bale TA, *et al*: Multi-institutional study of the frequency, genomic landscape, and outcome of IDH-mutant glioma in pediatrics. Neuro Oncol 25: 199-210, 2023.
34. Bale TA and Rosenblum MK: The 2021 WHO classification of tumors of the central nervous system: An update on pediatric low-grade gliomas and glioneuronal tumors. Brain Pathol 32: e13060, 2022.
35. Kakadia S, Yarlagadda N, Awad R, Kundranda M, Niu J, Naraev B, Mina L, Dragovich T, Gimbel M and Mahmoud F: Mechanisms of resistance to BRAF and MEK inhibitors and clinical update of US food and drug administration-approved targeted therapy in advanced melanoma. Onco Targets Ther 11: 7095-7107, 2018.
36. Nicolaides T, Nazemi KJ, Crawford J, Kilburn L, Minturn J, Gajjar A, Gauvain K, Leary S, Dhall G, Aboian M, *et al*: Phase I study of vemurafenib in children with recurrent or progressive $BRAF^{V600E}$ mutant brain tumors: Pacific pediatric neuro-oncology consortium study (PNOC-002). Oncotarget 11: 1942-1952, 2020.
37. Ullrich NJ, Prabhu SP, Reddy AT, Fisher MJ, Packer R, Goldman S, Robison NJ, Gutmann DH, Viskochil DH, Allen JC, *et al*: A phase II study of continuous oral mTOR inhibitor everolimus for recurrent, radiographic-progressive neurofibromatosis type 1-associated pediatric low-grade glioma: A neurofibromatosis clinical trials consortium study. Neuro Oncol 22: 1527-1535, 2020.
38. de Visser KE and Joyce JA: The evolving tumor microenvironment: From cancer initiation to metastatic outgrowth. Cancer Cell 41: 374-403, 2023.
39. Bejarano L, Jordão MJC and Joyce JA: Therapeutic targeting of the tumor microenvironment. Cancer Discov 11: 933-959, 2021.
40. Rajendran S, Hu Y, Canella A, Peterson C, Gross A, Cam M, Nazzaro M, Haffey A, Serin-Harmanci A, Distefano R, *et al*: Single-cell RNA sequencing reveals immunosuppressive myeloid cell diversity during malignant progression in a murine model of glioma. Cell Rep 42: 112197, 2023.
41. Jones DTW, Kocialkowski S, Liu L, Pearson DM, Bäcklund LM, Ichimura K and Collins VP: Tandem duplication producing a novel oncogenic BRAF fusion gene defines the majority of pilocytic astrocytomas. Cancer Res 68: 8673-8677, 2008.
42. Sievert AJ, Lang SS, Boucher KL, Madsen PJ, Slaunwhite E, Choudhari N, Kellet M, Storm PB and Resnick AC: Paradoxical activation and RAF inhibitor resistance of BRAF protein kinase fusions characterizing pediatric astrocytomas. Proc Natl Acad Sci USA 110: 5957-5962, 2013.
43. Wang H, Long-Boyle J, Winger BA, Nicolaides T, Mueller S, Prados M and Ivaturi V: Population pharmacokinetics of vemurafenib in children with recurrent/refractory BRAF gene V600E-mutant astrocytomas. J Clin Pharmacol 60: 1209-1219, 2020.
44. Wen PY, Stein A, van den Bent M, De Greve J, Wick A, de Vos FYFL, von Bubnoff N, van Linde ME, Lai A, Prager GW, *et al*: Dabrafenib plus trametinib in patients with $BRAF^{V600E}$-mutant low-grade and high-grade glioma (ROAR): A multicentre, open-label, single-arm, phase 2, basket trial. Lancet Oncol 23: 53-64, 2022.