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Acute-Onset Neurological Symptoms in a Child with a Large Solid-Cystic Brain Tumor: A Case Report

Roro Rukmi Windi Perdani [1], Bryantdary Arrafif Nasution[2], Carissa Aprilia Yusanda[2], and Divia Denisa Sitinjak [2]

[1]Department of Pediatric Neurology, Dr. H. Abdul Moeloek Regional General Hospital Bandar Lampung, University of Lampung
[2]Faculty of Medicine, Dr. H. Abdul Moeloek Regional General Hospital Bandar Lampung, University of Lampung
*Correspondence: bryantdaryy@gmail.com

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Abstrak:
Pendahuluan: Tumor otak pada anak dapat menimbulkan gejala nonspesifik sehingga diagnosis sering terlambat. **Laporan Kasus:** Seorang anak perempuan usia 4 tahun datang dengan nyeri kepala hilang timbul, tremor tangan kiri, kelemahan ekstremitas kiri, dan muntah. Pemeriksaan neurologis menunjukkan hemiparesis sisi kiri dan palsi fasialis sentral. MRI kepala menunjukkan massa solid-kistik supratentorial ukuran 10 cm dengan kalsifikasi, nekrosis, efek massa, dan hidrosefalus obstruktif ringan. MRI lanjutan termasuk spektroskopi dan SWI mengarahkan diagnosis banding pada glioma derajat tinggi, DNET, dan ganglioglioma. Biopsi otak melalui kraniotomi dilakukan, dan histopatologi menunjukkan kemungkinan astrocytoma, ependymoma, atau astroblastoma. Kejang fokal terjadi pascaoperasi hari ke-3 dan berhasil dikontrol. Pasien mendapatkan penanganan multidisiplin berupa antibiotik, kortikosteroid, antiepileptik, terapi suportif, serta rehabilitasi awal. Saat ini pasien stabil, tidak ada defisit neurologis, dan menjalani kemoterapi protokol glioma derajat rendah (cisplatin, etoposide, vincristine, carboplatin) sambil menunggu konfirmasi imunohistokimia. **Kesimpulan:** Deteksi dini melalui neuroimaging lanjut dan intervensi bedah tepat waktu penting untuk menghindari progresivitas tumor otak pediatrik. Penanganan komprehensif termasuk evaluasi histopatologi, imunohistokimia, terapi sistemik, serta dukungan psikososial dan rehabilitasi sangat penting untuk menunjang pemulihan dan meningkatkan kualitas hidup pasien.
Kata kunci: Histopatologi; Imunohistokimia; MRI; Tumor otak pediatrik

Abstract:
Introduction: Pediatric brain tumors often present with nonspecific symptoms, leading to diagnostic delays. **Case Presentation:** A 4-year-old girl presented with intermittent headaches, left-hand tremors, left-sided weakness, and vomiting. Neurological examination revealed left hemiparesis and central facial nerve palsy. Brain MRI demonstrated a 10 cm supratentorial solid-cystic mass with calcifications, necrosis, mass effect, and mild obstructive hydrocephalus. Advanced imaging, including MR spectroscopy and SWI, suggested differential diagnoses of high-grade glioma, DNET, or ganglioglioma. A craniotomy and tumor biopsy were performed, with histopathological analysis indicating possible astrocytoma, ependymoma, or astroblastoma. On postoperative day three, the patient developed a focal motor seizure, which was successfully controlled. A multidisciplinary team managed the patient with antibiotics, corticosteroids, antiepileptics, supportive therapy, and early rehabilitation. At present, the patient is neurologically stable with no deficits and is undergoing chemotherapy following a low-grade glioma protocol (cisplatin, etoposide, vincristine, and carboplatin) while awaiting final immunohistochemical confirmation. **Conclusion:** Early neuroimaging, including advanced MRI techniques, is critical for accurate diagnosis and prompt surgical intervention in pediatric brain tumors. Comprehensive care—including histopathology, immunohistochemistry, systemic therapy, and multidisciplinary support—plays a vital role in optimizing outcomes and improving the quality of life for affected children.
Keywords: *Histopathology; Immunohistochemistry; Magnetic Resonance Imaging (MRI); Pediatric brain tumor; Solid-cystic tumor*

1. Introduction

Pediatric brain tumors are the most common solid malignancies in children, representing the leading cause of cancer-related mortality in this age group. They account for approximately 15% to 20% of all childhood cancers, with an incidence rate of about 4 per 100,000 children annually (1). Among these, glial tumors, including astrocytomas, oligodendrogliomas, and ependymomas, are predominant, with astrocytomas alone constituting approximately 40% to 55% of cases (2).

Solid-cystic variants of pediatric brain tumors, such as certain astrocytomas and ependymomas, present unique diagnostic challenges due to their mixed composition. Early symptoms of pediatric brain tumors are often nonspecific and can mimic benign conditions such as infections or developmental delays. This similarity frequently results in delayed diagnosis, especially in primary care settings where advanced imaging may not be immediately available (3). These variants are less common and can complicate imaging interpretations, necessitating advanced neuroimaging techniques for accurate diagnosis. Clinical manifestations of pediatric brain tumors are often nonspecific and can include persistent headaches, vomiting, seizures, and focal neurological deficits, typically developing gradually over weeks to months. However, in this case, a 4-year-old girl presented with a rapid progression of symptoms within two weeks, including intermittent headaches, tremors in her left hand, limb weakness, and vomiting. Such an accelerated symptom onset, especially with a large tumor measuring 10 cm, is atypical and poses significant diagnostic challenges. The substantial size of the tumor, coupled with the brief clinical course, underscores the necessity for heightened clinical vigilance and prompt imaging to ensure accurate diagnosis.

This case is particularly noteworthy as it highlights the unusual clinical trajectory of a large supratentorial tumor that remained asymptomatic until shortly before hospitalization. This delay in symptom onset, despite the tumor's considerable size, emphasizes the complexity inherent in diagnosing pediatric brain tumors. Advanced neuroimaging techniques, such as Magnetic Resonance Imaging (MRI), are critical in the early detection of such tumors, guiding subsequent diagnostic and therapeutic decisions. Additionally, histopathological and immunohistochemical evaluations are indispensable in confirming the tumor’s type, which in this case includes possibilities such as astrocytoma, ependymoma, or astroblastoma (4).

This case underscores the importance of early neuroimaging in pediatric patients presenting with nonspecific symptoms like persistent headaches, especially when accompanied by subtle neurological deficits. It also serves as a reminder of the value of timely intervention and accurate histopathological diagnosis to direct appropriate therapy. Lessons drawn from this case may guide clinicians in managing similar challenging instances of pediatric brain tumors, leading to improved outcomes through prompt detection and treatment.

2. Case Presentation

A 4-year-old girl was referred to the hospital with complaints of progressive left-hand weakness and intermittent headaches for two weeks. The symptoms began two weeks before her hospital admission, starting with right-sided headaches that initially occurred only in the morning, but over time, they became persistent throughout the day. The patient also reported a single episode of non-projectile vomiting. There was no history of seizures, fever, respiratory symptoms, gastrointestinal disturbances, or urinary complaints.

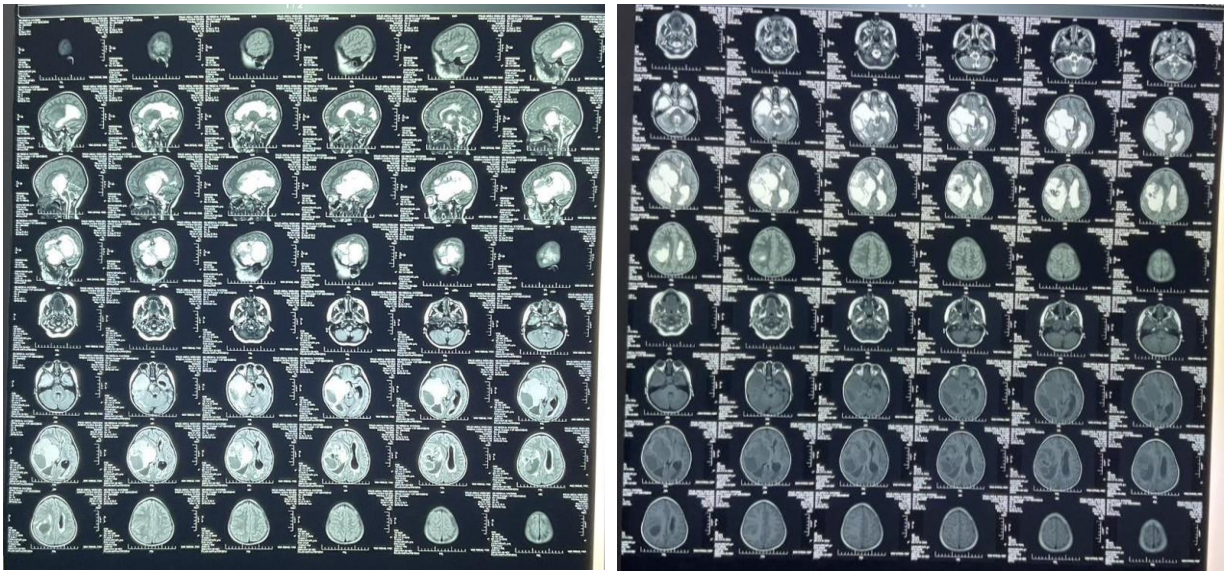
The patient began noticing tremors in her left hand when trying to grasp objects and weakness compared to her right hand. One week before admission, the symptoms persisted without significant worsening. Three days before hospitalization, she visited an outpatient clinic for further evaluation and was advised to undergo additional investigations and be admitted to the hospital. Upon hospital admission, the patient was alert and cooperative with a Glasgow Coma Scale score of E4M6V5. Her nutritional status was assessed as mildly underweight. Neurological examination revealed mild left-sided hemiparesis (motor strength 5/5 in the right extremities, 4/5 in the left extremities), slight tremors in the left hand, and cranial nerve deficit in the form of central-type facial nerve palsy

(CN VII), indicated by uvula deviation and a drooping mouth. Reflexes were normal, and no pathological reflexes were noted. No signs of meningeal irritation were present. Systemic examination was unremarkable.

Prior to surgery, the patient was treated with supportive and symptomatic therapy including intravenous fluid (IVFD D5 ½ NS at 10 TPM), intravenous ceftriaxone 700 mg twice daily (equivalent to 95 mg/kg body weight), dexamethasone 2.5 mg three times daily (0.5 mg/kg), and piracetam 400 mg once daily (25 mg/kg). Nutritional and neurodevelopmental support was given orally in the form of Prolacta with DHA for the baby (once daily) and vitamin D3 400 IU (once daily).

Brain MRI revealed a well-defined lobulated solid-cystic mass measuring 8.31 x 10.9 x 8.3 cm in the right temporofrontal-parietal region. The mass obliterated the right basal ganglia, compressed the right lateral ventricle, and displaced the midline by 2 cm to the left. The lesion showed mixed signal intensities: hypointense on T1 with isointense borders, hyperintense on T2 with isointense borders, and blooming artifacts on SWAN sequences. No restricted diffusion was noted, and MR spectroscopy showed reduced levels of NAA and Cr with elevated Cho levels.

The selection of advanced MRI techniques in this case followed current pediatric neuroimaging standards. Conventional MRI provided anatomical detail of the tumor's location and mass effect, while MR Spectroscopy offered metabolic differentiation by showing elevated choline and decreased NAA and creatine levels, features typically associated with higher-grade gliomas. Additionally, susceptibility-weighted imaging (SWI), specifically SWAN, enhanced the detection of intra-tumoral calcification and microhemorrhage, findings that are diagnostically valuable in characterizing solid-cystic pediatric tumors. These approaches are aligned with recent recommendations emphasizing a multimodal MRI strategy to improve diagnostic precision and preoperative planning in pediatric brain tumors (5). These findings suggested a differential diagnosis of Dysembryoplastic Neuroepithelial Tumor (DNET), ganglioglioma, or high-grade glioma. Additionally, non-communicating hydrocephalus with trans-ependymal edema and sub-falcine herniation was observed. Despite radiological evidence of mild obstructive (non-communicating) hydrocephalus with trans-ependymal edema and early subfalcine herniation, the patient remained clinically stable without signs of acute raised intracranial pressure. Therefore, cerebrospinal fluid diversion procedures, such as external ventricular drainage or ventriculoperitoneal shunting, were not immediately required, but close neurological monitoring was maintained postoperatively.



(a) (b)

Figure 1. Preoperative brain MRI of the patient demonstrating a large right temporofrontal-parietal tumor with solid and cystic components: (a) Sagittal, axial, and coronal T2-weighted and FLAIR sequences showing a well-defined lobulated mass with heterogeneous intensity, internal cystic areas, perilesional edema, and midline shift; (b) Axial T1 post-contrast sequences highlighting irregular peripheral enhancement, associated mass effect on the right lateral ventricle, and early subfalcine herniation.

The patient underwent a craniotomy and partial tumor evacuation with a biopsy on the third day of hospitalization, performed by a pediatric neurosurgeon. The procedure aimed not only to obtain diagnostic tissue but also to reduce intracranial pressure by decompressing the large supratentorial mass. The surgery was uneventful, and the patient was subsequently transferred to the pediatric intensive care unit (PICU) for postoperative monitoring. On postoperative day two, she remained alert, responsive, and stable, with mild periorbital swelling in the right eye. However, on postoperative day three, the patient developed a focal motor seizure, characterized by rhythmic jerking movements of the left hand and facial muscles. The episode was effectively controlled with the administration of antiepileptic therapy, and no further seizures were reported.

Postoperatively in the PICU, the patient received intravenous ceftriaxone 500 mg twice daily, ranitidine 15 mg every 12 hours, citicoline 250 mg every 12 hours, tranexamic acid 250 mg every 6 hours, paracetamol 200 mg every 8 hours, and a neodex drip at 2 mcg. Fluid management was maintained with IVFD KAEN 1B at 40 cc/hour. The patient remained stable under this regimen and continued to receive nutritional and neuroprotective support. During the postoperative phase, the patient was managed collaboratively by a multidisciplinary team including pediatric neurosurgeons, intensivists, rehabilitation specialists, and nutritionists. This collaborative monitoring facilitated the early detection of complications such as seizures and supported the initiation of early neurorehabilitation to optimize recovery.

Laboratory investigations post-surgery showed mild anemia (Hb 11.9 g/dL), leukocytosis (15,000/mm^3), and mild hypoalbuminemia (1.8 g/dL). Electrolytes were within normal limits. Histopathological examination on March 7, 2025, revealed a densely cellular neoplasm with perivascular pseudorosette structures, hyperchromatic round-to-oval nuclei, and eosinophilic cytoplasm within fibrovascular stroma. These findings suggested a differential diagnosis that includes astrocytoma, ependymoma, or astroblastoma. However, a definitive diagnosis could not yet be established. Further immunohistochemical (IHC) analysis was requested including GFAP, Vimentin, S100, Synaptophysin, and Ki-67 markers to confirm tumor type and guide further treatment planning. At the time of this report, the patient is clinically stable and undergoing regular outpatient follow-up with a pediatric hematology-oncology consultant. Chemotherapy is being administered following a low-grade glioma protocol, which includes intravenous cisplatin (18 mg), etoposide (90 mg), vincristine (0.9 mg), and carboplatin (100 mg) according to the

scheduled regimen. The patient currently has no neurological deficits, including hemiparesis, speech disturbance, or seizures. Final diagnosis confirmation is pending further evaluation from the pathology department.

3. Discussion and Conclusions

This case highlights the diagnostic and therapeutic challenges associated with pediatric solid-cystic brain tumors, particularly in cases where clinical presentation is atypically rapid. Brain tumors are the most common solid malignancies in children, comprising approximately 20-25% of all pediatric cancers. However, solid-cystic variants represent a rarer subset, complicating diagnostic efforts due to their heterogeneous radiological and histopathological characteristics (6). Given the significant morbidity and mortality associated with pediatric brain tumors, early recognition, and accurate classification are paramount to ensuring optimal clinical outcomes.

Neuroimaging plays a pivotal role in the evaluation of pediatric brain tumors, with MRI serving as the gold standard for tumor characterization. The differential diagnosis for supratentorial solid-cystic tumors in children includes dysembryoplastic neuroepithelial tumors (DNETs), gangliogliomas, high-grade gliomas, ependymomas, and astroblastomas. DNETs typically appear as cortical lesions with a 'bubbly' architecture and are often associated with long-standing seizures. Gangliogliomas usually present as cystic lesions with an enhancing mural nodule and a history of chronic epilepsy (7). High-grade gliomas and ependymomas, in contrast, tend to show heterogeneous enhancement, surrounding edema, and more rapid clinical progression. Astroblastomas, although rare, may resemble ependymomas radiologically but are distinguished by sharply demarcated margins and peripheral enhancement. In this case, the absence of a chronic seizure history, combined with rapid symptom onset and MRI findings including a large lobulated mass with calcification and perivascular pseudorosette structures made DNET and ganglioglioma less likely. The diagnosis was further refined through histopathology, which suggested astrocytoma, ependymoma, or astroblastoma, pending confirmation by immunohistochemistry (8).

Supratentorial tumors in children often present with a wide spectrum of symptoms depending on the tumor's size, location, and rate of growth. Common symptoms include headaches, seizures, nausea, vomiting, and behavioral changes. Tumors located in the frontal lobe may lead to personality changes, irritability, and impaired judgment, while those affecting the temporal lobe are often associated with speech difficulties and complex partial seizures. Parietal lobe involvement can cause hemisensory deficits, and occipital lobe tumors may result in visual disturbances (9). Early recognition of these focal neurological signs is essential for timely imaging and intervention, especially when signs of raised intracranial pressure are absent.

Histopathological analysis revealed a densely cellular neoplasm with perivascular pseudorosette structures, hyperchromatic nuclei, and eosinophilic cytoplasm, leading to differential considerations of astrocytoma, ependymoma, or astroblastoma. Immunohistochemical staining remains crucial in differentiating these entities. GFAP is a key marker for glial differentiation, while S100, Vimentin, and Synaptophysin assist in delineating neuronal and mesenchymal components. Ki-67, a well-established proliferative index marker, is particularly valuable in determining tumor grading and assessing its potential aggressiveness. The presence of perivascular pseudorosettes suggests a possible diagnosis of ependymoma, although further immunohistochemical analysis is required for confirmation (10).

Surgical intervention remains the primary treatment modality for pediatric brain tumors, with the goal of maximal safe resection while preserving neurological function. In cases where complete tumor excision is not feasible due to proximity to critical structures, subtotal resection followed by adjuvant therapy is often recommended. Postoperative complications, including focal seizures, are common in pediatric patients with cortical tumors and may arise from cortical irritation or perioperative edema, necessitating antiepileptic therapy (11). Additionally, postoperative inflammatory responses, such as transient leukocytosis and hypoalbuminemia, are frequently observed following neurosurgical procedures and reflect systemic stress associated with surgical trauma (12). In addition to surgical management, non-surgical therapies are essential components of pediatric brain tumor care. In this case, preoperative treatment included intravenous antibiotics (ceftriaxone),

corticosteroids (dexamethasone), and nootropic (piracetam), alongside nutritional support. Corticosteroids are widely used to reduce peritumoral edema and lower intracranial pressure, thereby improving neurological symptoms. Dexamethasone specifically decreases capillary permeability and stabilizes the blood-brain barrier (13). Nootropics such as piracetam and citicoline support cognitive function and neuronal recovery, although further evidence is still evolving. Antiepileptic drugs are critical in seizure management, especially in supratentorial tumors where cortical involvement predisposes to focal seizures. While most pediatric brain tumors have no preventable causes, some environmental exposures, such as ionizing radiation, pesticides, and parental occupational exposures, have been associated with increased risk. Public health strategies aiming to reduce these exposures may contribute to long-term prevention efforts. Supportive measures, including antipyretics, hemostatic agents (e.g., tranexamic acid), and fluid management, are important for maintaining systemic stability postoperatively. The integration of these medical treatments aims to alleviate symptoms, optimize surgical outcomes, and enhance recovery (14).

The findings in this case underscore the critical importance of early neuroimaging in pediatric patients presenting with persistent headaches and focal neurological deficits, even in the absence of classic signs of raised intracranial pressure. Advanced imaging modalities such as MR spectroscopy and diffusion tensor imaging further enhance diagnostic precision by providing metabolic and structural insights into tumor composition (15). Moreover, a multidisciplinary approach involving pediatric neurosurgeons, neuro-oncologists, and neuropathologists is essential for optimizing clinical outcomes. Immunohistochemical analysis will play a key role in establishing the final diagnosis and guiding further therapeutic strategies, including the consideration of adjuvant radiotherapy or chemotherapy based on molecular profiling and tumor grading (16). The current treatment plan follows well-established chemotherapy protocols for pediatric low-grade gliomas. The combination of vincristine and carboplatin, or cisplatin and etoposide, is commonly used in patients with unresectable or partially resected tumors. Studies have shown favorable progression-free survival and functional outcomes with such regimens, supporting their use as first-line therapy in selected cases (17,18).

In low- and middle-income countries, early detection of brain tumors is often hindered by limited access to imaging, low awareness among healthcare providers, and delays in referral systems. Addressing these barriers through structured referral pathways, clinical decision tools, and community education initiatives is essential to improve early diagnosis and outcomes (19). Beyond clinical management, the psychosocial impact of pediatric brain tumors on both patients and their families is profound. Survivors frequently experience neurobehavioral impairments, including emotional dysregulation and attention difficulties, which can persist long after treatment completion. Additionally, parents often face heightened psychological distress, requiring sustained emotional support during and after their child's treatment. Addressing these challenges requires integrated psychosocial care as part of the overall management strategy (20).

Comprehensive management of pediatric brain tumors requires a multidisciplinary approach from the point of diagnosis through postoperative care. Involvement of pediatric neurosurgery, pediatric oncology, neuroradiology, neuropathology, rehabilitation medicine, and psychology ensures that all aspects of the patient's condition, oncologic, neurologic, functional, and psychosocial, are addressed in an integrated fashion. Such coordination is especially vital in complex cases involving large tumors with rapid progression, where surgical, neuroprotective, and rehabilitative planning must occur in parallel (21). Equally important to multidisciplinary care is early detection, which can significantly improve survival outcomes and minimize neurologic sequelae, especially in tumors with atypical or silent presentations. This case highlights the complexity of diagnosing and managing pediatric solid-cystic brain tumors, emphasizing the necessity of early detection, thorough histopathological evaluation, and a comprehensive treatment approach. The patient's ongoing chemotherapy regimen and neurologic stability illustrate the importance of long-term follow-up and coordinated multidisciplinary care in maintaining disease control and optimizing functional outcomes.

Despite the rarity of large supratentorial tumors with rapid symptom onset, timely surgical intervention combined with multimodal therapy significantly influences patient prognosis. Ongoing follow-up and individualized treatment planning remain crucial in optimizing long-term outcomes and quality of life for pediatric brain tumor patients. This case underscores the diagnostic and therapeutic complexities associated with pediatric solid-cystic brain tumors, particularly those presenting with atypically rapid symptom progression. Given the significant morbidity associated with pediatric brain neoplasms, early neuroimaging and histopathological evaluation remain crucial for accurate diagnosis and timely intervention (22, 23). MRI serves as the gold standard in initial tumor characterization, while immunohistochemical analysis is indispensable for definitive classification and prognostic assessment (2). Surgical intervention, when feasible, plays a pivotal role in reducing tumor burden and alleviating mass effects, with postoperative seizure management and systemic inflammatory responses requiring close monitoring (1). The integration of molecular profiling into standard diagnostic workflows has the potential to refine tumor classification and guide personalized therapeutic strategies. Ultimately, a multidisciplinary approach involving pediatric neurosurgeons, neuro-oncologists, and neuropathologists remains essential in optimizing clinical outcomes. Advances in molecular diagnostics and targeted therapies may further improve survival rates and long-term prognosis in pediatric patients with brain tumors. This case reinforces the necessity of early recognition, comprehensive histopathological evaluation, and individualized treatment planning to ensure optimal patient care. In addition to early diagnosis, the outcome in this case was strongly influenced by coordinated multidisciplinary care involving neurosurgery, pediatric intensive care, rehabilitation, and nutritional support, which collectively ensured timely intervention and comprehensive recovery.

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List of Abbreviations

MRI	Magnetic Resonance Imaging
CT	Computed Tomography
CN	Cranial Nerve
DNET	Dysembryoplastic Neuroepithelial Tumor
GFAP	Glial Fibrillary Acidic Protein

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