Case report

PILOCYTIC ASTROCYTOMA - MANAGEMENT OF POST OPERATIVE COMPLICATIONS

ABSTRACT:

Pilocytic astrocytoma (PA) is the most common juvenile cerebellar tumor and glial neoplasm of the central nervous system, typically diagnosed in children and young adults. Characterized by benign, low-grade, slow-growing tumors, PA has a favorable prognosis, with a 94% survival rate at 10 years. Most often located in the cerebellum, these tumors may also present in the optic tracts, hypothalamus, and brainstem. A 5-year-old male with a history of recurrent PA presented with generalized tonic-clonic seizures and acute neurological deterioration, requiring urgent management. He had undergone prior surgery and radiotherapy for a left temporal PA. Upon presentation, the patient was treated with a range of interventions, including antiepileptics, antibiotics, and corticosteroids for cerebral edema, and was supported with ventilatory assistance. A resistant Acinetobacter species was identified in surgical cultures, and targeted antibiotic therapy was adjusted accordingly. Despite ongoing seizures and neurological deficits, gradual improvement was observed, particularly in motor function, with physiotherapy and careful weaning from mechanical ventilation. This case highlights the complex management of recurrent PA, emphasizing the importance of timely surgical interventions, individualized seizure control, targeted antimicrobial therapy, and multidisciplinary rehabilitation in improving long-term outcomes for pediatric patients. Follow-up care, including regular neurology and oncology consultations, is crucial for monitoring tumor recurrence and managing complications.

Keywords: Pilocytic astrocytoma, seizures, pediatric, rehabilitation, antimicrobial therapy.

INTRODUCTION:

Pilocytic astrocytoma is the most prevalent juvenile cerebellar tumor and glial neoplasm of the central nervous system. With a remarkable benign biologic behaviour, this tumor has the best survival rate of any glial tumor, with a 94% survival rate at 10 years. Clinical symptoms and signs typically last for many months and are directly related to the tumors unique location; the majority of patients present within the first twenty years [1].

Most pilocytic astrocytoma have been reported to have modified BRAF genes and changes in the mitogen-activated protein kinase (MAPK) signalling pathway. The fifth KIAA1549-BRAF gene fusion is present in about 60% of cerebellar pilocytic astrocytoma. In One intracellular serine/threonine kinase that helps to activate the MAPK pathway is called BRAF. Human malignancies have been linked to mutations in this proto-

oncogene.Additionally, BRAFV600E point mutations, which occur in 5–10% of all cases, are commonly observed in pilocytic astrocytoma [2].

The incidence is somewhat higher in males than in females. With an average annual age-adjusted incidence rate (adjusted to the 2000 US standard population) of 0.84 (per 100,000), PA is the most common primary brain tumor in children aged 0 to 19 years, according to the CBTRUS statistical report. This rate significantly decreases from the age group of 10 to 14 years to the age group of 15 to 19 years. 15.4% of children and teenagers (19 years) and 17.6% of initial brain tumors in children (0–14 years) are pilocytic astrocytoma [3].

Pilocytic astrocytoma has been declared as a grade 1 brain tumorby World Health Organisation (WHO)which is more common in children than adults and also very little is known about the behavior of pilocyticastrocytomas in adult patients, which indicates the rarity of the condition among adult population [4].

PRESENTATION OF CASE:

A 5-year-old male child presented to the emergency department of a tertiary care hospital with complaints of generalized tonic-clonic seizures (GTCS) occurring early in the morning. The patient had a known history of recurrent pilocytic astrocytoma, previously treated with radiotherapy, and bilateral optic atrophy. On examination, he exhibited spontaneous eye opening and was making incomprehensible sounds. The patient was initially started on Ceftriaxone, Ranitidine, Mannitol, Furosemide, Levetiracetam, and Phenytoin. Later, Amikacin and Metronidazole were added to the regimen. A pre-existing pilocytic astrocytoma located in the left temporal region had been surgically managed with a frontotemporoparietalcraniectomy and debulking of the space-occupying lesion.

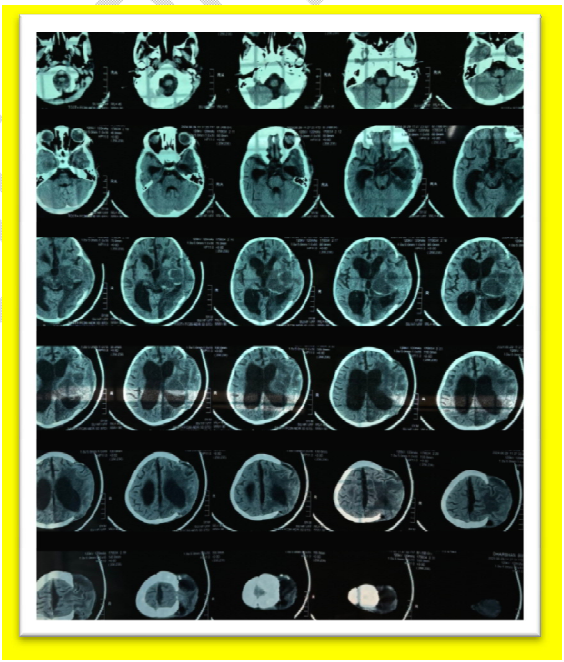

Figure 1BRAIN MRI

Following the onset of seizures, the patient developed peri-orbital swelling and was intubated. His CNS function assessment showed severely reduced motor activity, with zero power (0/5) in both upper and lower limbs. Additionally, his pulse rate was elevated to 130 beats per minute. Dexamethasone was introduced to address potential cerebral edema, and scalp and flap edema on the left side of the face were noted. The patient was found to be anemic, with a drop in hemoglobin from 9.6 to 8.4 g/dL, which warranted the transfusion of packed red blood cells (PRBC) at a dose of 10 ml/kg over four hours. Right-sided weakness and tonic posturing of the right limb were observed, which responded to intravenous antiepileptics. A subsequent seizure episode was managed with a half-loading dose of Phenytoin and an intravenous dose of Midazolam (1.5 mg).

To improve the Glasgow Coma Scale (GCS) score, the patient was gradually weaned off from pressure-assisted control ventilation (p-AC) to synchronized controlled mandatory ventilation (SCMV), then to endotracheal continuous positive airway pressure (ET-CPAP), and finally to high-flow nasal cannula (HFNC) ventilation with an FiO2 of 40% and flow at 25 L/min. A Foley catheter, central venous line, and orogastric tube were maintained throughout this period. Vancomycin was added to the antibiotic regimen at a dose of 225 mg IV TDS in 45 ml NS over 1 hour, and the patient's temperature was managed with oral Paracetamol as needed.

Surgical site culture results revealed the presence of Acinetobacter species, which was sensitive to Levofloxacin, Cotrimoxazole, and Amikacin but resistant to Meropenem and Ceftazidime, with moderate sensitivity to Piperacillin-Tazobactam. In response, Levofloxacin and Piperacillin-Tazobactam were started as per the susceptibility profile. Despite this, the patient continued to experience multiple seizures, which were controlled with Phenobarbitone (50 mg OD). After several days of management, a modest improvement in CNS functional power was noted (2/5). Additionally, exposure keratopathy was diagnosed in both eyes and treated with Hydroxyl Methyl Cellulose eye drops and Tobramycin eye drops.

The patient was gradually weaned off from HFNC to T-piece ventilation as his condition improved. Physiotherapy was initiated to assist with motor recovery. Over time, doses of Levetiracetam and Phenytoin were de-escalated, and Levofloxacin treatment was discontinued in favor of Tigecycline (18 mg IV BD) and Colistin (600,000 units IV TDS) based on further culture and sensitivity results. The frequency of seizures decreased significantly, and the patient was eventually discharged with oral antiepileptic drugs, with a recommendation for weekly follow-up visits to monitor his progress.

DISCUSSION:

Pilocytic Astrocytoma (PA) is a distinctive subtype of astrocytoma that occurs predominantly in children especially male at a median age of 10.5 years and their incidence decrease with age, which is in accordance with the retrospective study conducted by Cyrine S in 2013 [5].In our study also the patient is a 5 year male child which agrees with Cyrine's study.

Initial seizure management was achieved with Levetiracetam and Phenytoin, which are first-line agents for paediatric seizure control. Levetiracetam is frequently chosen due to its favorable side-effect profile and effectiveness in children [6].Phenytoin, while still widely used in paediatric seizures, was supplemented with Midazolam and Phenobarbitone for refractory seizures, which are typical for status epilepticus management [7, 8]. The decision to continue with the current AET regimen and adjust doses based on clinical response (e.g.,

gradually de-escalating levetiracetam and phenytoin doses) highlights the importance of individualizing seizure management in paediatric patients.

In addition to pharmacological management, electroencephalogram (EEG) monitoring, if performed, would have been valuable in evaluating ongoing seizure activity and adjusting antiepileptic therapy [9]. The absence of seizures after the introduction of Phenobarbitone and the stabilization of the patient's GCS score suggest that seizures were controlled, but close monitoring remained crucial due to the risk of recurrent seizures [8].

Given the resistance profile of the Acinetobacter species organism observed, including the resistance to Meropenem and Ceftazidime, but sensitivity to Levofloxacin, Cotrimoxazole, andAmikacin, the choice to use Levofloxacin, Cotrimoxazole, Tigecycline, and Colistin was appropriate. This is an example of timely antibiotic de-escalation following culture results, a cornerstone of antimicrobial stewardship, particularly in paediatric patients with complex, resistant infections. The shift to a more targeted therapy allowed for effective control of the infection while minimizing the risk of resistance and adverse effects associated with broad-spectrum antibiotics [10].

The management of the patient's respiratory status required a gradual transition from mechanical ventilation to spontaneous breathing. This is consistent with guidelines for paediatric critical care, which recommend a staged approach to weaning, particularly in patients with neurosurgical interventions. Initially, the patient was on Pressure Assisted Control (P-AC) ventilation and later transitioned to Synchronised Controlled Mandatory Ventilation (SCMV) and High Flow Nasal Cannula (HFNC). This staged weaning approach allowed for careful monitoring of the patient's respiratory effort and optimal oxygenation.

The decision to wean off invasive ventilation was driven by improving clinical parameters such as stable GCS, decreased seizure frequency, and better ventilatory support, as evidenced by the transition from HFNC to T-piece ventilation. As the patient's neurological status improved, transitioning from high-flow nasal cannula (HFNC) to non-invasive support reflects best practices in weaning paediatric patients from mechanical ventilation, ensuring minimal ventilator-associated complications and promoting recovery [11].

A key component of recovery in paediatric patients after major neurological surgery is rehabilitation. This case underscores the importance of early and comprehensive rehabilitation for paediatric patients with significant neurological deficits. As the patient’s CNS functional power improved from 0/5 to 2/5, physiotherapy played an essential role in promoting motor recovery. The multidisciplinary team approach, involving paediatric neurologists, intensivists, and physiotherapists, is crucial in improving long-term outcomes.

Although the patient showed early signs of right-sided weakness and tonic posturing, which are common after brain surgery, the gradual improvement in motor function highlights the importance of individualized rehabilitation protocols. Early physical therapy interventions, tailored to the patient's neurological status, are recommended to prevent long-term functional deficits in paediatric patients [12].

This case emphasizes the need for long-term follow-up in paediatric brain tumor survivors. After discharge, the patient continued on oral antiepileptic therapy, with scheduled weekly follow-ups to monitor seizure control, cognitive development, and neurological recovery.

Regular neurology and oncology consultations are essential to monitor for recurrence of seizures or tumor growth, ensuring timely interventions [13].

As with any paediatric oncology patient, the family was educated on the importance of adhering to follow-up appointments and seeking early intervention in case of any new symptoms, such as worsening seizures or neurological changes. The holistic approach to managing the child's epilepsy, infection, and rehabilitation provides a roadmap for similar future cases.

CONCLUSION:

Pilocytic astrocytoma (PA) is a common, benign brain tumor in children, typically presenting in the cerebellum with favourable outcomes. A 5-year-old male with recurrent PA experienced generalized tonic-clonic seizures and neurological deterioration, requiring urgent intervention. Treatment included antiepileptics, corticosteroids, and targeted antibiotics for infection, with gradual improvement in motor function and seizure control. This case underscores the importance of timely management, multidisciplinary care, and long-term follow-up for paediatric PA patients.

CONSENT:

All authors declare that oral informed consent was obtained from the patient for publication of this case report.

ETHICAL APPROVAL:

No ethical conflicts were observed. As a result, it was determined that formal ethical clearance was not deemed necessary.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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REFERENCES:

1. Koeller KK, Rushing EJ. From the archives of the AFIP: pilocytic astrocytoma: radiologic-pathologic correlation. Radiographics. 2004 Nov-Dec;24(6):1693-708.

2. Knight J, Karsonovich T, De Jesus O. Pilocytic Astrocytoma. [Updated 2024 Aug 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/sites/books/NBK560614/

3. Collins VP, Jones DT, Giannini C. Pilocytic astrocytoma: pathology, molecular mechanisms and markers. ActaNeuropathol. 2015 Jun;129(6):775-88.

4. Johnson DR, Brown PD, Galanis E, Hammack JE. Pilocytic astrocytoma survival in adults: analysis of the Surveillance, Epidemiology, and End Results Program of the National Cancer Institute. Journal of neuro-oncology. 2012 May;108:187-93.

5. Cyrine S, Sonia Z, Mounir T, Badderedine S, Kalthoum T, Hedi K, Moncef M. Pilocytic astrocytoma: a retrospective study of 32 cases. Clinical neurology and neurosurgery. 2013 Aug 1;115(8):1220-5.

6. Fiani B, Andraos C, Mabry I, Siddiqi J. A Comparison of Seizure Prophylaxis: Phenytoin Versus Levetiracetam. Cureus. 2021 May 11;13(5)

7. Hanley DF, Kross JF. Use of midazolam in the treatment of refractory status epilepticus. Clin Ther. 1998 Nov-Dec;20(6):1093-105.

8. Gulati S, Sondhi V, Chakrabarty B, Jauhari P, Lodha R, Sankar J. High dose phenobarbitone coma in paediatric refractory status epilepticus; a retrospective case record analysis, a proposed protocol and review of literature. Brain Dev. 2018 Apr;40(4):316-324.

9. Rayi A, Murr NI. Electroencephalogram. [Updated 2022 Oct 3]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan.
Available from: https://www.ncbi.nlm.nih.gov/books/NBK563295/

10. Lakbar I, De Waele JJ, Tabah A, Einav S, Martin-Loeches I, Leone M. Antimicrobial De-Escalation in the ICU: From Recommendations to Level of Evidence. Adv Ther. 2020 Jul;37(7):3083-3096.

11. Baalaaji AM. Weaning from Mechanical Ventilation in Children: Are We Getting It Right? Indian J Crit Care Med. 2021 Sep;25(9):974-975.

12. Li X, Kang Y, Tang H. The effects of early rehabilitation in high-risk infants with brain injury: a systematic review and meta-analysis. TranslPediatr. 2021 Oct;10(10):2467-2478.

13. Otth M, Wyss J, Scheinemann K. Long-Term Follow-Up of Pediatric CNS Tumor Survivors-A Selection of Relevant Long-Term Issues. Children (Basel). 2022 Mar 22;9(4):447.