Case Report

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One Lung Ventilation and Erector Spinae Plane Block in a Child with Posterior Mediastinal Tumour: A Case Report

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ABSTRACT

Tumours located in the posterior mediastinum of children present unique anaesthetic challenges because they are in proximity to large vessels and the airway, which puts the child at risk for airway compression, difficulty breathing, and loss of haemodynamic stability during surgery. This case describes the perioperative anaesthetic management of this eight-year-old girl, weighing 23 kg, with a large ganglioneuroma that extended from D1 to D7 in the posterior mediastinum. Because of the risk of airway compromise, an Awake Fibreoptic Intubation (AFOI) was performed while allowing the child to breathe on her own before General Anaesthesia (GA) was induced. To achieve lung isolation and enable One-Lung Ventilation (OLV), a 5 Fr paediatric bronchial blocker was used under fibreoptic guidance. During OLV, lung-protective ventilatory strategies were used, and oxygenation and haemodynamic stability were maintained throughout. Postoperatively, she received analgesia with an Erector Spinae Plane Block (ESPB) using 0.25% bupivacaine under ultrasound guidance. Her intraoperative and postoperative courses were uncomplicated. This case stresses the need for careful preoperative assessments, maintenance of spontaneous ventilation until airway control has been established, appropriate techniques for lung isolation, and multimodal analgesic therapy for safe anaesthetic management of posterior mediastinal tumours in children.

Keywords: Ganglioneuroma, Mediastinal neoplasms, Paediatric anaesthesia, Thoracic surgery

CASE REPORT

An eight-year-old female with a weight of 23 kg presented to the surgery department with an acute one-day history of dry cough without any associated difficulty breathing, difficulty sleeping, or other symptoms such as chest pain. She had similar episodes six months back, but medical help was not sought by the parents then. She had no past medical history or prior surgeries. The child's prenatal period and development were unremarkable. There was no history of any adverse drug reactions to medication or other health-related issues.

For the preanaesthetic evaluation, the child was awake and stable with a heart rate of 110 beats per minute and with blood pressure within normal limits. She had an adequate mouth opening of three finger breadths, a Mallampati Class-I, and normal dentition, and a full range of motion of all neck joints. Upon performing a respiratory examination, the child had equal ventilation on both sides of her chest at rest and no wheezing or abnormal breath sounds. The cardiovascular and neurological examinations were all normal. The preoperative laboratory studies were normal. A two-dimensional echocardiogram demonstrated that the heart was structurally and functionally normal with a left ventricular ejection fraction of 60%.

A well-defined mass in the posterior mediastinal region between thoracic vertebrae D1 and D7 was identified on Contrast-Enhanced Computed Tomography (CECT) imaging of the thorax. The mass (6.9×7.5×7.2 cm) caused displacement of vascular structures and the oesophagus, but no obstruction to the oesophagus. The mass partially encircled the aorta, but did not invade it. There was an enlargement of the left neural foramina at the D6-D7 level. Biopsy showed evidence of a ganglioneuroma. The patient was classified as American Society of Anaesthesiologists' (ASA) physical status II.

Adequate fasting prior to surgery was observed. ASA standard monitors were attached, and a 22-G IV cannula was secured. Given the size of the posterior mediastinal mass and the potential for airway compromise from muscle relaxation induced by anaesthesia, AFOI was performed. Glycopyrrolate (0.004 mg/kg=0.09 mg) was given as premedication. Sedation was carefully titrated with midazolam (0.03 mg/kg=0.7 mg) and fentanyl (2 μg/kg=46 μg) while spontaneous ventilation was provided. The trachea was topically anaesthetised with 2 mL 2% lidocaine by nebulisation and 3 mL 2% lidocaine through the bronchoscope working channel.

An AFOI was performed, and a 5.5 mm cuffed endotracheal tube was placed under direct visualisation. Correct placement was determined by capnography and auscultation. After securing the airway, GA was induced using intravenous propofol at 2 mg/kg (46 mg), followed by neuromuscular blockade with atracurium at 0.5 mg/kg (11.5 mg). Two-lung ventilation was initiated with a tidal volume of about 4-5 mL/kg, following which a 5 Fr paediatric bronchial blocker was placed through the endotracheal tube via a fibreoptic bronchoscope for lung isolation, and appropriate positioning was confirmed by bronchoscopy. OLV was then initiated by inflating the blocker cuff to seal off the operative bronchus while ventilating the dependent lung with pressure-controlled ventilatory mode. During the OLV phase of the procedure, ventilation was maintained at an FiO_2 of 0.6-0.8, tidal volume of 6 mL/kg (approximately 130-140 mL), respiratory rate of 18-22 breaths/min (to keep end-tidal carbon dioxide at 35-40 mmHg), and positive end-expiratory pressure of 5 cm H_2O. The peak airway pressures were kept < 25 cm H_2O. Oxygen saturation was maintained >95% throughout the OLV period.

Anaesthesia was maintained with a combination of sevoflurane (MAC 1-1.2) and oxygen/air (FiO2-50%), intermittent doses of atracurium (0.1 mg/kg), and fentanyl as required. Intraoperative blood loss was approximately 30 mL and did not require transfusion; positioning in the lateral decubitus position was uneventful without haemodynamic or respiratory compromise. The surgery was then conducted, with careful monitoring. Once the tumour had been surgically excised, a bilateral ESPB using 0.25% bupivacaine, approximately 6 mL on each side for postoperative analgesia, was performed using an ultrasound at the level of T4. A chest tube was placed prior to closure, and satisfactory lung re-expansion was achieved under direct vision. The bronchial blocker was deflated and removed under fibreoptic vision. There was clinical evidence of bilateral lung expansion. Neuromuscular blockade was reversed with neostigmine 0.05 mg/kg (1.15 mg) and glycopyrrolate 0.01 mg/kg (0.23 mg). The child was extubated after meeting standard extubation criteria and transferred to the paediatric intensive care unit for monitoring. The postoperative period was unremarkable, with adequate analgesia for six hours. Rescue analgesia was given with paracetamol 15 mg/kg (345 mg) every six hours following this. The child was transferred to the paediatric ward after eight hours and discharged on postoperative day 4. At the one-month follow-up, the child was found to be healthy with no complications.

DISCUSSION

The management of anaesthesia for posterior mediastinal tumours comes with unique difficulties because of the proximity between the mass and important cardiorespiratory structures. Posterior mediastinal masses are typically considered to have a lower risk than anterior mediastinal masses. However, there is potential for significant airway or haemodynamic difficulties in the presence of large posterior mediastinal masses or those closely associated with the airway, great vessels, or heart. The presence of these difficulties will require careful evaluation and thorough perioperative planning to ensure patient safety and good outcomes [1,2]. Similar challenges have been highlighted by Chandana SK et al., and Saiyed A et al., where tumour proximity to major vessels and airway led to intraoperative respiratory and haemodynamic concerns, reinforcing that posterior mediastinal masses are not always benign from an anaesthetic perspective [3,4].

Airway management is a key concern in these cases. Compression of the trachea/bronchi can occur with a large mediastinal tumour, especially when the patient is placed under GA. The extent of tracheal/bronchial compression may not be apparent while the patient is upright. However, with loss of muscle tone after induction of GA, compression may become more significant. AFOI is often used to secure the airway before the induction of GA to reduce the risk of airway obstruction. AFOI allows for preservation of spontaneous ventilation until the airway is definitively secured, and reduces the risk of complete airway obstruction during induction. Awake techniques are particularly useful when imaging studies reveal proximity to or compression of the airway [5,6]. In contrast, Saiyed A et al., reported successful conventional intravenous induction after confirming adequate ventilation, emphasising that airway strategy should be individualised based on preoperative imaging and clinical presentation [4].

The OLV is indicated for providing surgical exposure from either a thoracotomy or thoracoscopy. Achieving effective lung isolation in children can be challenging due to the limited availability of double-lumen tubes. In addition to double-lumen tube use, bronchial blockers (e.g., Arndt-type) can be placed under fibreoptic bronchoscopy guidance as an alternative to double-lumen tubes for OLV. Proper placement of the bronchial blocker and confirmation of lung isolation will help ensure the surgical site remains free of smoke while still allowing adequate ventilation of the dependent lung. The goal of OLV ventilation is to provide adequate oxygenation for the patient with minimal chance of barotrauma to the dependent lung during OLV. To achieve this goal, a moderate fraction of oxygen during inspiration, a protective tidal volume, an adjusted rate of respiration, and positive end-expiratory pressure should be utilised according to the child's physiological parameters [7,8]. Chandana SK et al., demonstrated the utility of a Fogarty catheter for lung isolation in a child with distorted airway anatomy due to mediastinal shift. At the same time Saiyed A et al., used intentional endobronchial intubation as a rescue technique in the absence of paediatric lung isolation devices, though this was associated with recurrent hypoxaemia [3,4].

Another concerning aspect of OLV is maintaining adequate ventilation and oxygenation in the child during the procedure. The functional residual capacity in children is less than that of adults; therefore, their oxygen consumption per unit weight is much greater than that of adults. Children are often more susceptible to developing hypoxaemia if they are undergoing OLV. Continuous monitoring of the child's oxygen saturation, along with adjustment of the ventilatory parameters used during OLV, is vital to ensure adequate gas exchange throughout the entire OLV process [8,9]. Episodes of desaturation during lateral positioning and OLV as reported by Saiyed A et al., as well as the need for permissive hypercapnia described by Chandana SK et al., highlight the importance of vigilant intraoperative monitoring and flexibility in ventilatory strategies [3,4].

A very important factor to consider is postoperative pain management. Pain management using regional analgesia techniques postoperatively is much more effective than general pain control using systemic opioids. Use of these techniques improves comfort postoperatively and can help not only the healing process but also the overall amount of time until total recovery. ESPB was used successfully to provide adequate postoperative analgesia [10,11]. Chandana SK et al., further emphasised the benefit of a continuous ESPB catheter for prolonged analgesia, compared to single-shot techniques, particularly in extensive combined procedures [3]. Bakshi SG et al., highlighted the growing role of ultrasound-guided continuous ESPB catheters in paediatric postoperative pain management, particularly in cases where neuraxial techniques are contraindicated due to intraspinal tumour extension. They further emphasised that continuous ESPB catheters can provide effective, opioid-sparing analgesia and facilitate recovery in complex thoracic oncology cases [12].

A multidisciplinary group of anaesthesiology, surgery, radiology, and intensive care is important to help develop a plan for perioperative care, anticipate and prepare for possible complications, and develop a plan to manage unanticipated complications. The use of preoperative imaging to delineate the relationship between the major blood vessels/airway and the tumour, and to ensure clear lines of communication among all team members, is necessary for proper management [1,13].

[Table/Fig-1] summarises the anaesthetic management strategies, OLV techniques, and key perioperative takeaways from paediatric posterior mediastinal mass cases [3,4,12].

Author	Case description	Anaesthetic management	Takeaway points
Verma N and Kamble PS, 2026, India	Eight-year-old (23 kg) female with large (6.9×7.5×7.2 cm) posterior mediastinal ganglioneuroma (D1-D7) displacing vascular structures without invasion. No airway compression. ASA II.	AFOI was performed while maintaining spontaneous ventilation due to the risk of airway compromise. After securing the airway, GA with neuromuscular blockade was administered. A paediatric bronchial blocker facilitated OLV with lung-protective ventilation and close monitoring. Bilateral ultrasound-guided ESPB provided postoperative analgesia. The child was extubated after meeting criteria and monitored in the paediatric intensive care unit.	• Maintain spontaneous ventilation until the airway is secured. • AFOI enhances safety in mediastinal masses. • Bronchial blockers allow controlled paediatric OLV. • Lung-protective ventilation is essential. • ESPB improves postoperative recovery.
Chandana SK et al., 2023, India [3]	Four-year-old girl (13.8 kg) with large paraspinal ganglioneuroma (T1-T9) causing spinal cord compression and spastic paraplegia. Mass abutted the aorta and compressed the left main bronchus. Factor XII deficiency. Combined spinal and thoracic surgery planned.	After inhalational induction and intubation with invasive monitoring, total intravenous anaesthesia was used for motor evoked potential monitoring. Following intraspinal excision, lung isolation for thoracotomy was achieved using a 3Fr Fogarty catheter placed in the left main bronchus under fibreoptic bronchoscopy guidance despite a mediastinal shift. OLV was managed with oxygen supplementation and permissive hypercapnia. A continuous ultrasound-guided ESPB catheter provided prolonged analgesia. The child was electively ventilated overnight and extubated the next day.	• Careful planning is required for combined neurosurgical and thoracic procedures. • Total intravenous anaesthesia optimises motor evoked potential monitoring. • Fogarty catheter useful for paediatric OLV in distorted anatomy. • Anticipate airway deviation and desaturation during OLV. • Continuous ESPB provides sustained analgesia.

Saiyed A et al., 2014, India [4]	Eight-year-old male (25 kg) with a large (6×6×10 cm) posterior mediastinal mass partially encasing the aorta, presenting with dyspnoea and cough. Trachea central. Planned thoracotomy for excision.	Standard intravenous induction with muscle relaxation was performed after confirming adequate ventilation, followed by invasive arterial and central venous monitoring. Maintenance was with inhalational anaesthesia and neuromuscular blockade. In the lateral position, desaturation episodes occurred and were treated with 100% oxygen. Due to the unavailability of a paediatric double-lumen tube, intentional endobronchial intubation was performed to achieve OLV, which was associated with recurrent hypoxaemia. Significant intraoperative blood loss led to hypotension requiring fluid resuscitation and transfusion. The child was electively ventilated postoperatively in the intensive care unit and extubated the next day.	• Lateral positioning can precipitate desaturation in mediastinal masses. • Endobronchial intubation is a rescue technique for OLV when dedicated devices are unavailable. • Anticipate major blood loss during posterior mediastinal tumour excision. • Invasive monitoring is vital for haemodynamic instability. • Postoperative elective ventilation may be required in high-risk cases.
Bakshi SG et al., 2020, India [12]	Two paediatric cases (four-year-old, 11 kg; three-year-old, 15 kg) with posterior mediastinal ganglioneuroblastoma/ ganglioneuroma with intraspinal extension and spinal canal involvement. Epidural/paravertebral techniques avoided due to neuraxial disease.	Case 1: GA with thoracotomy; postoperative respiratory deterioration requiring ventilation. Ultrasound-guided ESPB catheter placed at D8 after recovery; bupivacaine boluses used with multimodal analgesia. Case 2: GA with significant blood loss and postoperative ventilation; ESPB catheter placed at D5 postoperatively under ultrasound guidance with levobupivacaine boluses. Both cases avoided neuraxial blocks due to tumour extension.	• ESPB is valuable when neuraxial blocks are contraindicated. • Continuous ESPB catheters improve analgesia and reduce opioid need. • Ultrasound guidance improves safety in distorted anatomy. • Multidisciplinary planning is essential. • ESPB may reduce postoperative respiratory complications.

[Table/Fig-1]: Comparative anaesthetic management and key takeaways in paediatric mediastinal mass resections [3,4,12].

CONCLUSION(S)

In order to safely perform posterior mediastinal tumour excision in children, exhaustive preoperative assessments must be conducted prior to developing an appropriate anaesthesia plan accounting for the likelihood of airway compression and ventilating and haemodynamic instability. Preoperative airway management includes AFOI, appropriate use of bronchial blockers for lung isolation, use of lung protective ventilator strategies, and adequate regional analgesia. A multidisciplinary collaborative approach to these patients, combined with the identification of potential complications preoperatively, is critical for achieving the best possible outcomes.

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