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CASE REPORT

Thoracoscopic Resection of a Mediastinal Mature Cystic Teratoma in a Two-month-Old Infant: A Case Report and Literature Review

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Objective: Mediastinal teratomas are rare in the pediatric population and are even more infrequent in neonates and young infants. Early detection and appropriate surgical intervention are critical to avoid complications associated with airway compression. Minimally invasive thoracoscopic resection has emerged as a viable approach, though its application in infants remains technically challenging.

Materials and Methods: We present the case of a two-month-old male infant who was referred with progressive respiratory distress. Imaging revealed a well-circumscribed middle mediastinal mass compressing the left main bronchus. Thoracoscopic resection was performed after multidisciplinary planning. Intraoperatively, a cystic teratoma was identified, and decompression of its contents facilitated excision. A small bronchial perforation was noted and successfully repaired thoracoscopically.

Results: Histopathological analysis confirmed a mature cystic teratoma without malignant features. The postoperative course was uneventful, and follow-up imaging at four months showed no recurrence. This case demonstrates that thoracoscopic resection is a safe and effective option for managing mediastinal mature cystic teratomas in very young infants.

Conclusion: This case contributes to the growing evidence supporting thoracoscopy as a preferred approach in selected pediatric mediastinal lesions. With meticulous planning, technical expertise, and postoperative care, minimally invasive surgery can provide excellent clinical and cosmetic outcomes.

Keywords: Mediastinum, teratoma, thoracoscopy, infant, case report

Introduction

Teratomas are a rare subset of congenital germ cell tumors that arise from pluripotent embryonic cells and contain derivatives from all three germ layers, including ectoderm, mesoderm, and endoderm.[1] Teratomas are estimated to occur in approximately 1 in every 4000 live births worldwide.[2] Although teratomas can develop anatomical sites and across all age groups, most commonly diagnosed during the second and third decades of life. Their occurrence in the mediastinum, particularly in neonates and young infants, is relatively uncommon, accounting for approximately 1–5% of all mediastinal tumors in children.[2] Clinical presentation ranges from asymptomatic incidental findings to severe respiratory distress due to compression of adjacent thoracic structures.[3,4]

Historically, the standard surgical approach for mediastinal teratomas has been open thoracotomy. While effective, this technique is associated with significant postoperative pain, prolonged recovery, and complications related to extensive tissue disruption. Over the past few decades, the advent of minimally invasive surgery has transformed pediatric thoracic procedures. Thoracoscopic surgery offers several advantages, including smaller incisions, reduced postoperative discomfort, shorter hospital stays, and improved cosmetic results. However, its application in neonates and infants remains technically demanding due to limited intrathoracic working space, tissue fragility, and the need for meticulous intraoperative ventilatory management.[5,6]

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This case report describes the successful thoracoscopic resection of a mature cystic mediastinal teratoma in a two-month-old infant. We detail the clinical course and review the literature to highlight the benefits and challenges of thoracoscopic surgery in the pediatric population. This case contributes to the growing body of evidence supporting minimally invasive approaches in the management of mediastinal masses in infants.

Case Presentation

A two-month-old male infant was referred to our institution due to progressive respiratory distress. At presentation, the patient weighed 5 kg and exhibited suprasternal and subcostal retractions that had persisted for ten days. According to the parents, he experienced episodes of increased work of breathing and mild cyanosis during feeding, raising concerns for an underlying intrathoracic pathology. His perinatal history was unremarkable, and no significant comorbidities were identified.

Initial evaluation included a chest X-ray, which revealed trachea with right deviation. To further characterize the lesion, computed tomography (CT) was performed. Imaging showed a well-circumscribed mass measuring approximately 2.4×1.5 cm, located in the middle mediastinum at the T4–T7 level. The mass was closely associated with several vital structures, including the carina, bilateral bronchial trees, esophagus, thoracic aorta, and adjacent vertebral bodies (Figure 1). Given these anatomical considerations, a thorough preoperative assessment was deemed necessary. Flexible bronchoscopy was performed, revealing significant external compression of the left bronchus without evidence of fistula formation between the tumor and the airway. This confirmed that the respiratory symptoms were due to the compressive effect of the mediastinal mass.

Following a multidisciplinary discussion involving pediatric surgeons, anesthesiologists, and radiologists, a thoracoscopic resection of the mass was planned. Given the patient's stable hemodynamic status and the tumor's relatively small size, thoracoscopy was considered a safe and feasible approach. Preoperative planning focused on meticulous ventilation management, using conventional pressure-controlled ventilation, as one-lung ventilation was not

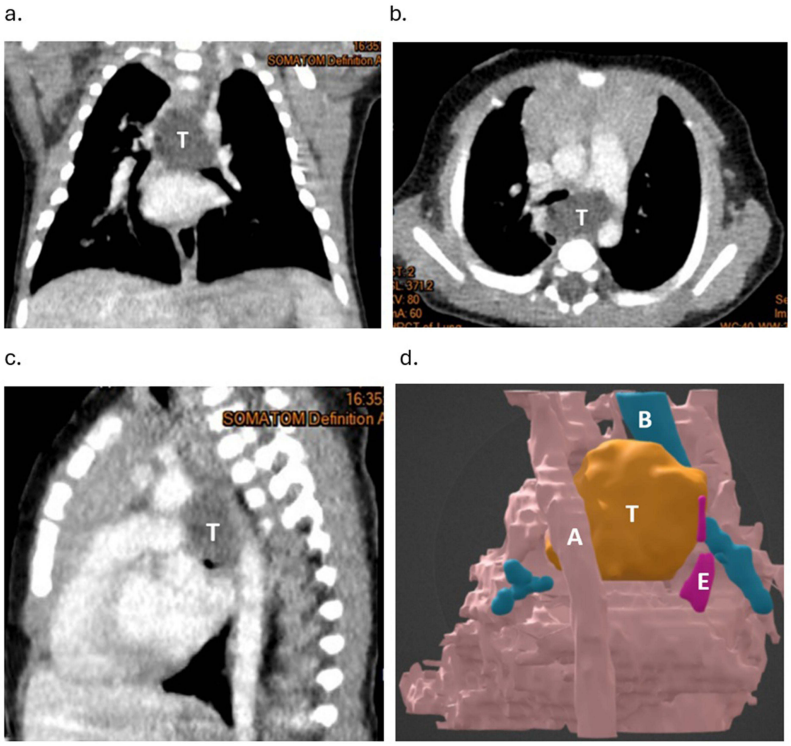

Figure 1 Computed tomography (**a–c**) revealed a well-circumscribed mass measuring approximately 2.4×1.5 cm located in the middle mediastinum at the T4–T7 level. The three-dimensional reconstruction (posterior view, (**d**)) demonstrates the tumor (T) in close proximity to critical structures, including the carina, bilateral bronchial trees (B), esophagus (E), and thoracic aorta (A).

feasible due to the patient's small size and the lack of appropriately sized endotracheal tubes and bronchial blockers. Close collaboration with the anesthesiology team allowed for adequate visualization of the surgical field. Under general anesthesia, the infant was placed in the left lateral decubitus position with the right hemithorax elevated to optimize surgical access. A 5-mm incision was made at the fifth intercostal space along the mid-axillary line, through which blunt dissection was used to enter the pleural cavity. A 5-mm trocar was inserted, followed by three additional ports: a 3-mm trocar in the fourth intercostal space at the posterior axillary line, another 3-mm trocar in the sixth intercostal space at the posterior axillary line, and a final 3-mm trocar placed just below the scapular tip. Carbon dioxide insufflation was used during the thoracoscopic procedure with a flow rate of 1 L/min and pressure maintained at 3–5 mmHg to provide adequate visualization. Dissection was performed using a 3-mm hook cautery. Hemostasis and tissue handling were managed using conventional ligation and suturing techniques, as energy-sealing devices compatible with 3-mm ports were not available.

Intraoperatively, a well-encapsulated cystic mass measuring approximately 2.5×2 cm was identified. The cyst was filled with mucus, which was aspirated prior to dissection. The mass was carefully excised thoracoscopically with attention to preserving surrounding vital structures. While separating the mass from left main bronchus, a small perforation in the left main bronchus was discovered. The bronchial defect was repaired with four interrupted 5–0 polydioxanone sutures. To reinforce the repair, 2 mL of Tisseel fibrin sealant was applied to the suture line. After thorough irrigation and confirmation of hemostasis, a Fr.12 chest tube was inserted through the 6th intercostal port and secured at a depth of approximately 4 cm (Figure 2). The total operative time was 5 hours and 5 minutes, with an estimated blood loss of 3 mL. The patient remained hemodynamically stable throughout the procedure. The excised specimen was sent for histopathological evaluation. Microscopic examination revealed a mature cystic teratoma composed of well-differentiated tissues from all three germ layers, including gut epithelium, respiratory epithelium,

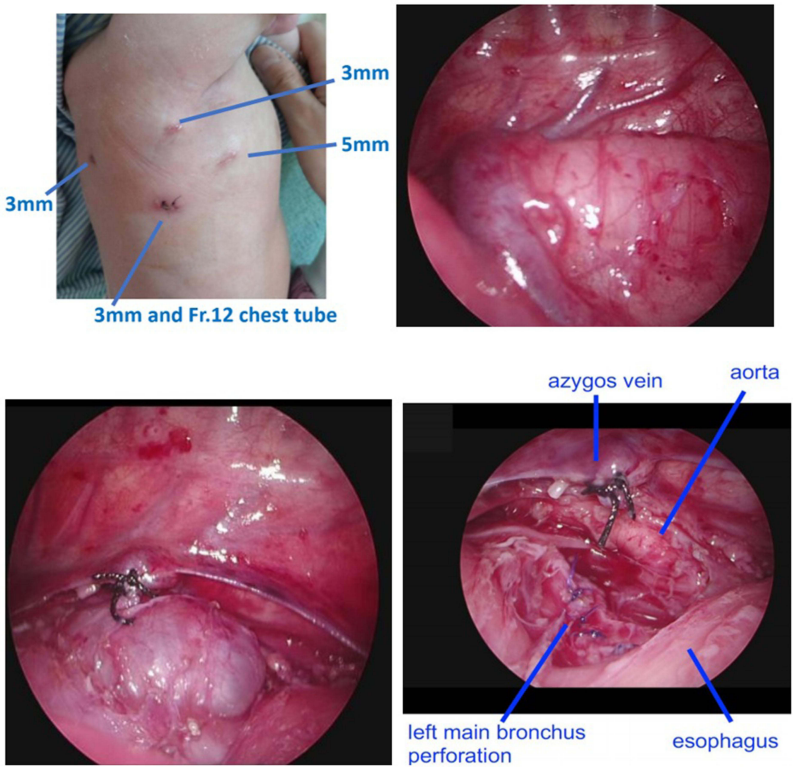

Figure 2 Thoracoscopic view illustrating the port placement and operative field. A 5-mm trocar was inserted through the fifth intercostal space at the mid-axillary line, followed by three additional 3-mm trocars placed at the fourth and sixth intercostal spaces along the posterior axillary line, and beneath the scapular tip. A cystic mediastinal mass (2.5 × 2.0 cm) was aspirated to aid dissection. A small perforation in the left main bronchus was repaired with 5–0 polydioxanone sutures and sealed with Tisseel fibrin glue. A 12 Fr chest tube was placed via the sixth intercostal port.

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cartilage, nerve bundles, and skeletal muscle tissue. No immature components or features of malignancy were identified (Figure 3).

The postoperative course was uneventful. The patient was managed in the pediatric intensive care unit with close monitoring of respiratory and hemodynamic parameters. Postoperative imaging confirmed complete excision of the mass without complications such as pneumothorax. The infant was gradually weaned from ventilatory support and resumed oral feeding within 48 hours post-surgery. He remained asymptomatic and demonstrated normal growth at the six-month follow-up (Figure 4). Furthermore, no clinical signs of recurrence were observed during ongoing follow-up at a regional hospital.

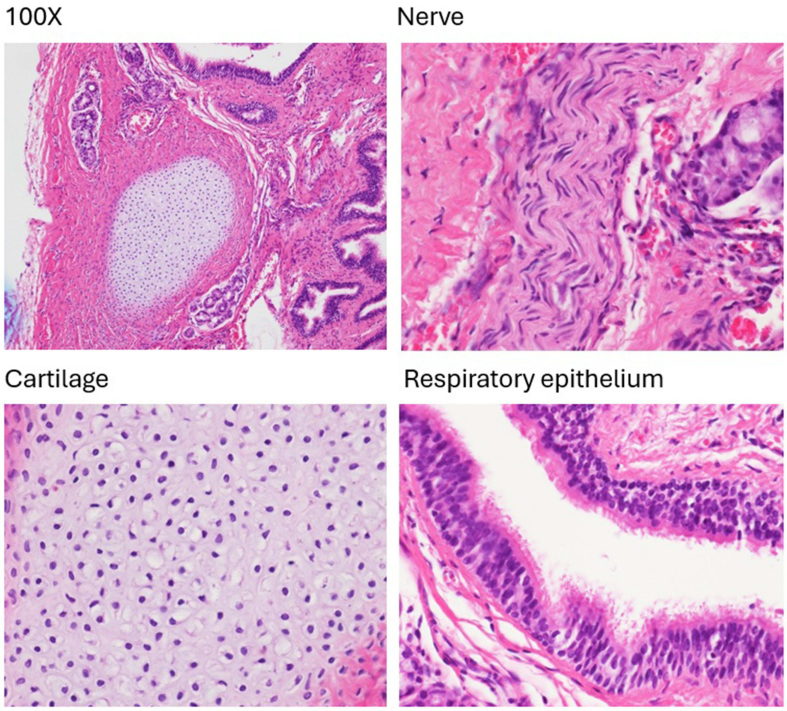

Figure 3 Histopathological examination confirming a mature cystic teratoma. The image shows differentiated tissue components from all three germ layers, including gut epithelium, respiratory epithelium, cartilage, nerve bundles, and skeletal muscle (hematoxylin and eosin stain, original magnification ×100).

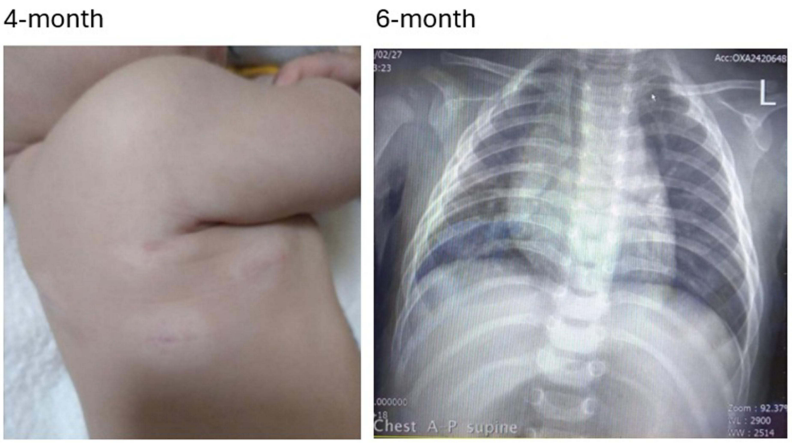

Figure 4 Clinical photograph at the four-month follow-up and chest radiograph at the six-month follow-up, showing the patient in good general condition. He remained asymptomatic with normal growth, and no evidence of recurrence was observed.

Discussion

Mediastinal teratomas are rare tumors in the pediatric population, with their occurrence in neonates and young infants being particularly uncommon.[7,8] In 2022, Howell RS et al reported the successful surgical resection of a giant mediastinal teratoma in a two-month-old infant in the United States.[9] In 2023, Su Y et al described a case of a large anterior mediastinal teratoma identified prenatally and resected within one day after birth, representing the youngest reported case to date.[10] Our report adds to this growing body of literature by documenting a rare case of an infantile mediastinal teratoma, successfully treated via thoracoscopic resection.

Teratomas arise from pluripotent embryonic cells and display a diverse histological composition, including neural tissue, respiratory epithelium, adipose tissue, and fibrous stroma.[9] Although mature cystic teratomas are typically benign, their mediastinal location can cause significant clinical symptoms due to compression of vital structures, particularly the airway.[11,12] Early detection is essential to prevent complications such as respiratory distress, infection, or rarely malignant transformation.[13,14]

Thoracoscopic surgery has become increasingly favored in pediatric thoracic procedures due to its minimally invasive advantages over open thoracotomy.[15–17] First, the magnified view provided by thoracoscopic imaging allows for precise dissection and accurate identification of anatomical structures—critical in the confined pediatric thoracic cavity. Second, smaller incisions and minimal tissue dissection result in reduced postoperative pain and morbidity. Third, the use of thoracoscopic techniques reduces visible scarring, which is particularly relevant in pediatric patients, thus improving cosmetic outcomes.[18] Finally, thoracoscopic approaches are associated with shorter recovery times and reduced hospital stays.[19,20] However, despite these benefits, thoracoscopic surgery in neonates and infants presents distinct challenges, including limited working space, the need for specialized instrumentation, and the requirement for advanced surgical expertise and thorough preoperative planning.[21] There is no established consensus regarding the maximum size threshold for thoracoscopic resection, but thoracotomy may be necessary for large tumors with significant adhesions or infiltration into surrounding structures.[22,23] The decision is often made on tumor characteristics such as encapsulation, proximity to vital structures, and the experience of the surgical team, rather than absolute size alone.[24,25] In our case, although the tumor was relatively small (2.5 × 2 cm), it was closely adjacent to critical structures, which made preoperative planning and intraoperative technique crucial for a successful minimally invasive approach.

Several technical and intraoperative considerations are unique to infants undergoing thoracoscopic procedures.[26] The small thoracic cavity and close proximity of the tumor to key structures such as the carina and thoracic aorta demand meticulous technique.[27,28] In our case, a four-port thoracoscopic approach enabled optimal triangulation and access. The cystic tumor was decompressed through aspiration of its mucinous contents, facilitating excision. Preservation of adjacent tissues, particularly the bronchial tree and esophagus, was prioritized to avoid complications. A small perforation in the left main bronchus was repaired intraoperatively and reinforced with fibrin sealant. Despite the procedure's technical demands and prolonged duration, no intraoperative complications occurred. The case supports the feasibility and safety of thoracoscopic resection for mediastinal masses in infants.

A recent systematic review and meta-analysis compared video-assisted thoracoscopic surgery (VATS) with open thoracotomy for mediastinal tumor resection in pediatric patients.[25] The findings supported thoracoscopic surgery as a viable alternative, demonstrating benefits such as shorter hospital stays, lower complication rates, and decreased intraoperative blood loss. These advantages were consistent with our clinical experience. Importantly, the meta-analysis found no significant differences in recurrence or mortality rates between the two approaches, which reinforced the safety and efficacy of thoracoscopy in this context. While most literature focuses on older pediatric cohorts, a few reports have documented successful thoracoscopic resections in infants. The steep learning curve associated with infant thoracoscopy underscores the importance of institutional experience and surgical expertise in achieving favorable outcomes.[17,29] In our case, complete resection of the mature cystic teratoma was confirmed intraoperatively and via postoperative imaging. The patient's postoperative recovery was uneventful, with sustained symptom resolution and no evidence of recurrence at the four-month follow-up. Long-term surveillance remains essential to detect potential late complications, including tumor recurrence and thoracic structural abnormalities.

To date, thoracoscopic resection of pediatric mediastinal teratomas remains relatively rare, with fewer than 40 published cases reported in the literature, mostly in the form of individual case reports or small institutional series.

These cases span a wide pediatric age range, with some successful resections performed even in neonates and young infants, highlighting the expanding applicability of minimally invasive techniques in this patient population.[9,10,29,30] While no large-scale multicenter data are currently available, recent systematic reviews and single-center experiences have continued to support thoracoscopic surgery as a safe and effective alternative to thoracotomy in selected cases, particularly when the tumor is well-encapsulated and preoperative imaging suggests favorable anatomical planes.[25,31] These accumulating reports underscore the importance of institutional expertise, careful patient selection, and continued documentation of outcomes to further refine best practices in this evolving field.

This case adds to the expanding evidence base supporting thoracoscopic techniques in the management of mediastinal masses in infants. Although the operative duration in this case was longer than typical for thoracoscopic procedures, it reflected the technical complexity of the tumor dissection and bronchial repair in a very small infant. While a thoracotomy may have allowed for a shorter operation time, it would have entailed greater surgical trauma, wider exposure, and potentially increased postoperative pain and recovery time. The minimally invasive approach, despite its longer duration, minimized tissue disruption, avoided rib spreading, and contributed to an excellent cosmetic and clinical outcome. Therefore, we believe that thoracoscopy remains justified in such selected cases where safety and complete resection can be achieved. Future research should focus on larger case series to assess long-term outcomes, identify procedure-specific limitations, and refine surgical techniques. Technological advancements and the development of neonatal-specific instruments may further enhance the safety and efficacy of thoracoscopic interventions in this vulnerable population. Comparative studies involving matched patient cohorts would provide valuable insights into best practices for managing complex mediastinal lesions in pediatric patients.

Conclusion

This case report demonstrates that thoracoscopic excision is a safe, effective, and feasible approach for managing mediastinal mature cystic teratomas in very young infants, provided that meticulous preoperative planning, precise intraoperative technique, and vigilant postoperative care are employed. The benefits of minimally invasive surgery, such as reduced postoperative pain, shorter hospital stays, and improved cosmetic outcomes, were clearly evident in our case. Together with existing literature, our experience supports the consideration of thoracoscopic resection as a preferred approach for selected small, well-circumscribed mediastinal masses in the pediatric population. Continued advancements in minimally invasive technology and surgical expertise are essential to broaden the applicability of thoracoscopy to more complex mediastinal lesions and to optimize long-term outcomes in this vulnerable age group.

Ethics Approval and Consent to Publish

This study was conducted under the most recent version of the Declaration of Human Rights in Helsinki. Institutional approval (IRB Number: 24MMHIS427e) was obtained from the Institutional Review Board of MacKay Memorial Hospital for the publication of the case details without identifiable information.

Informed Consent Statement

Written informed consent was obtained from the legal guardians (parents) of this case who agreed on participation and publication of the case report and the accompanying images.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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