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NEUROANESTHESIA MANAGEMENT IN POSTERIOR FOSSA PILOCYTIC ASTROCYTOMA SURGERY

Eva Indahwati[1*], Radian Ahmad Halimi[2], Dewi Yulianti Bisri[3]

[1]Neuroanesthesia Fellow, Neuroanesthesia Subspecialist Study Program, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia
[2] Lecturer and Neuroanesthesia Consultant, Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia
[3] Lecturer and Neuroanesthesia Consultant, Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia
***Corresponding author**: Eva Indahwati, dr_evahoo@yahoo.com

ABSTRACT
Pilocytic astrocytoma is a low-grade benign brain tumor commonly found in children and young adults. Although its clinical course is generally favorable, atypical presentations may lead to diagnostic challenges and delays in management. This case report describes the diagnostic process and neuroanesthetic considerations in a young adult patient with an infratentorial pilocytic astrocytoma presenting with unusual symptoms. A 19-year-old male presented with nausea, hematemesis, and headache, which later progressed to status epilepticus. An initial abdominal computed tomography (CT) scan revealed no abnormalities; however, subsequent brain CT and magnetic resonance imaging (MRI) demonstrated a large cystic mass with a solid component in the infratentorial region, resulting in non-communicating hydrocephalus. The patient was diagnosed with suspected pilocytic astrocytoma and underwent ventriculoperitoneal (VP) shunt placement to manage increased intracranial pressure (ICP). Definitive tumor resection was postponed due to elevated liver function parameters requiring stabilization. The patient subsequently underwent posterior fossa craniotomy and tumor excision under propofol-based total intravenous anesthesia (TIVA). Neuroanesthetic management focused on maintaining cerebral perfusion, controlling ICP, preserving hemodynamic stability, and minimizing the risk of complications associated with posterior fossa surgery, including venous air embolism and pneumocephalus. Invasive arterial blood pressure monitoring was performed, and intraoperative hemodynamic parameters remained stable without evidence of increased ICP. The patient was successfully extubated in the operating room due to adequate consciousness and respiratory function. Postoperative recovery was uneventful, and the patient was discharged after four days. Histopathological examination confirmed pilocytic astrocytoma. This case emphasizes the importance of recognizing atypical manifestations of infratentorial pilocytic astrocytoma and demonstrates that propofol-based TIVA can provide effective ICP and hemodynamic control during complex neuroanesthetic.

KEYWORDS: infratentorial tumor, pilocytic astrocytoma, total intravenous anesthesia (propofol)

INTRODUCTION
Astrocytomas originate from astrocytes and are the most common type of glioma, accounting for up to 60% of brain tumors (Kapoor & Gupta, 2025). The WHO classifies astrocytomas based on their growth rate and spread to surrounding tissues. Pilocytic astrocytoma is the most common type of grade 1 astrocytoma. These tumors are typically benign, grow slowly, and generally have a good prognosis (Knight et al., 2025). Pilocytic astrocytomas frequently occur in children and account for 25% of all central nervous system tumors in children. They can also affect adults, though at a lower rate of 5% (Knight et al., 2025; Mitschang et al., 2025). Symptoms vary depending on the tumor's location and size but are generally related to increased intracranial pressure, such as headaches, nausea, vomiting, balance disturbances, or changes in gait. Pilocytic astrocytomas most commonly originate in the cerebellum, hypothalamus, and optic pathways (Kapoor & Gupta, 2025; Knight et al., 2025).
The posterior fossa contains vital structures such as the cerebellum, brainstem, and cranial nerves. The posterior fossa is a narrow and rigid compartment because it is surrounded by bony structures; therefore, an increase in volume due to a tumor mass, edema, or hemorrhage can lead to increased intracranial pressure, brainstem compression, and even life-threatening complications. Surgical procedures in this area present significant anesthesiological challenges. Appropriate anesthetic techniques are required to maintain hemodynamic stability, low intracranial pressure, and adequate cerebral perfusion, as well as to avoid complications such as venous air embolism (VAE), *paradoxical air embolism* (PAE), hemodynamic disturbances, and ventilation problems. It is important to conduct a preoperative evaluation, particularly to rule out possible cranial nerve dysfunction that could lead to dysphagia, loss of the gag reflex, or laryngeal dysfunction all of which impact airway protection and increase the risk of aspiration. In addition, cardiac screening is necessary to rule out a *patent foramen ovale* (PFO), which can increase the risk of complications (Bisri & Bisri, 2016; Cottrell & Patel, 2024).
Total Intravenous Anesthesia (TIVA) using propofol and fentanyl is often the preferred choice for posterior fossa surgery compared to inhalation techniques. Propofol can proportionally reduce *the cerebral metabolic rate of*

oxygen ($CMRO_2$) and *cerebral blood flow* (CBF), thereby lowering intracranial pressure without disrupting cerebral autoregulation. The combination of propofol and opioids also allows for stable intraoperative pain control, suppresses the sympathetic response, and facilitates rapid recovery of consciousness, enabling postoperative neurological evaluation.

This report presents a case involving a male patient diagnosed with a pilocytic astrocytoma in the cerebellum who underwent a posterior fossa craniotomy for tumor resection, and discusses the anesthetic management implemented using a propofol-based TIVA technique.

CASE REPORT

Medical History

A 19-year-old male presented to the hospital complaining of nausea, vomiting blood, and headaches that had persisted for the past two weeks. An abdominal CT scan showed normal results, and the patient was admitted for observation with a diagnosis *of profuse vomiting*, *hematemesis*, and *headache*. One month later, the patient returned to the hospital complaining of four episodes of recurrent seizures characterized by generalized rigidity and eyes rolling upward, consistent with status epilepticus. He continued to experience headaches and had lost 7 kg in weight. A brain CT scan revealed non-communicating hydrocephalus, suspected to be caused by a cystic lesion in the cerebellar region. *A ventriculoperitoneal (VP) shunt* procedure was subsequently performed. The patient's condition was stable following the VP shunt placement, and the patient was discharged with phenytoin therapy at 3 × 100 mg tablets. The patient underwent a contrast-enhanced brain MRI, which revealed a pilocytic astrocytoma, leading to a plan for surgery. During preoperative evaluation, the patient was found to have impaired liver function; consequently, the surgery was postponed, and the patient received treatment to improve liver function. After liver function improved, the patient was rescheduled for a posterior fossa craniotomy. The patient complained of unsteadiness while walking; headaches had resolved; the patient was still able to eat and drink independently; and there were no swallowing difficulties or a history of choking. The patient could speak clearly with no slurred speech or hoarseness. The medical history revealed no prior illnesses; the patient denied a history of hypertension, heart disease, allergies, or lung disease.

Physical Examination

Physical examination of this patient revealed a height of 169 cm and a weight of 67 kg. The patient was fully conscious with *a Glasgow Coma Scale* (GCS) score of 15. Blood pressure was 110/70 mmHg, pulse rate was 90 beats per minute, and respiratory rate was 18 breaths per minute. The patient complained of a sensation of imbalance and unsteadiness when walking long distances. No abnormalities were found in other examinations, such as for dysdiadochokinesis, dysmetria, ataxia, or nystagmus. Cranial nerve examinations particularly of nerves IX, X, XI, and XII showed normal results. No abnormalities were found in the gag reflex, swallowing, phonation, or tongue muscle function. However, on the Romberg test, the patient fell to the left.

Supporting Tests

Initial laboratory tests showed significant elevation of liver function markers, with SGOT at 188 U/L, SGPT at 89 U/L, non-reactive HBsAg, non-reactive anti-HAV, and non-reactive anti-HCV. After undergoing treatment, liver function parameters improved, with SGOT at 43 U/L, SGPT at 32 U/L, prothrombin time (PT) at 11.8 seconds (control: 13.8 seconds), and APTT at 32.9 seconds (control: 38.8 seconds). Other parameters included Hb 16.8 g/dL, hematocrit 46.5%, white blood cells 8,910/µL, platelets 381,000/µL, urea 0.82 mg/dL, creatinine 22 mg/dL, potassium 4.27 mmol/L, chloride 103 mmol/L, sodium 142.8 mmol/L, random blood glucose (RBG) 120 mg/dL.

HIV test: Non-reactive

A contrast-enhanced MRI scan revealed a cystic mass with solid components in the infratentorial region involving the left cerebellum, the vermis, and part of the right cerebellum, with intralesional calcifications. The mass caused narrowing of the fourth ventricle and the aqueduct of Sylvius, but there were no signs of obstructive hydrocephalus. A VP shunt with its tip in the right lateral ventricle was visible. There are signs of microvascular ischemia in the centrum semiovale of the right and left corona radiata.

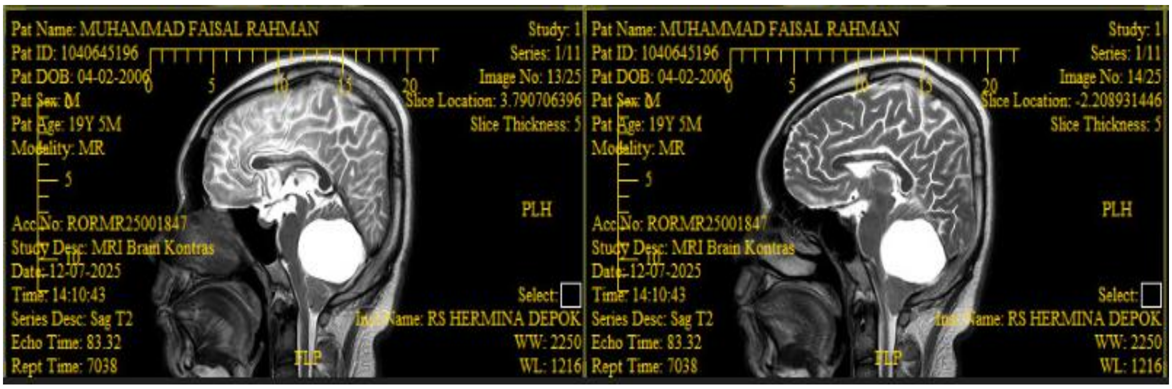

Figure 1. Contrast-Enhanced.Brain MRI.

Chest X-ray revealed no abnormalities of the heart or lungs.

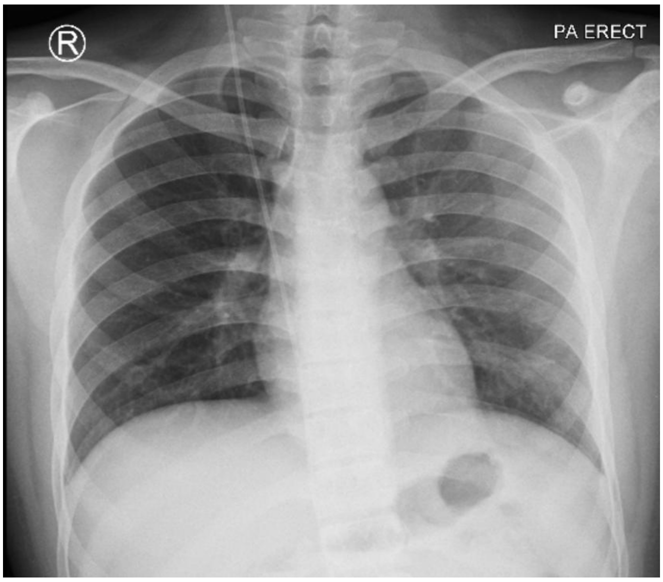

Figure 2. Normal chest X-ray findings with no cardiopulmonary abnormalities.

The patient was diagnosed with a suspected pilocytic astrocytoma of the infratentorial region with hydrocephalus following *VP shunt* placement.

Anesthesia Management

Preoperative preparation involved a comprehensive examination, particularly regarding cardiac, pulmonary, and neurological function. The patient in this case had stable hemodynamic status, with no abnormalities in respiratory or cardiovascular function, particularly no heart murmur. In this patient, an echocardiogram was not performed; only a physical examination and an electrocardiogram were conducted. An echocardiogram should be performed, especially in patients with a murmur or suspected PFO, as this test can identify *intracardiac shunts* that could potentially cause serious complications during posterior fossa surgery. No neurological abnormalities were found in the patient, including impaired gag reflex, laryngeal dysfunction, dysphagia, or tongue muscle dysfunction. The patient was educated about the procedure and *informed* consent was obtained; the patient was placed on a fast and *an intravenous line* was inserted to administer maintenance fluids in the ward. Blood components (PRC) were prepared and ready for use, and the intensive care unit and operating room were set up with the necessary equipment, such as an anesthesia machine, *airway management* equipment, *an endotracheal tube*, STATICS, *a syringe pump*, vital sign monitors, an $EtCO_2$ monitor, as well as anesthetic and *emergency* medications.

During preinduction monitoring in the operating room, the patient's GCS was 15, blood pressure was 117/74 mmHg, pulse rate was 80 beats per minute, respiratory rate was 18 breaths per minute, SpO_2 was 98%, and temperature was 36°C. Preoxygenation was performed, followed by induction using 100 µg of fentanyl (1–3 µg/kg body weight), 100 mg of propofol (1–2.5 mg/kg body weight), 40 mg of the muscle relaxant rocuronium (0.6–1 mg/kg body weight), and 80 mg of lidocaine (1–1.5 mg/kg body weight). The patient was then intubated using *a* non-kinking size 7.5 *endotracheal tube* (ETT) with a depth of 21 cm. Mechanical ventilation was administered using *volume-controlled ventilation* (VCV) with a tidal volume of 400 ml, a rate of 15, PEEP of 5, and FiO_2 of 50%. Anesthesia was maintained with propofol-based total intravenous anesthesia (TIVA) (50–100 mcg/kg body weight/min). *An arterial line* was placed, and *peripheral* access was established using *an 18-G Abbocath*; the patient was then positioned in *the right lateral decubitus position*. Fentanyl and rocuronium were administered *intermittently*.

The surgery lasted 2 hours. During the procedure, hemodynamic parameters remained stable, with systolic blood pressure between 115–125 mmHg, diastolic blood pressure between 72–80 mmHg, heart rate between 70–90 beats per minute, oxygen saturation between 99–100%, and $EtCO_2$ between 25–28. Fluid management during the surgery involved the administration of 1,000 mL of Sterofudin. Blood loss during the surgery was approximately 200 mL, and urine output was 300 mL.

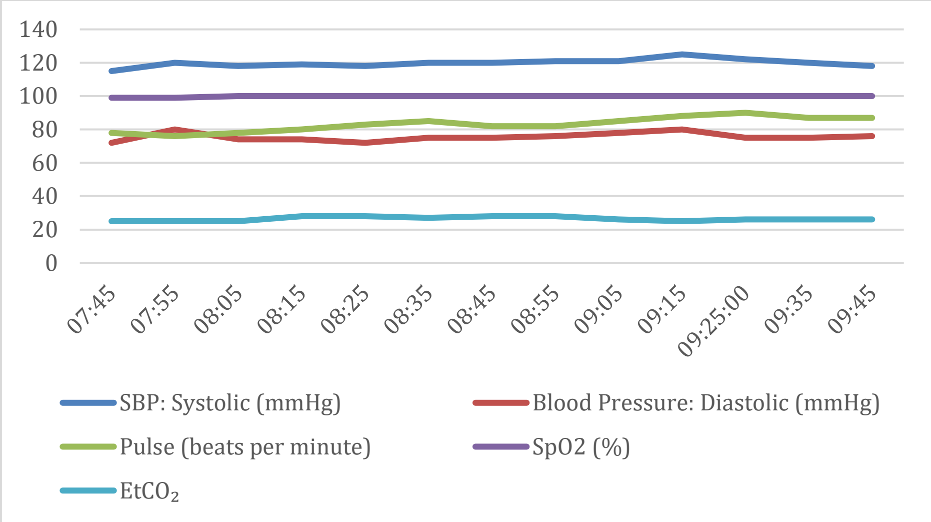

Figure 3. Hemodynamics During Surgery

After the surgery is complete, a comprehensive assessment is conducted of the patient's neurological and respiratory status, level of consciousness, ability to open their eyes and follow simple commands, return of airway protective reflexes (gag reflex and cough), respiratory muscle strength, and hemodynamic stability. Once it was confirmed that the patient met the criteria for safe extubation, extubation was performed in the operating room, and the patient was then transferred to the intensive care unit (ICU).

Table 1. Postoperative Patient Assessment After Infratentorial Craniotomy

	Day 1	**Day 2**
Subjective (S)	mild headache	headache +-
Objective (O)	GCS E4M6V5 BP 125/66 HR 85 bpm Respiratory rate 14 breaths/minute with a nasal cannula at 3 L/min; SpO2 100% Pupils isocoric, 3 mm; light reflex +/+; conjunctiva anemic -/-, sclera icteric -/-; lungs: vesicular breath sounds +/+, rhonchi -/-, wheezing -/-; abdomen: soft, bowel sounds (+), tenderness (-) motor function 5/5	GCS E4M6V5 BP 112/78 HR 75 bpm Respiratory rate 15 breaths/minute SpO2 99% on room air pupils isocoric 3 mm, light reflex +/+ Anemic conjunctiva -/-, icteric sclera -/- Lung sounds: Vesicular +/+, rhonchi -/-, wheezing -/- Abdomen: Soft, bowel sounds (+), tenderness (-) Motor function 5/5
Assessment (A)	*Post-craniotomy due to infratentorial SOL*	*Post-craniotomy due to infratentorial SOL*
Plan (P)		
Treatment	1. Paracetamol 3 x 1 g IV 2. Omeprazole 40 mg IV twice daily 3. Tranexamic acid 3 × 500 mg IV 4. Vitamin K 2×1 5. Mannitol 4 × 100 mL 6. Phenytoin 2×100 mg 7. Sterofundin 42 mL/hour 8. Ampicillin-Sulbactam 3 x 1.5 g 9. Dexamethasone 3x1 amp IV 10. Gradual transition to a soft diet	11. Paracetamol 1 g IV 3 times daily 12. Omeprazole 2 times 40 mg IV 13. Tranexamic acid 3 times 500 mg IV 14. Vitamin K 2x1 15. Mannitol: taper off until stopped 16. Phenytoin 2x100 mg 17. Sterofundin 42 ml/hour 18. Ampicillin-Sulbactam 3 x 1.5 g 19. Dexamethasone 3x1 amp IV 20. Gradual transition to a soft diet 21. The patient is being treated in a general ward

Throughout the course of treatment, the patient remained in stable condition, with a GCS of 15 and normal vital signs and oxygen saturation. No new neurological deficits were observed; the pupils were isocoric with good light reflexes, and there were no signs of increased intracranial pressure. Two days later, the patient was transferred to a general ward and then discharged with the following medications: dexamethasone 1 tablet 3 times daily, omeprazole 1 tablet 2 times daily, glauseta 1 tablet 3 times daily, cefixime 200 mg 2 times daily, and paracetamol 500 mg 3 times daily.

RESULTS AND DISCUSSION

Pilocytic astrocytoma is the most common low-grade glioma (*WHO grading*) in children. This tumor accounts for 25% of all central nervous system tumors in children, and as many as 75% of cases occur before the age of 20. Pilocytic astrocytoma most commonly originates in the cerebellum, hypothalamus, and optic pathways (Knight et al., 2025). Cerebellar astrocytomas fall under the category of infratentorial tumors in the posterior fossa. Patients in these cases present with clinical manifestations such as nausea, vomiting, and progressively worsening headaches. These symptoms indicate increased intracranial pressure due to the tumor in the cerebellum. The tumor can also cause obstruction of cerebrospinal fluid flow in the fourth ventricle, leading to hydrocephalus, which further increases intracranial pressure; consequently, the patient underwent *ventriculoperitoneal (VP) shunt* placement. Other symptoms, such as hematemesis and seizures, are atypical for astrocytomas in the cerebellum. Hematemesis may occur due to mucosal irritation caused by prolonged, continuous vomiting. Seizures are also rare in lesions of the posterior fossa. This is because the cerebellum is not directly connected to cortical areas that can trigger seizures. However, seizures can occur because the tumor can compress the surrounding brain tissue, including supratentorial regions. This condition can disrupt cerebral perfusion, which may trigger abnormal electrical activity and lead to seizures. Other symptoms of cerebellar lesions, such as ataxia, *dysmetria,* tremor, dysarthria, and nystagmus were not observed in this patient (Bisri & Bisri, 2016; Knight et al., 2025).

The posterior fossa is a narrow cavity containing the brainstem and cerebellum and surrounded by rigid bone. This structure contains numerous motor and sensory nerves, cranial nerves, and vital centers that control the respiratory and cardiovascular systems. An increase in the volume of the posterior fossa due to a tumor, edema, or hemorrhage can lead to increased intracranial pressure and life-threatening complications (Vibhuti et al., 2025). Therefore, the management of anesthesia and surgery performed in the posterior fossa presents several challenges, such as prolonged operative time, extreme surgical positions, the risk of increased intracranial pressure and brainstem stimulation, intraoperative monitoring techniques, and potential complications such as venous air embolism and pneumocephalus (Bisri & Bisri, 2016).

The principle of neuroanesthesia in posterior fossa surgery is to maintain cerebral homeostasis and prevent secondary brain injury. Cerebral homeostasis is influenced by *cerebral perfusion pressure* (CPP), cerebral metabolism ($CMRO_2$), cerebral blood flow (CBF), and intracranial pressure. Certain conditions, such as severe hypoxia and hypercapnia, can cause vasodilation of cerebral blood vessels, increasing CBF and intracranial pressure. Therefore, it is important to monitor airway stability and respiratory patterns to maintain optimal oxygenation. In addition, circulatory factors must also be considered, as mean arterial pressure (MAP) can affect cerebral autoregulation. A MAP that is too high can increase CBF and intracranial pressure, while a MAP that is too low can lead to decreased cerebral perfusion, thereby increasing the risk of ischemia. The placement *of an arterial line* during surgery helps monitor blood pressure *in real time (Butterworth et al., 2018)*.

The principles of anesthesia management for brain surgery, including posterior fossa craniotomy, require the application of the ABCDE principles to prevent secondary brain injury. *The airway* must be kept clear at all times, as hypoxia and hypercapnia can increase cerebral blood flow and intracranial pressure. In brain tumor surgery, *breathing* is focused on -controlled ventilation to achieve a $PaCO_2$ of 30–35 mmHg and a PaO_2 of 100–200 mmHg. *Circulation* is focused on controlling blood pressure, as it can affect cerebral perfusion pressure (CPP = MAP – ICP). Procedures such as laryngoscopic intubation, pin placement, skin incisions, skull drilling, or extubation can increase blood pressure and therefore require careful attention. Additionally, mechanical factors that can increase cerebral venous pressure such as coughing, straining, the Trendelenburg position, abdominal pressure, chest wall resistance, and obstruction of the large neck veins must be avoided. Target parameters include normotension, iso-osmolar fluids, normovolemia, and normoglycemia. Regarding *medication,* we must avoid drugs and techniques that can increase intracranial pressure and administer medications with neuroprotective effects. *Environmental* management involves maintaining a core body temperature of 35°C during surgery and 36°C postoperatively to preserve optimal metabolic conditions (Bisri & Bisri, 2019).

Preoperative preparation must be carried out thoroughly to assess the patient's medical history and condition. Important examinations to be performed before a posterior fossa craniotomy include ruling out increased intracranial pressure, a neurological examination, a brainstem assessment, and an evaluation of the planned surgical position and potential complications resulting from the surgery. Elevated intracranial pressure can be identified through symptoms and diagnostic tests such as *CT scans* and MRIs. In this patient, *a VP shunt* had already been implanted to manage elevated intracranial pressure prior to surgery. A comprehensive neurological examination, particularly regarding cranial nerve function, is also essential. Cranial neuropathy causing loss of the gag reflex, laryngeal dysfunction, dysphagia, and tongue muscle dysfunction can compromise airway protection and increase the risk of aspiration. Brainstem compression due to a tumor mass can cause respiratory and cardiovascular dysfunction, impaired consciousness, or *dysautonomia*; therefore, the placement *of an arterial line* should be considered. Placement of an arterial line allows for *continuous*, *real-time* invasive blood pressure monitoring to maintain cerebral perfusion, prevent increased intracranial pressure, and rapidly detect hemodynamic changes resulting from venous air embolism. Additionally, *an arterial line* facilitates repeated arterial blood sampling, for example, for blood gas analysis (Bisri & Bisri, 2016; Butterworth et al., 2018; Cottrell & Patel, 2024).

Prior to surgery, the patient in this case. received therapy such as phenytoin, which was administered to prevent recurrent seizures following status epilepticus by stabilizing neuronal membranes through the inhibition of sodium channels. The use of phenytoin prior to surgery requires caution because this drug can cause arrhythmias, hypotension, and interactions with anesthetic agents through CYP450 enzyme induction, which accelerates the metabolism of certain intravenous anesthetics and muscle relaxants(Hardman et al., 2018; Kolb & Farley, 2024).

Positioning is an important part of the surgical procedure. Proper positioning provides optimal surgical conditions for the surgeon, as well as good access to the airway and veins and adequate monitoring for the anesthesiologist. An examination is necessary to rule out the presence of *a cardiac murmur* (risk *of patent foramen* ovale [PFO]), right ventricular heart failure, or pulmonary hypertension. In the presence of these conditions, surgery in a sitting position is not recommended because it can increase the risk of venous air embolism. The presence of a PFO can also increase the risk of *paradoxical air embolism* (PAE) because air entering the venous circulation has the potential to pass into the arterial circulation through the opening in the PFO (*a shunt* from the right atrium to the left). The patient in this case was positioned in *the right lateral decubitus* position. The lateral position can affect hemodynamics by reducing *venous return, stroke- -volume, and cardiac output*, as well as increasing peripheral vascular resistance. In addition, respiratory function may also be affected because compression of the right lung can cause a decrease in ventilation. However, gravity will increase blood flow to the right lung, resulting in higher perfusion compared to the left lung. An imbalance in perfusion and ventilation can reduce oxygenation. These changes are important to note because impaired oxygenation and reduced cardiac output can affect cerebral perfusion and intracranial pressure stability. Furthermore, the lateral position may also increase the risk of brachial plexus injury and quadriplegia due to extreme neck flexion. Nevertheless, this position is safer because it reduces the risk of venous air embolism and provides good surgical access (Bisri & Bisri, 2016; Cottrell & Patel, 2024; Rozet & Vavilala, 2007).

Premedication varies from person to person, depending on the patient's physical condition, increased intracranial pressure, and level of anxiety. Patients with elevated intracranial pressure should avoid sedatives, as they can trigger hypercapnia and further increase intracranial pressure. After preoxygenation, anesthesia induction is performed gradually to avoid spikes in blood pressure or heart rate and to prevent coughing, thereby preventing an increase in intracranial pressure. Anesthesia induction is performed using fentanyl, propofol, rocuronium, and lidocaine. These four agents serve to suppress pain and sympathetic nervous system stimulation while providing hypnotic and muscle-relaxing effects. Intubation is then performed using a 7.5-sized non-kinking endotracheal tube (ETT) to ensure airway patency, followed by mechanical ventilation in *volume-controlled ventilation* (VCV) mode. Controlled mechanical ventilation is crucial to prevent hypercapnia, which can increase cerebral blood flow and intracranial pressure. During surgery, the patient's hemodynamics remained stable, with $EtCO_2$maintainedat approximately 25–28. Mild hypocapnia can cause cerebral vasoconstriction, reduce CBF, and lower intracranial pressure (Bisri & Bisri, 2016; Butterworth et al., 2018).

Anesthesia was maintained using a propofol-based TIVA (*Total Intravenous Anesthesia*) technique (50–100 mcg/kg body weight/min), accompanied by the administration of oxygen and *water*. Fentanyl was also administered intermittently in small doses as an additional analgesic agent. The use of TIVA with propofol and fentanyl is considered to offer greater advantages for posterior fossa craniotomy compared to inhalation anesthesia. Propofol administration reduces the oxygen metabolic rate ($CMRO_2$) and cerebral blood flow (CBF), thereby lowering intracranial pressure. In addition, the administration of propofol and fentanyl can also lower systemic blood pressure, thereby reducing *cerebral perfusion pressure* (CPP) and intracranial pressure. In contrast, inhalation anesthesia can cause cerebral vasodilation, which increases cerebral blood flow and intracranial pressure. Increased intracranial pressure can complicate surgery, thereby increasing the risk of brain injury and ischemia. With the use of propofol, cerebral autoregulation can be maintained, thereby keeping cerebral blood flow stable(Cole et al., 2007; Intarakhao et al., 2025). Propofol also provides better cerebral relaxation compared to inhalation agents. Optimal cerebral relaxation is crucial in neurosurgery, particularly during posterior fossa craniotomy, as it minimizes retraction stress on brain tissue and reduces the risk of ischemic injury (Intarakhao et al., 2025). TIVA, which primarily uses propofol and low-dose opioids, is believed to facilitate faster recovery of consciousness, allowing for immediate postoperative neurological assessment. In fact, inhalational agents are also capable of rapidly restoring the patient's consciousness, but the effects of increased CBF and ICP associated with inhalational agents may prolong the patient's recovery process. Furthermore, propofol-based TIVA is associated with fewer postoperative complications compared to inhalational anesthesia (Cole et al., 2007; Nguyen et al., 2023; Oh et al., 2024).

One of the drawbacks of the TIVA technique is the lack of an anesthetic concentration indicator, unlike in inhalation techniques. However, inadequate anesthesia can lead to *intraoperative awareness*. This is a condition in which the patient is conscious and has explicit memories after surgery, which can result in psychological complications. In this case, monitoring of anesthesia depth is not performed using *the Bispectral Index* (BIS), but rather PRST (*Pressure, Rate, Sweating, Tears*). PRST is used to assess the depth of anesthesia based on clinical parameters. The assessment is based on the stability of blood pressure and pulse rate, as well as sympathetic manifestations such as sweating and tears. PRST assessments must be performed repeatedly to minimize the risk of intraoperative awareness (Bullard et al., 2025; Smajic et al., 2011).

Extubation following posterior fossa craniotomy requires special consideration due to the risk of brainstem dysfunction, cranial nerve disorders (particularly the IXth, Xth, and XIIth nerves), and a higher potential for airway obstruction compared to other intracranial procedures. Before extubation, it must be confirmed that the patient's neurological function has recovered for example, the patient is awake, able to follow commands, and demonstrates the return of protective airway reflexes. The appropriateness of postoperative extubation is also determined based on the nature and extent of the surgery. Prolonged surgical procedures and manipulation of the brainstem increase the risk of residual hypoventilation and brainstem edema; therefore, the endotracheal tube (ETT) should be maintained until the patient regains consciousness. In these circumstances, additional sedation may be required until full recovery is achieved. Persistent postoperative hypertension and bradycardia in previously normotensive patients should prompt the anesthesiologist to consider the possibility of brainstem compression, ischemia, or hematoma. Additionally, attention should be paid to postoperative nausea and vomiting, which are side effects of anesthesia and surgery. These conditions require immediate management as they can lead to increased intracranial pressure and the risk of postoperative hemorrhage(Cottrell & Patel, 2024).

In this case, following surgery, no brainstem dysfunction, cranial nerve dysfunction, or potential airway obstruction was found; therefore, the patient was immediately extubated and transferred to the ICU. This patient was administered tranexamic acid and mannitol during ICU care. Tranexamic acid is an antifibrinolytic agent that works by inhibiting the activation of plasminogen and plasmin, thereby helping to stabilize blood clots and reduce postoperative bleeding. The administration of tranexamic acid in the postoperative phase aims to prevent secondary bleeding, particularly in the surgical site. Meanwhile, mannitol was administered to control intracranial pressure. Mannitol acts as an osmotic diuretic that increases plasma osmolarity, thereby drawing fluid from the brain parenchyma into the blood vessels, reducing brain volume, alleviating cerebral edema, and lowering intracranial pressure. This therapy is crucial for patients following posterior fossa craniotomy because this area has a narrow anatomical compartment, meaning that postoperative edema can rapidly lead to brainstem compression and neurological deficits. The combination of tranexamic acid and mannitol is intended to maintain hemodynamic stability, control bleeding, and maintain intracranial pressure (Cottrell & Patel, 2024).

Once the patient's condition stabilized, he was transferred to a general ward and then discharged with a regimen of cefixime, paracetamol, dexamethasone, omeprazole, and Glauceta. Cefixime is a third-generation cephalosporin antibiotic that is effective against certain Gram-negative and Gram-positive bacteria. Paracetamol is used as an analgesic to control postoperative pain without increasing the risk of bleeding or neurological side effects that may arise with the use of NSAIDs or opioids. Corticosteroids can reduce vasogenic edema and lower intracranial pressure. In patients with peritumoral edema, corticosteroids typically lower intracranial pressure (ICP) and improve neurological symptoms within 48 hours. Dexamethasone is the corticosteroid of choice due to its minimal mineralocorticoid effects, high potency, and long half-life (Cottrell & Patel, 2024). Omeprazole is a *proton pump inhibitor* that reduces gastric acid secretion and helps lower the risk of gastritis, ulcers, and gastrointestinal bleeding caused by high-dose corticosteroid therapy. Glauseta is a medication containing acetazolamide. Acetazolamide helps reduce cerebrospinal fluid production by inhibiting carbonic anhydrase in the choroid plexus. This mechanism can help lower intracranial pressure (Farzam & Abdullah, 2025; Prasad, 2016).

Venous air embolism (VAE) is a significant complication of posterior fossa craniotomy, particularly in the sitting position, because this position facilitates the entry of air due to subatmospheric pressure in the exposed veins and involves venous structures that cannot collapse, such as the diploic veins and dural sinuses. Air can also enter through *the burr hole*, due to head support-related injury, or during the removal of a central venous catheter while the head is in an upright position. Air bubbles entering the venous circulation can cause mechanical obstruction of pulmonary vascularization, endothelial activation, cytokine release, and free radical formation, which subsequently lead to pulmonary hypertension, impaired gas exchange, hypoxemia, hypercapnia, bronchoconstriction, and a decrease in $ETCO_2$. A decrease *in venous return* due to impaired venous blood flow can also reduce cardiac output and systemic blood pressure, thereby increasing the risk of myocardial or cerebral ischemia. The earliest clinical manifestations of VAE include a rapid decrease in $ETCO_2$, an increase in pulmonary artery pressure, air aspiration through the central venous catheter, and changes in blood gas levels characterized by a decrease in PaO_2 and an increase in $PaCO_2$. Symptoms that appear later may include a heart murmur, hypotension, arrhythmias, and even cardiac arrest. Therefore, early detection is crucial and can be achieved through monitoring of hemodynamic changes, $ETCO_2$, precordial Doppler, *central venous catheter* (CVC), and *transesophageal echocardiography* (TEE). Management of VAE during the intraoperative period aims to stop the entry of air, remove air that has already entered, and correct ventilatory and hemodynamic disturbances. As soon as findings such as a decrease in $ETCO_2$ or Doppler changes are detected, the surgeon must be immediately informed to temporarily halt the surgery and seal the source of air entry via saline irrigation or direct compression. If available, air aspiration via a central venous catheter (CVC) in the right atrium should be performed immediately, as this has been shown to reduce morbidity. The patient's position may be adjusted by lowering the head to heart level, while increasing oxygen to 100%, discontinuing N_2O use, and administering intravenous fluids or vasopressors to maintain perfusion. In the postoperative phase, management aims to prevent hypoxemia and detect cerebral air embolism via funduscopy or imaging such as CT scan or MRI. Administration of 100% oxygen helps accelerate the elimination of air bubbles, and reintubation may be considered if the patient exhibits neurological deficits after extubation. Hyperbaric oxygen therapy may be administered if available, particularly within six hours of the event, as it has been shown to improve neurological outcomes. In this case, the patient is positioned in the right lateral decubitus position, which reduces the risk of VAE compared to a sitting position; however, vigilance is still required (Bisri & Bisri, 2016; Butterworth et al., 2018; Cottrell & Patel, 2024).

Paradoxical air embolism (PAE) is also a serious complication of posterior fossa surgery. PAE occurs when air from the venous circulation enters the arterial circulation. This condition often occurs in patients with *a patent foramen ovale* (PFO). A PFO allows air to pass from the right atrium to the left atrium (right-to-left shunt), causing air to enter the systemic circulation. This condition can lead to ischemic stroke, focal neurological deficits, impaired cerebral perfusion, and hemodynamic instability (Mair et al., 2020).

Another complication that may occur is pneumocephalus. A craniotomy performed in a sitting position allows air to enter the subarachnoid space. Cerebrospinal fluid lost during surgery may be replaced by air. The expansion of pneumocephalus after dural closure can compress the brain. Postoperative pneumocephalus can cause delayed awakening and persistent neurological dysfunction. Prevention can also be achieved by avoiding the use of N2O. The patient in this case did not experience complications such as venous air embolism or pneumocephalus (Butterworth et al., 2018).

CONCLUSION

Infratentorial pilocytic astrocytoma is a common condition in children and young adults and can present with nonspecific clinical manifestations. Tumors in the posterior fossa pose a challenge for anesthesiologists due to the confined anatomical space, the risk of increased intracranial pressure, brainstem stimulation, and complications related to the surgical position. The use of propofol-based *Total Intravenous Anesthesia* (TIVA) has been shown to offer advantages in posterior fossa surgery. This agent reduces $CMRO_2$ and CBF, maintains cerebral autoregulation, lowers intracranial pressure, and provides optimal cerebral relaxation to facilitate the surgical procedure. Combining it with fentanyl provides hemodynamic stability and good quality of intraoperative analgesia, while also allowing for rapid recovery for postoperative neurological evaluation.

Overall, the successful management of this case was achieved through a comprehensive perioperative approach: optimization of preoperative conditions, appropriate anesthetic techniques (TIVA), close hemodynamic monitoring, and anticipation of potential risks associated with surgery in the posterior fossa.

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