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A Child with a Large Posterior Mediastinal Mass with Intraspinal Extension—Perioperative Anesthetic Challenges and Importance of Postoperative Analgesia

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Abstract

A 4-year-old girl child with a large posterior mediastinal mass with intraspinal extension (T2–T5) presented with paraplegia and bowel and bladder dysfunctions. She was planned for T1 to T6 laminoplasty and excision of the intraspinal tumor, followed by thoracotomy and excision of the posterior mediastinal tumor. Neurogenic tumors are common posterior mediastinal masses in children. These children pose many anesthetic challenges because of their size, location, and invasiveness. Challenges include difficult intubation, ventilation due to compression of the tracheobronchial tree, hemodynamic fluctuations because of compression of vital structures, associated autonomic dysfunction, and intraoperative bleeding. Pediatric lung isolation for thoracotomy and excision, obtaining motor evoked potential response in a child with poor functional grade status, and selecting appropriate analgesia techniques in the presence of neurological deficits are some of the added challenges. Anesthetic management and the use of a continuous erector spinae plane block for postoperative analgesia are highlighted in this report.

Keywords

- erector spinae plane block
- neurogenic tumors
- pediatric
- posterior mediastinal mass
- one-lung ventilation

Introduction

Neurogenic tumors are the most common posterior mediastinal tumors in children. Anesthetic challenges often depend on size, location, presentation, and intraspinal extension. Here, we present the perioperative anesthetic challenges of a child with a large posterior mediastinal tumor with intraspinal extension causing paraplegia planned for laminoplasty and excision of the intraspinal tumor followed by thoracotomy and excision of the mediastinal mass. The importance of postoperative analgesia using a continuous erector spinae plane block (ESPB) catheter to enhance recovery is highlighted in this report.

Case Report

A 4-year-old girl with a body mass index of 15 kg/m^2 (height, 96 cm; weight, 13.8 kg) presented with back pain, progressive difficulty in walking, and urinary and bowel incontinence. On examination, the higher mental function and cranial nerves were normal. Examination of the motor and sensory systems revealed spastic paraplegia (lower limb muscle power grade, 0/5) with the loss of sensation below the umbilicus. There were no symptoms suggestive of airway or esophageal compression. Routine preoperative blood investigations were within normal limits except for an isolated elevation of activated partial thromboplastin time

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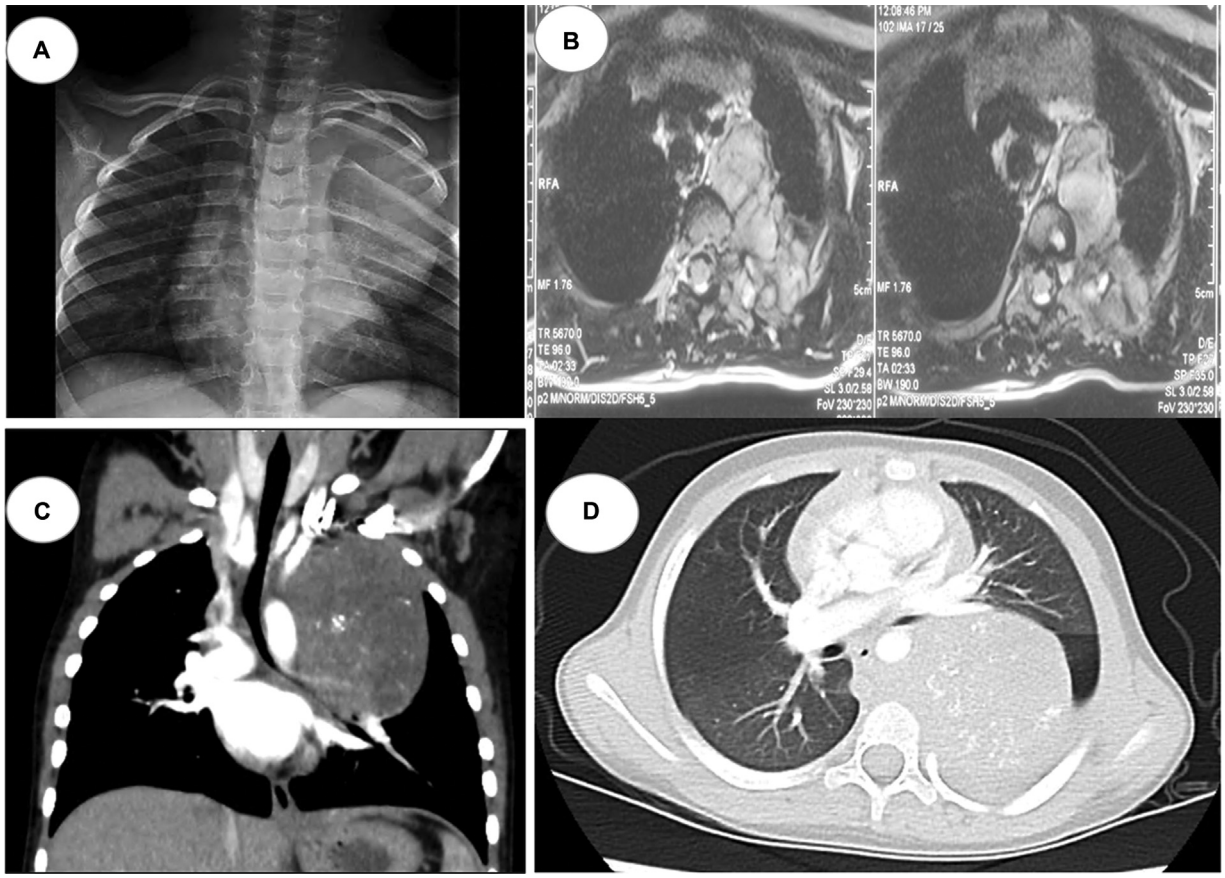

Fig. 1 Chest X-ray posteroanterior view showing a well-lobulated mass causing mediastinal shift. (**A**) Magnetic resonance imaging spine axial view (T1-weighted, postcontrast) showing a posterior mediastinal mass with intraspinal extension. (**B**) Computed tomographic thorax coronal (**C**) and axial views (**D**) showing the mass compressing the left bronchial lumen.

that was investigated and diagnosed with factor-XII (Hageman factor) deficiency which did not warrant any intervention.

Chest X-ray (►**Fig. 1A**), computed tomography, and magnetic resonance imaging of the thorax and spine revealed a large ($7.5 \times 6.0 \times 6.0$ cm) paraspinal mass along the left border of the upper thoracic spine(T1–T9) with an extension into the neural foramina (T2–T5), and the epidural space causing compression of the spinal cord (►**Fig. 1B**). The lesion abutted the distal arch and proximal descending aorta and compressed the left main bronchus (LMB), resulting in luminal narrowing (►**Fig. 1C, D**). She was scheduled for intraspinal tumor excision in a prone position under motor evoked potential (MEP) monitoring followed by excision of the mediastinal mass in the right lateral decubitus position (LDP).

After placing the standard, American Society of Anesthesiologists monitors, inhalational induction was carried out with oxygen, nitrous oxide (50%), sevoflurane (2–4%), and a 22G intravenous cannula was inserted. After ensuring mask ventilation, fentanyl (2 µg/kg) was administered for analgesia, and the child was paralyzed with atracurium (0.5 mg/kg) and intubated with a 5 mm cuffed endotracheal tube (ETT). The intubation response was obtunded with propofol (0.5mg/kg), fentanyl (0.5 µg/kg), and preservative-free lignocaine(1.5mg/kg). Another large-bore peripheral cannula (20G) and an 8 cm, 5F right subclavian triple lumen catheter were inserted for fluid, blood, and vasopressor administration. The right radial artery was cannulated for invasive monitoring of blood pressure and blood gas. Anesthesia was maintained with total intravenous anesthesia using propofol and fentanyl infusions and was titrated to maintain a bispectral index between 40 and 50. A subanesthetic dose of ketamine (0.5mg/kg bolus and 0.1mg/kg/h infusion) was administered to augment analgesia and the MEP response and prevent central sensitization, opioid-induced hyperalgesia, and opioid tolerance. The blood pressure was maintained at the high normal range. The baseline blood gas analysis was within normal limits. The MEP response could not be elicited despite augmenting with ketamine and keeping all the physiological parameters within normal limits. From the neurophysiology side, MEP stimulation was maximized by increasing the train of stimulation to five with a stimulus intensity of 180 to 250V.

After completion of intraspinal tumor excision, the child was repositioned supine in preparation for one-lung ventilation (OLV) for thoracotomy. A 5 mm ETT was changed to a 4 mm uncuffed tube to place the 3F Fogarty catheter (FC) into the LMB. A 3F, FC was railroaded through the ETT and placed in the LMB under fiberoptic bronchoscopy (FOB) guidance on

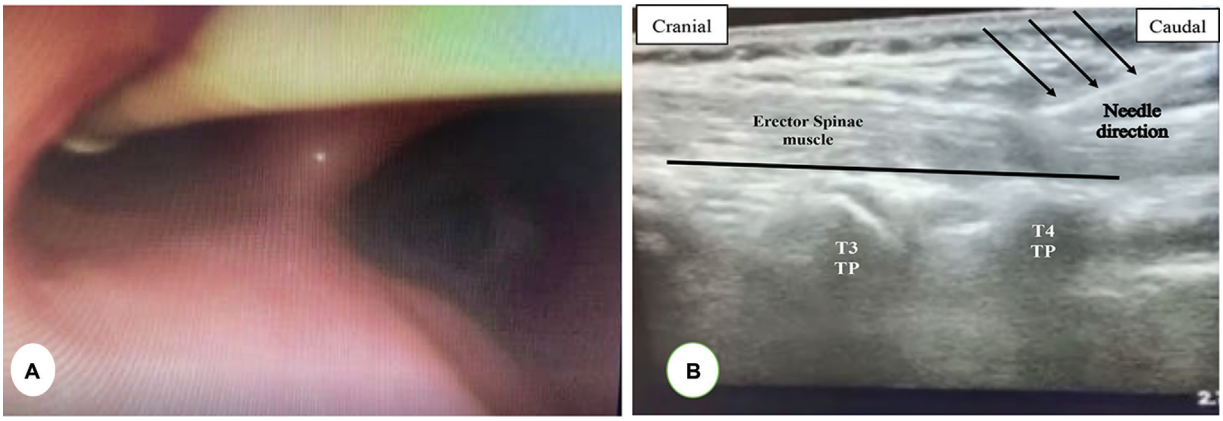

Fig. 2 The 3F Fogarty catheter in situ (**A**) in the left main bronchus for left lung isolation. (**B**) The ultrasonography showing the anatomy and needle direction for the erector spinae plane block (in-plane technique) at the T3 and T4 levels. TP, transverse process.

the third attempt (►**Fig. 2A**). Due to the mediastinal shift, the trachea was aligned with the right main bronchus (RMB); thus, the FC slipped into the RMB. After successful placement of the FC, the 4 mm ETT was withdrawn and placed outside the mouth over the FC, and a new 5 mm cuffed ETT was secured into the trachea. The position of the FC was confirmed with FOB, and the balloon was inflated with 0.5 mL saline under vision. The patient was positioned in the right LDP, and OLV was initiated. During OLV, desaturation episodes were treated with 100% oxygen and permissive hypercapnia (end-tidal carbon dioxide, 40–45) was maintained. At the end of tumor resection, the balloon of the FC was deflated, and two-lung ventilation was initiated after recruitment. Surgery was completed with 500 mL of blood loss, which was replaced with 350 mL of packed red cells.

After surgery, ultrasonography-guided (linear probe, 4–12 MHz) ESPB was performed at the left T3 and T4 levels using a 20G Touhy needle (►**Fig. 2B**). A total of 10 mL 0.2% ropivacaine was administered (5 mL at each level), and a 22G catheter was placed (catheter length—2.5 cm beyond the needle tip) under the erector spinae muscle. Since it was a long-duration surgery with a late evening finish, the child was ventilated overnight and extubated. Eight mL of 0.2% ropivacaine was administered through the ESPB catheter before extubation to ease the extubation process by aiding analgesia. Over the next 72 hours, the child received 0.2% ropivacaine (8 mL) every 8th hour through an ESPB catheter and paracetamol (15mg/kg) every 6th hour for analgesia. The ESPB catheter-based analgesia technique helped to prevent autonomic dysreflexia and helped in faster recovery. The neurological status remained unchanged at discharge, and the biopsy was reported as ganglioneuroma.

Discussion

Schwannomas, ganglioneuromas, and neuroblastomas are neurogenic tumors that account for 80% of posterior mediastinal tumors in children. They are asymptomatic initially and hence present as large mediastinal masses.[1–7] Children with large posterior mediastinal tumors with intraspinal extension pose many challenges for an anesthesiologist because of their size, location, and invasiveness.[1–7] The various challenges include difficult intubation, ventilation, hemodynamic fluctuations because of tumor compression on vital structures, associated autonomic dysfunction with intraspinal extension, and intraoperative bleeding. In addition, obtaining the MEP response with poor functional grading, isolating one lung for thoracotomy and excision in small children with bronchial compression, and appropriate techniques for perioperative analgesia in children with neurological deficits are some of the additional challenges we faced in this case.

Posterior mediastinal masses occupy more than one compartment of the mediastinum as there are no anatomical boundaries between mediastinal compartments.[7] It should be borne in mind that cardiorespiratory compression often manifests after anesthesia induction and positioning owing to the pliable and cartilaginous nature of airways, complicating ventilation and hemodynamics.[7] Hence, one should anticipate and be prepared to manage the complications after induction and positioning. A thorough understanding of the radiological imaging of tumor extension and compression to nearby vital structures is paramount for meticulous planning and execution of anesthesia without major adverse events.

The worsening of spinal cord compression and ischemia, albeit rare, mandates the use of intraoperative neuromonitoring. The likelihood of obtaining an MEP response is low due to poor functional grade and muscle power.[8–10] In our case, despite taking all measures from the anesthesia and neurophysiology side to augment MEP, the MEP response could not be obtained. This could be due to the poor functional grading in our patient.

Pediatric lung isolation and management of hypoxia and hypercapnia during OLV is a challenge in the pediatric age group because of pathology-associated anatomical distortion, technicalities, and the availability of resources.[11] In our case, we could place the FC only during the third attempt because of the anatomical distortion of tracheobronchial anatomy by the tumor.

Providing good postoperative analgesia is paramount not only to enhance recovery but also to avoid pain-induced

autonomic hyperreflexia in a paraplegic child.[12] Systemic administration of opioid-based, patient-controlled analgesia was not considered an option because the child had a high thoracic lesion with a borderline respiratory reserve; even mild respiratory depression can increase morbidity. Epidural analgesia and paravertebral block in a paraplegic child are not feasible options; hence, we chose to provide an ESPB using a catheter for postoperative analgesia. Continuous ESPB has recently been utilized for analgesia in children undergoing thoracotomy for tumor removal.[12–14] Our report adds to the literature regarding the same. Because of continuous ESPB, no postoperative hemodynamic fluctuations were noted, and the child had a faster postoperative recovery.

Conclusion

Perioperative management of a large posterior mediastinal mass in the pediatric population involves several challenges, such as airway, bleeding, neuromonitoring, and pain management, which require a meticulous and collaborative multidisciplinary approach. The importance of an opioid-free effective analgesia plan for these procedures in pediatric patients cannot be overemphasized, and we were able to successfully provide it with the help of a continuous EPSB catheter-based technique.

Conflict of Interest
None declared.

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