

## Anesthetic Management of a Pediatric Patient with a Giant Anterior Mediastinal Mass and Dextrocardia: A Case Report

Diego Ariel Aguilar Gutiérrez<sup>\*1</sup>, Edwin de Jesús Varguez Salas<sup>2</sup>, Victoria de los Ángeles Viveros Cámara<sup>2</sup>

<sup>1</sup>Third-year resident in the Department of Anesthesiology, Yucatán Health Services. General Hospital “Dr. Agustín O’Horán,” Mérida, Yucatán, Mexico. Faculty of Medicine, Universidad Autónoma de Yucatán.

<sup>2</sup>Attending physician in the Department of Anesthesiology, Yucatán Health Services. General Hospital “Dr. Agustín O’Horán,” Mérida, Yucatán, Mexico.

### ABSTRACT

**Introduction:** Anterior mediastinal masses in pediatric patients pose an anesthetic challenge due to the risk of airway compression and cardiovascular collapse, further complicated by anomalies such as dextrocardia and thoracic deformities. **Case presentation:** A 6-year-old male patient with dextrocardia, pectus excavatum, and chronic biomass exposure presented with progressive respiratory distress. CT imaging revealed a 13 × 9 × 13 cm cystic-solid lesion occupying the left hemithorax and anterior mediastinum. The anesthetic risk was classified as ASA III due to tumor size and associated comorbidities. Thoracotomy, complete tumor resection, and left pneumonectomy were performed. **Anesthetic approach:** An individualized general anesthesia strategy was implemented, emphasizing invasive monitoring, hemodynamic support, and airway management under indirect visualization. Balanced anesthesia included sevoflurane, dexmedetomidine, magnesium sulfate, opioids, and vasopressors. The surgery lasted 10 hours, with significant blood loss requiring transfusion support. **Outcomes:** The patient was admitted to the pediatric intensive care unit under mechanical ventilation and vasopressor support, both successfully withdrawn within 24 hours. Histopathological analysis confirmed a mature cystic teratoma. The patient was discharged without complications. **Conclusion:** This case highlights the importance of individualized anesthetic planning and multidisciplinary coordination in high-risk pediatric patients with mediastinal masses. Early identification of clinical and radiologic warning signs, proactive hemodynamic management, and appropriate airway control are essential to prevent potentially fatal complications..

**KEYWORDS:** Pediatric anesthesia, Anterior mediastinal mass, Mature cystic teratoma, Difficult airway, Hemodynamic monitoring, Pneumonectomy.

### ARTICLE DETAILS

**Published On:**  
**13 August 2025**

**Available on:**  
**<https://ijmscrs.com>**

### INTRODUCTION

Mediastinal masses are rare and comprise a heterogeneous group of tumors that account for 3% of thoracic surgeries in children (75% benign, 25% malignant). They may be located in the anterior, middle, or posterior mediastinum.<sup>1</sup>

Anterior mediastinal tumors carry a high risk of morbidity and mortality due to the frequent occurrence of airway obstruction and cardiovascular collapse during anesthetic induction. Both are potentially fatal and have a complication incidence of 7–18%.<sup>2</sup>

Clinical presentation depends more on the tumor’s location than its size, due to the anatomical features of the thoracic

cavity. For this reason, anterior mediastinal tumors are the most symptomatic. Cough and dyspnea are the most common presenting symptoms, occurring in up to 60% of cases.<sup>3</sup>

Regarding preoperative assessment, imaging studies are the most useful diagnostic tools for this pathology. The gold standard is computed tomography (CT), which provides detailed anatomical information, defines tumor boundaries, and its relationship to intrathoracic structures. This imaging helps determine the compartment of origin. Additionally, it allows evaluation of the tumor’s relationship to vascular structures and helps differentiate between solid, cystic, fatty, or vascular masses.<sup>4</sup>

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Although rare in pediatrics, anterior mediastinal masses pose a significant challenge in anesthetic management due to their proximity to vital structures such as the trachea, great vessels, and heart. Compression of these structures can cause airway obstruction, reduced cardiac output, and difficulty with ventilation, especially during anesthesia induction and tumor manipulation. These complications may result in cardiorespiratory collapse, even in the absence of overt preoperative symptoms.<sup>5</sup>

In these patients, preoperative risk assessment must be based on findings of airway and cardiovascular compression. The patient's preferred position of comfort must be identified, and anesthetic planning should be detailed, covering induction, maintenance, and postoperative periods.<sup>6</sup>

### CASE PRESENTATION

Male patient, 6 years old, student, originally from Molas, Yucatán, with a history of dextrocardia diagnosed at birth, no follow-up with pediatric cardiology, and pectus excavatum. No relevant family medical history. His psychosocial background reveals a low-income family with limited access to specialized healthcare. He lives in a rural home with chronic exposure to biomass due to the use of firewood for cooking, contributing to prolonged pulmonary exposure. His diet is predominantly low in calories and protein, with occasional intake of fruits and vegetables and no nutritional oversight. His lifestyle is sedentary, consistent with his socioeconomic status and rural environment. The patient has an incomplete vaccination record and lacks an official immunization card. He has a history of recurrent undocumented respiratory infections and multiple unspecified empirical treatments without satisfactory outcomes. No economic, linguistic, or cultural barriers were identified that could affect the diagnosis or medical intervention.

Symptoms began 24 days prior to hospital admission with paroxysmal cough, unquantified fever unresponsive to antipyretics, and progressive respiratory difficulty. He received multiple courses of treatment by a private physician without improvement and with unspecified therapies. The initial evaluation included a comprehensive physical examination with the following findings: Weight: 16 kg, BP: 90/50 mmHg, HR: 115 bpm, RR: 26 rpm, Temp: 36.5°C, O<sub>2</sub> Sat: 99%, conscious, alert, Glasgow score: 15. Moist mucous membranes, Mallampati I, Patil-Aldrete I, unrestricted neck extension (Bellhouse-Dore I), age-appropriate tongue, stable dentition with caries and poor dental hygiene. No facial or neck masses observed. Chest exam showed no signs of respiratory distress, presence of non-productive cough, not emetogenic or cyanotic, presence of pectus excavatum, decreased ventilatory movements on the left side with hypoventilation in the left hemithorax and no added sounds. The precordium was displaced to the right, with no audible murmurs. No pathological findings were observed in the abdomen or extremities.

Laboratory tests revealed leukocytosis ( $16.9 \times 10^3/\mu\text{L}$ ), hemoglobin 9.3 g/dL, platelets  $494 \times 10^3/\mu\text{L}$ . As part of the imaging assessment, a chest X-ray (anteroposterior view) was performed, showing a radiopaque image with mediastinal shift, initially interpreted as a probable pulmonary abscess (Figure 1). Subsequently, a contrast-enhanced chest CT scan revealed a semi-rounded  $13 \times 9 \times 13$  cm mass with a cystic component in the left hemithorax and a solid component in the anterior mediastinum, consistent with a mediastinal tumor (Figure 2). Cardiology ruled out significant structural heart disease. The pediatric surgical oncology team suspected an abscessed mediastinal teratoma.

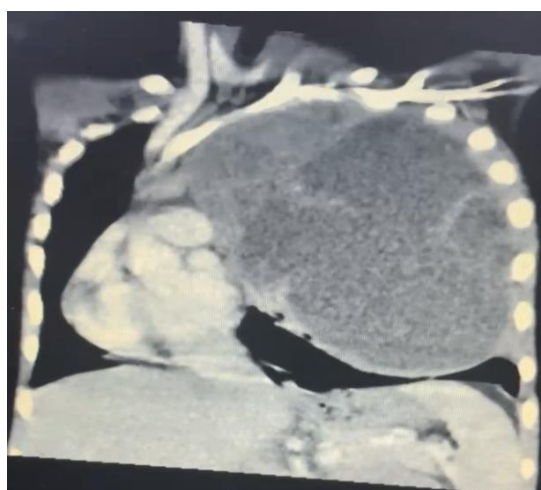


**Figure 1. Contrast-enhanced computed tomography of the chest (coronal view). A well-defined mass with a mixed appearance and a predominant cystic component is observed, occupying the left hemithorax and displacing mediastinal structures toward the right.**

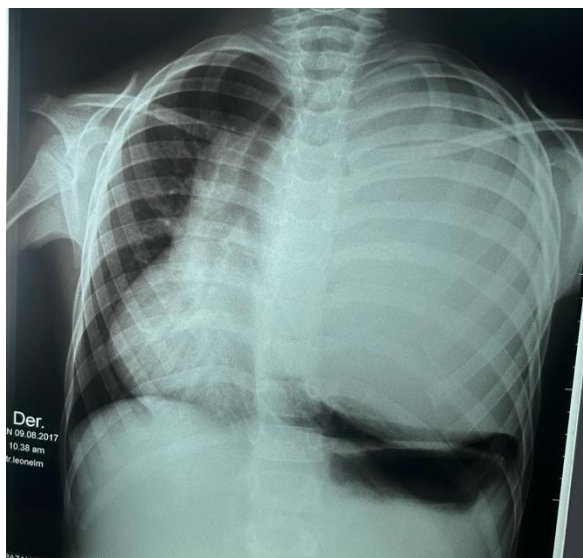


**Figure 2. Anteroposterior chest radiograph. Image showing opacity in the left hemithorax with contralateral mediastinal shift.**

The diagnostic reasoning included the following main differential diagnoses: pulmonary abscess, mediastinal tumor (lymphoma, neuroblastoma, teratoma), and complicated pneumonia with empyema. The presence of a mixed solid-cystic mass, associated with cardiac displacement and congenital history, pointed toward the diagnosis of mediastinal teratoma, which was confirmed by the pediatric surgical oncology team and histopathological examination. A guarded prognosis was considered prior to the intervention due to the size and pulmonary compromise caused by the tumor.

**Therapeutic Intervention:** Given the patient's clinical deterioration, a thoracotomy with resection of the mediastinal mass was scheduled. The anesthetic risk was classified as ASA III due to the high surgical risk. In the operating room, monitoring included ECG, SpO<sub>2</sub>, NIBP, temperature, and placement of a right femoral central venous catheter. The intervention involved both pharmacologic and surgical approaches. Premedication included midazolam 3 mg IV, glycopyrrolate 0.1 mg IV. Induction was achieved with sevoflurane 3 vol%, fentanyl 80 mcg, propofol 20 mg IV, and

rocuronium 30 mg IV. Orotracheal intubation was performed using videolaryngoscopy (POGO 100%) with a size 5 tube and cuff pressure of 25 cmH<sub>2</sub>O.

Anesthesia was maintained with:

- Dexmedetomidine 0.7 – 0.5 mcg/kg/hr (total dose 40 mcg)
- Magnesium sulfate 10 mg/kg/hr (total dose 200 mg)
- Fentanyl 0.026–0.052 mcg/kg/min (total dose 390 mcg)
- Sevoflurane 2 – 2.5 vol% (MAC 1)
- Vasopressors: norepinephrine 0.15 – 0.3 mcg/kg/min, dopamine 5 – 15 mcg/kg/min, vasopressin 0.001 – 0.0015 IU/kg/min, epinephrine 0.1 – 0.15 mcg/kg/min

The surgical procedure was modified intraoperatively from a simple mass resection to a left pneumonectomy, after confirming complete destruction of the left lung. This decision was justified by the extensive inflammatory process and abscess formation. (Figure 3).

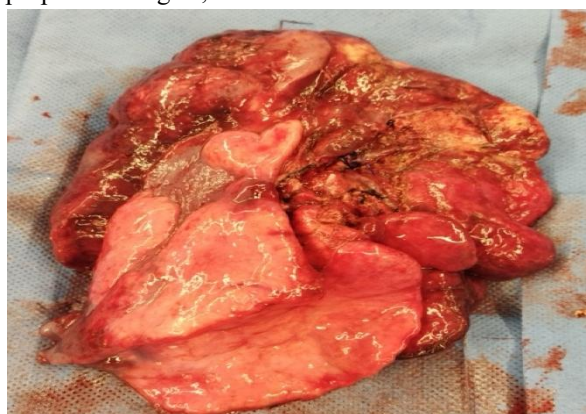


**Figure 3. Surgical specimen. Macroscopic image of the mature cystic mediastinal mass, extracted along with the left lung during pneumonectomy.**

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The surgery lasted 10 hours, during which 400 mL of purulent fluid was drained, and a resection of the mediastinal mass along with a pneumonectomy was performed. The patient experienced a blood loss of 900 mL, with a total fluid output of 3001 mL and a negative balance of 183 mL. Intravenous fluids, packed red blood cells, fresh frozen plasma, and platelets were administered, calculated at 10 mL/kg. Urine output was 260 mL (UO 1.8 mL/kg/h).

**Follow-up and Outcomes:** At the end of the surgical procedure, the patient was transferred to the pediatric intensive care unit under invasive mechanical ventilation and vasopressor support (norepinephrine and vasopressin).

Twenty-four hours later, ventilatory parameters were evaluated in volume-guaranteed mode. Tidal volumes were appropriate for the patient's age and weight, and respiratory rate targets were met. Sedoanalgesia was gradually reduced, and ventilatory support was transitioned to intermittent positive pressure ventilation, allowing for successful extubation and progressive withdrawal of vasopressors without hemodynamic instability. Pain was adequately controlled, and no signs of postoperative infection were observed. Full adherence to the intervention protocol was maintained from premedication and anesthetic induction to monitoring and postoperative care. Adherence was evaluated through daily clinical follow-up, medication administration records in the anesthesia chart, and nursing reports, all of which confirmed that the planned management was followed. The multidisciplinary team reported no refusals or interruptions by the patient or family, nor any logistical or technical omissions. Tolerability was adequate, with no adverse effects attributable to the drugs used, and no complications during the surgical intervention. Tolerability was assessed through continuous monitoring of vital signs, hemodynamic parameters, pharmacologic side effects, and postoperative liver and renal function tests, which remained within normal limits. The patient tolerated extubation, discontinuation of vasopressors, and the initiation of enteral nutrition without complications. The final diagnosis was confirmed by histopathological analysis, identifying a mature cystic teratoma of the mediastinum. The patient had a favorable postoperative course and was discharged without complications.

### DISCUSSION

This case describes the complex anesthetic management of a pediatric patient with a large anterior mediastinal mass, confirmed as a mature cystic teratoma, requiring thoracotomy, tumor resection, and left pneumonectomy.

The clinical significance of this case lies in the coexistence of anatomical comorbidities such as dextrocardia and pectus excavatum, environmental risk factors (chronic biomass exposure), a hypocaloric and hypoproteic diet, and an

incomplete vaccination schedule—all of which posed a multifactorial anesthetic challenge in a vulnerable patient.

The literature indicates that up to 55% of mediastinal masses in childhood originate in the anterior mediastinum, and that compression of the airway, great vessels, or cardiac chambers may precipitate intraoperative cardiopulmonary collapse. Perioperative complication rates have been reported between 9.7% and 15% in such scenarios. Tracheal compression greater than 50% of the cross-sectional area and the presence of pericardial effusion are considered high-risk predictors.<sup>7–8</sup> Several studies have documented the anesthetic challenges of mediastinal masses in pediatric patients. Tan et al. (2022) retrospectively evaluated 48 children with mediastinal masses and found a significant association between tracheal compression >50% and critical respiratory events during anesthetic induction, supporting the need for individualized planning. A multicenter study by Erdős & Tzanova (2009) emphasized that anesthetic induction should be tailored according to the degree of vascular and tracheal compression observed on imaging—validating the approach used in this case.<sup>9–10</sup>

In this patient, left-sided hypoventilation and mediastinal shift guided a stepwise anesthetic strategy. Induction was performed under direct controlled visualization to ensure a safe airway, with early hemodynamic support. General anesthesia was justified given the anticipated ease of intubation, in contrast with cases where spontaneous ventilation is prioritized.

Strengths of the management included early implementation of invasive monitoring, gradual and controlled use of vasopressors, and a multimodal analgesic strategy that supported smooth ventilatory and hemodynamic recovery. Limitations included the inability to perform preoperative pulmonary function testing and a complete nutritional evaluation—common barriers in rural pediatric settings. These were mitigated by computed tomography imaging and multidisciplinary collaboration, considering the urgency of the patient's condition.

A comprehensive review by Blank and de Souza on the pathophysiology and anesthetic management of mediastinal masses emphasized that the loss of spontaneous ventilation, deep inhalational anesthesia, and positive-pressure ventilation can exacerbate tracheobronchial and cardiovascular compression, increasing the risk of collapse during induction. In high-risk patients, they recommend maintaining spontaneous ventilation and even considering rescue strategies such as rigid bronchoscopy or extracorporeal circulation in extreme cases.<sup>7</sup> This case aligns with those recommendations in terms of risk anticipation and the availability of advanced resources for potential intraoperative decompensation.

The rationale for the decisions made was based on progressive evaluation of left lung compromise, radiological

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evidence of a cystic mass with mediastinal shift, absence of structural heart disease, and suspicion of a benign tumor with abscess formation. This allowed for targeted surgical planning and controlled anesthesia management aligned with the patient's risk.

Differential diagnoses included chronic pulmonary infection, primary abscess, mediastinal lymphoma, neuroblastoma, and teratoma. CT imaging and intraoperative findings guided the diagnostic process. Poreddy et al. (2022) reported the case of a 1 year and 9-month-old child with a 2-month history of non-productive cough and respiratory distress, initially attributed to respiratory infection, but ultimately diagnosed with a mature mediastinal teratoma. This finding reinforces the importance of considering tumor etiologies in recurrent respiratory presentations unresponsive to conventional treatment.<sup>11</sup>

From the patient and family's perspective, the postoperative outcome was perceived as successful, especially since the condition had been long-standing and previously undiagnosed. In accordance with the CARE guidelines, this report contributes to the clinical literature by documenting a highly educational experience, highlighting the importance of contextualizing anesthetic decisions based on the dynamic risks presented by pediatric patients with mediastinal masses.

### CONCLUSION

Timely intervention, a multidisciplinary approach, and individualized anesthetic planning led to a favorable outcome despite the high surgical risk.

This report not only describes the technical execution of complex anesthesia in a pediatric patient with a mediastinal teratoma but also emphasizes the relevance of a comprehensive assessment of clinical, social, and nutritional factors in rural settings. The educational value of this case lies in its demonstration of how to adapt standardized protocols to resource-limited scenarios without compromising patient safety. The applicability of this case extends to second- and third-level surgical units in regions facing structural barriers, where strategic preparation, rational use of available technology, and interspecialty collaboration can be decisive for therapeutic success. This case provides replicable clinical lessons for the anesthetic management of mediastinal masses in children—especially when anatomical, social, and public health factors converge—and represents a valuable contribution to the training of anesthetic and surgical teams in similar environments.

**Acknowledgments:** Special thanks to Hospital General Agustín O'Horán and the Faculty of Medicine of the Autonomous University of Yucatán.

**Funding:** None.

**Conflicts of Interest:** None.

**Ethical Considerations:** The patient's mother was informed at all times about the diagnosis, interventions performed, and potential risks. Written informed consent was obtained for the surgical and anesthetic procedures, as well as for the publication of this case report, in accordance with the ethical principles of the Declaration of Helsinki and the institutional regulations of the hospital.

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