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Anesthesia for an infant with congenital mediastinal mass: a case report

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Abstract

Background Giant anterior mediastinal masses in infants are one of the most challenging cases faced in pediatric anesthesia practice. They can pose unique challenges for resection such as cardiovascular collapse on induction of anesthesia and injury to surrounding structures that maybe compressed or displaced. Principles that must be followed and kept in mind during removal of giant mediastinal mass include appropriate diagnostic imaging to define mass extent, airway control during induction, a multidisciplinary team approach including cardiothoracic for sternotomy, cannulation to institute cardiopulmonary bypass, otolaryngology for rigid bronchoscopy, preservation of neurovascular structure, and complete resection whenever possible. Our patient had a mass that weighed twice his whole body weight.

Case presentation Here we present a 3-month-old Middle Eastern infant weighing 3.2 kg with a large congenital teratoma who presented to the emergency room with cyanosis and respiratory distress. During his hospital course, he underwent three procedures, two of them under light-to-moderate sedation: a diagnostic computer tomography scan followed by mass content drainage by interventional radiology (Figs. 1, 2). On the third day, he had a thoracotomy with complete tumor resection under general anesthesia with the help of an epidural for pain control (Fig. 3). The resected tumor weighed 2.5 kg, which was equal to twice the patient's total body weight (Fig. 4). After the surgery, he was extubated in the operating room and discharged home 3 days later.

Conclusion Anterior mediastinal mass patients can be challenging for the anesthesiologist. They need meticulous thorough perioperative assessment to determine the extent of compression on major intramediastinal structures and to predict the complications. Planning by multidisciplinary team and discussion with the family is important. These types of cases should be preferably operated on by an experienced team in a well-equipped operation room in tertiary care institutes.

Keywords Mediastinal mass, Congenital teratoma, Infant

Background

Mediastinal masses comprise a broad histopathological spectrum, ranging from benign to malignant. Fifty percent of mediastinal masses occur in the anterior compartment, the most common of which are thymoma, teratoma, thyroid goiter, and lymphoma. Anterior mediastinal masses (AMM) are one of the most challenging cases faced in anesthetic practice due to the need of meticulous preoperative assessment of those patients to determine the extent of compression on major

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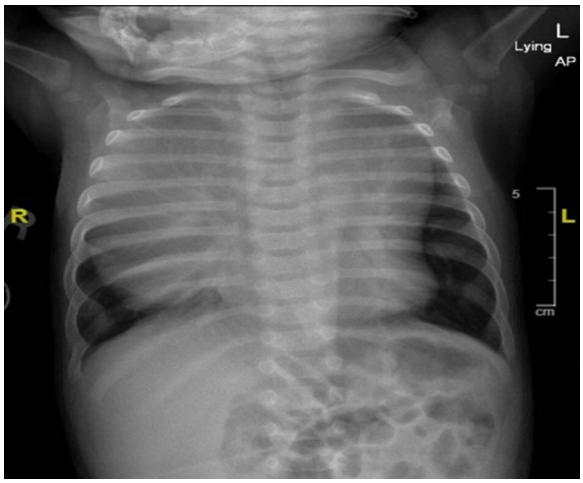

Fig. 1 Anterior–posterior chest x-ray showing the anterior mediastinal mass (AMM)

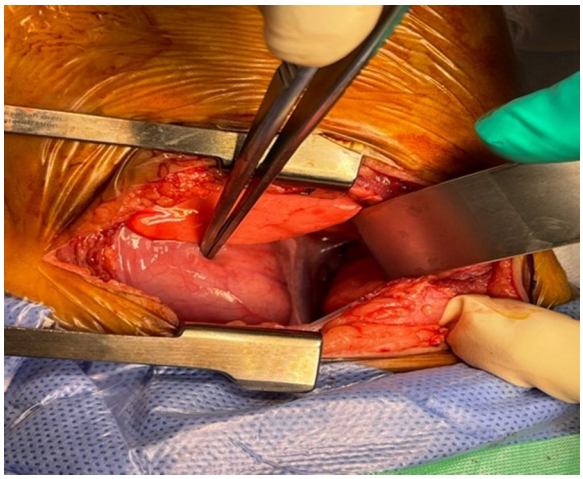

Fig. 3 Gross anatomy of the tumor before resection

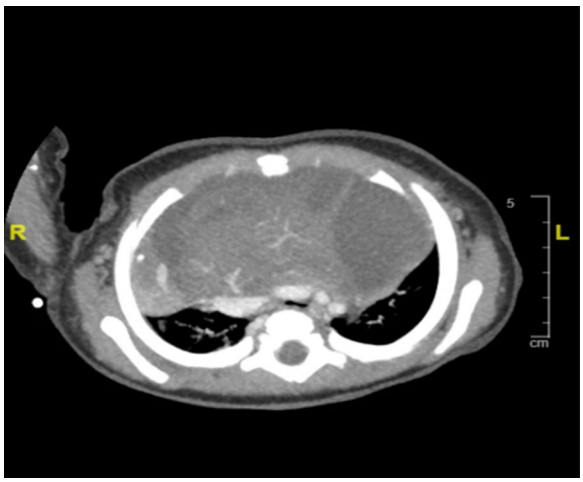

Fig. 2 Cross-section computed tomography (CT) showing large anterior mediastinal mass (AMM)

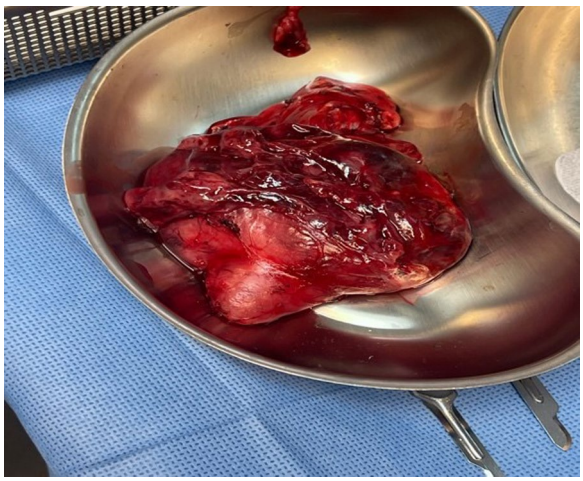

Fig. 4 Gross anatomy of the removed tumor

intramediastinal structures, which may lead to serious complications[1]. In this case report, we share our experience of a 3-month-old child with an anterior mediastinal mass who presented to the emergency room in respiratory distress. He underwent complete resection and was discharged home in a good condition.

Case report

A 3-month-old Middle Eastern baby boy born full term with a birth weight of 3.8 kg presented with wheezing, dry cough, increased respiratory rate, sweating associated with feeding, and facial cyanosis when crying at the age of 6 weeks.

On examination, he was normal looking with no dysmorphic features, had oxygen saturation of 88% on room air, improved 96% on 1 L/minute of oxygen via nasal cannula, tachypnea with respiratory rate of 40–45 beats per minute (BPM) with mild-to-moderate suprasternal retraction.

Investigations included chest x-ray (Fig. 1), which showed a gross enlargement of the mediastinum suggesting a mediastinal mass. Echocardiogram was normal. He was admitted to the pediatric intensive care unit (PICU) for monitoring and further management. Chest computerized tomography (CT) imaging done under sedation with ketamine 1 mg/kg. showed an anterior mediastinal mass measuring 9.1×3.6×7.7 cm in transverse diameter, Anterior- Posterior (AP) and Cross-Section (CC) dimensions (Fig. 2), causing mass effect on the major vasculature and airways. The mass showed a cystic and solid

component with internal calcification suggestive of mediastinal teratoma. Postsedation he was transferred back the PICU with no complications.

A multidisciplinary team meeting involved pediatric surgery, pediatric intensive care unit, pediatric anesthesia, interventional radiology, and oncology. The decision made was to drain the cystic component of the mass by the interventional radiologist to decrease the mass effect on the airway and major vessels and to confirm the tissue diagnosis. Anesthesia risks were explained to the family including hemodynamic instability, complete airway obstruction, and cardiac arrest. The family consented to the procedure.

Ultrasound-guided drainage of the accessible fluid content of the mass was done by interventional radiology team in the operating room suite under sedation using fentanyl (1 mcg/kg), ketamine (3 mg/kg) titrated as required, and dexmedetomidine (2 mcg/kg). A total of 61 ml of serosanguineous fluid was removed followed by insertion of drain. The patient remained stable throughout the procedure and was transferred back to the PICU.

CT images post drainage showed no significant regression in the size of the mass and its mass effect within the anterior mediastinum. There was no significant improvement in the patient's symptoms post drainage. In view of the CT findings and persistent clinical symptoms, surgical removal was planned.

Surgery was scheduled a day after ultrasound (US)-guided drainage of the multicystic lesion. On the next day, a high-risk consent was obtained from the family after explaining the risks related to anesthesia. Standard American Society of Anesthesiologists (ASA) standard monitors were attached, and the patient was premedicated with 20 mcg/kg of glycopyrrolate. The surgical team was inside the operating room (OR) for any possible emergency intervention, otorhinolaryngology (ENT) was ready with possible rigid bronchoscopy in case of difficult intubation, and the extracorporeal membrane oxygenation (ECMO) team were involved in case of cardiopulmonary collapse. Induction was done with titrated doses of ketamine (2–4 mg/kg), 1 mcg/kg dexmedetomidine, and sevoflurane. The goal was to keep the patient spontaneously breathing during induction. After attaining the optimal depth of anesthesia, the patient was intubated with size 3.0 mm cuffed endotracheal tube (ETT) by direct laryngoscopy. ETT position was confirmed (bilateral air entry by auscultation). Arterial line and central venous cannulations were done and the patient was positioned in the left lateral position for right thoracotomy.

Anesthesia was maintained with sevoflurane, ketamine infusion of 0.25–0.5 mg/kg/hour and dexmedetomidine 0.5–1 mcg/kg/hour. Fentanyl 1 mcg/kg was used for analgesia. After the surgical incision and thoracotomy (Fig. 3), the pressure effect of the mass released from the tracheobronchial tree, and we changed the mode of ventilation to pressure control mode. The patient stayed stable throughout the procedure and total excision of the mass was successful (Fig. 4).

An caudal epidural catheter was placed at the end of the surgery to the level of incision. The catheter position was confirmed with ultrasound. Then, 3 ml of 0.2% ropivacaine was injected followed by catheter removal. The patient was transferred to PICU extubated, awake, and free of pain.

Discussion

Anterior mediastinal masses in children are challenging secondary to the mass effect inside closed thoracic cavity, which leads to displacement and compression of vital intrathoracic structures including the tracheobronchial tree, the heart, and the great vessels, resulting in severe cardiopulmonary compromise during anesthesia with undesirable outcomes despite use of all appropriate resuscitative maneuvers.

Patients with anterior mediastinal mass present with variable cardiopulmonary signs and symptoms including tachypnoea, orthopnea, nocturnal dyspnea, stridor, and superior vena cava syndrome. The severity of symptoms depends on the size and location of the tumor within the mediastinum relative to other nearby structures, and it can predict the perioperative complications. Patients usually lie or sleep preferentially in a particular posture, and it is important to determine and note this position preoperatively so as to be used as rescue position and hence minimize compression of vital mediastinal organs and avoid related complications [2]. Ng *et al.* reviewed 48 pediatric cases with a mediastinal mass who received general anesthesia for the diagnostic procedure or primary tumor resection. They found that the complication rate was 15%; complications included problems with ventilation, intubation, and cardiovascular collapse, and resulted in two deaths and one tracheostomy. All the patients with complications had evidence of tracheal or vascular compression, infection, and at least three respiratory symptoms at time of presentation. In contrast, 83% of the patients with no perioperative complications had less than three respiratory signs or symptoms. The study concluded that tracheal compression and the presence of three or more respiratory signs and symptoms are the strongest predictive factors in children with mediastinal tumor at risk of receiving general anesthesia [3, 4].

Laboratory evaluation to diagnose and treat patients with a mediastinal mass include complete blood count, electrolytes, chest x-ray, and CT chest images. Radiologic imaging by chest radiograph, CT scan, and magnetic

resonance imaging (MRI) is important to see the mass effect of tumor and its anatomical relationship with various thoracic vital structures. These static images help us to determine the degree and level of airway compromise in nonanesthetized, awake patients but may not accurately quantify the degree of compression and may fail to predict the course after induction of anesthesia. Some investigators advocate preoperative radiotherapy and chemotherapy to reduce the size of the mass and therefore the risks of anesthesia, whereas others suggest the likelihood of tissue distortion and histology alteration that can compromise the accuracy of diagnosis and curative treatment [5, 6].

Personnel and equipment for emergency airway management including rigid bronchoscopy, difficult airway equipment and expertise, and tracheostomy as a backup plan should be available. In patients at high risk of cardiorespiratory instability, preparations for extracorporeal membrane oxygenation (ECMO) or cardiopulmonary bypass (CPB) should be made preoperatively. Various anesthetic agents (volatile anesthetics, ketamine, dexmedetomidine, and propofol) have been used for sedation or general anesthesia, and it appears that no agent is superior as long as the agents are used judiciously. It is prudent to maintain spontaneous ventilation throughout the anesthetic procedure to avoid worsening of any compressive effects the mass may have on the cardiovascular structures or airways. Use of muscle relaxants and institution of positive-pressure ventilation may result in catastrophic airway obstruction, as the increased gas flow across the stenosis decreases the intraluminal pressure leading to further tendency to collapse. Hence, muscle relaxants should be used only after ensuring adequate ventilation after induction [7–9].

Conclusions

Anterior mediastinal mass patients can be challenging for the anesthesiologist. They need meticulous thorough perioperative assessment to determine the extent of compression on major intramediastinal structure and to predict the complications. Planning by a multidisciplinary team and discussions with the family are important. These types of cases should be preferably operated on by an experienced team in well-equipped operation rooms in tertiary care institutes.

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Author contributions
SA: contributed to obtaining the consent, patient information and writing the manuscript. AB: Contributed to obtaining images, IRB and patient information. AA: contributed to writing the manuscript. FA: the corresponding Author, attending anesthesiologist, contributed in providing anesthesia, writing the manuscript and submitting the article for publication. MA: contributed to writing the manuscript. YA: contributed to writing the manuscript.

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Declarations

Ethical approval and consent to participate
The authors declare no conflicts of interest, and that this work was done with all due respect to the code of ethics under the supervision of the medical and ethics committee of king Fahad medical city research center.

Consent for publication
Written informed consent was obtained from the patient's parents for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal."Internal Review Boards approved according to ICH GCP guidelines.

Competing interests
Not applicable.

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