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Case Report

Anesthetic Challenges in Managing a Case of Anterior Mediastinal Mass: Catastrophe Better Prevented

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Abstract: ***Background*:** Anterior mediastinal masses in children pose significant anesthetic challenges because of the potential for airway compression, cardiovascular compromise, and acute cardiorespiratory collapse during induction of anesthesia. Careful preoperative assessment, appropriate planning of airway and vascular access, and maintenance of spontaneous ventilation are important considerations in these patients. ***Case Presentation*:** We report the perioperative anesthetic management of a 8 years old pediatric patient with a large anterior mediastinal mass who presented for thoracotomy and surgical resection. Preoperative evaluation included clinical assessment, imaging, and evaluation for evidence of airway and cardiovascular compression. Appropriate preparation was made for difficult airway management and emergency cardiopulmonary support. Anesthesia was induced intravenously, with continuous monitoring of respiratory and cardiovascular status. After securing the airway and confirming adequate manual ventilation, there was difficulty in controlled ventilation due to compression of the airway, so the patient was immediately reversed with sugammadex and the rest of case done under spontaneous ventilation with sevoflurane with oxygen-air mixture, and thoracic epidural was placed for adequate analgesia. The mass was successfully resected through thoracotomy without major intraoperative cardiorespiratory complications. Postoperative care included close respiratory and hemodynamic monitoring, with appropriate analgesia and subsequent recovery. ***Conclusion*:** Anesthetic management of children with anterior mediastinal masses requires meticulous preoperative risk stratification and preparation for sudden airway or cardiovascular compromise. Maintaining spontaneous ventilation during the critical phase of induction, minimizing factors that can worsen airway compression, and ensuring immediate availability of advanced airway and cardiopulmonary rescue strategies are important principles.

Keywords: Anterior Mediastinal Mass, Thoracotomy, Airway Compression, Spontaneous Ventilation, Thoracic Epidural Analgesia.

INTRODUCTION

Mediastinum in thoracic cavity is a space which harbors some of the vital organs, proper functioning of which are needed to maintain the sustainability of life. Any external mass may lead to compression/displacement of major vessels/ trachea/ heart. With induction of general anesthesia, loss of voluntary muscle tone may lead to cardiovascular compromise or airway loss. Dealing such cases need a closed loop communication between anesthesiologists, surgeons, other OT team members. Anterior mediastinal masses (AMMs) are metastatic lesions or originate from structures within or passing through mediastinum, representing about 3% of thoracic tumors [1]. The most common cause of AMMs reported in children is Lymphomas [2].

Securing the airway past the site of obstruction is a challenge and can be accomplished via fiberoptic bronchoscopy. Awake intubation as found to be a better choice in adult patients might be actually difficult to achieve in pediatric patients. Thus, if general anesthesia is required then a short acting muscle relaxant or its antagonist must be readily available to avoid any hypoxic cardiac arrest. Rigid bronchoscopy might be reserved for Plan B with the advantage of ventilation via the side port.

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In situations of cardiovascular collapse, first-line therapy includes a rapid fluid bolus I.V/reducing the depth of anaesthesia/repositioning, including to the prone position. If there is no improvement with these initial maneuvers, then in dire situations sternotomy and lifting of the mass from the central thoracic structures may be required [3].

Extracorporeal membrane oxygenation (ECMO) both preemptive or rescue have been suggested as management of high-risk patients or severe deterioration.

CASE REPORT

An 8 years old female child weighing 25 kg presented with anterior bulging chest wall, gradually increasing in size for over 6 months with repeated dry cough. Negative history was ruled out for syncopal attacks, breathlessness, pedal edema, facial swelling, and neck veins engorgement. Patient clarified no positional distress or any symptom relieving in any particular position. Preoperative workup was done for thoracotomy.

Routine blood investigations done, radiographic evaluation done with chest-x-ray (Figure 1) and CECT Thorax (Figure 2) confirming a well-defined, lobulated heterogeneously enhancing soft tissue lesion of size 7.4*9.1*10.1 cm in anterior mediastinum with internal necrotic areas and extension as:

- Anteriorly, the lesion is closely abutting anterior chest wall,
- Posterolateral, the mass abuts the superior vena cavae (SVC), pericardium with mild compression over right atrium, pushing trachea posteriorly,
- Inferiorly mass reaching up to superior border of T7.

An electrocardiography (ECG) and 2D Echocardiography scan revealed a normal study.

We plan to conduct this case under general anesthesia with thoracic epidural anesthesia. The operation theatre was prepared, all emergency drugs ready to deal with any vascular collapse that may occur while induction along with difficult airway cart to manage for suspected difficult airway as the lesion was compressing the trachea as well. The patient was preloaded with isotonic crystalloid solution and blood components were kept ready, American society of Anesthesiologists (ASA) standard monitors attached and two large bore IV cannula secured. General anesthesia was intravenously induced with fentanyl 2 mcg/kg, ketamine 50mg, propofol 1 mg/kg and succinylcholine 1.5 mg/kg. Endotracheal intubation was done via direct laryngoscopy with cuffed ETT of size 5.0, tube position was confirmed, long-acting muscle relaxant vecuronium 0.1mg/kg given and shifted to circle system with volume-controlled ventilation, but were not able to ventilate the patient. Fiberoptic bronchoscopy was done to rule out for any tube malposition but right mainstem bronchus was found to be collapsed thus there was drop in saturation. We tried placing the tube beyond obstruction but achieved ventilation at very high peak pressures. The team decided to reverse the muscle relaxant with sugammadex 16 mg/kg. After a brief discussion with surgeons, we decided to proceed with the case under thoracic epidural placed at T6-T7 level and conscious sedation achieved with dexmedetomidine loading dose of 25 mcg maintenance dose @ 0.25mcg/kg/hour titrated with sevoflurane in 1:1 ratio of oxygen and air to maintain required state of sedation and hemodynamics. Patient was ventilated on pressure support mode. During the surgery noradrenaline was started and titrated to maintain mean arterial pressure (MAP) of 55-60 mmHg. After completion of surgery, fiberoptic bronchoscopy was done to evaluate for any residual compression effect on trachea so as to decide for extubation failure if may occur. Patient was extubated on table only after confirming for negative leak test. Child was thereafter shifted to recovery area on oxygen via facemask.

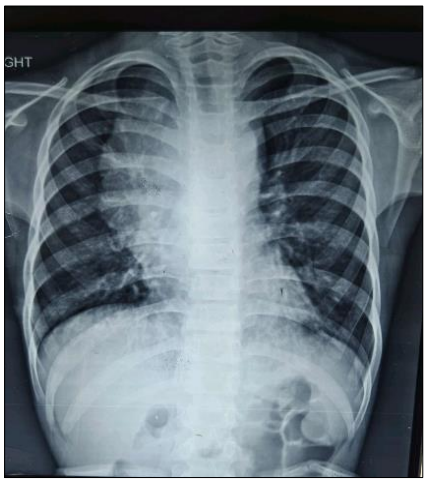

Figure 1: Showing widened mediastinum

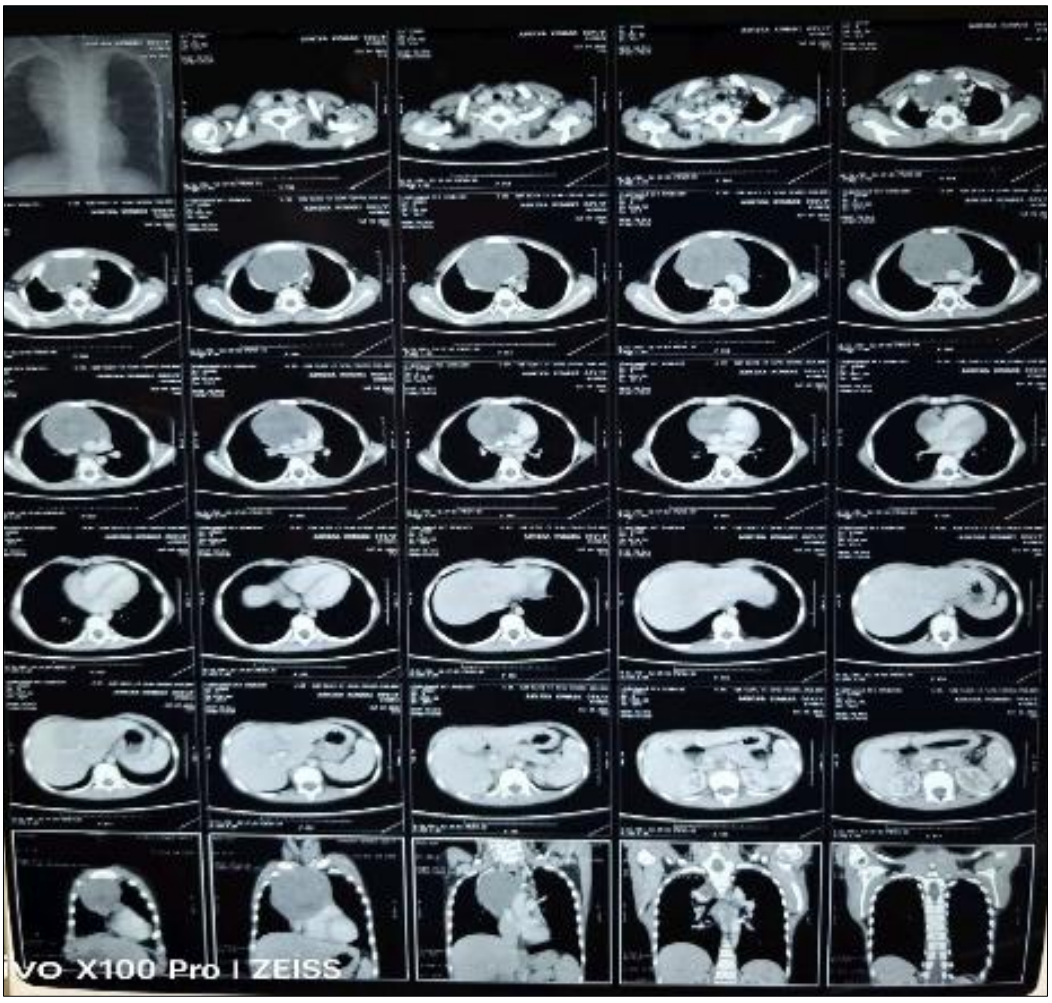

Figure 2: Computed tomography of chest showing anterior mediastinal-mass compressing the right bronchus and lung

DISCUSSION

This case describes the complex anesthetic management of a pediatric patient with a large anterior mediastinal mass, which was later confirmed on biopsy to be a thymoma. 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 [5]. 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 [6]. In our case, need for general anesthesia was justified by the procedure. The only concern regarding intubation and PPV was tracheal compression as suggested via CT scan, to combat that we were prepared with fiberoptic bronchoscopy so to visualize the site of obstruction and pass that.

Strengths of management relied on judicious decision making, gradual and controlled use of vasopressors and multimodal analgesic strategy that supported smooth ventilatory and hemodynamic recovery.

Limitation included the inability to perform preoperative pulmonary function testing.

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 [6]. This case aligns with those recommendations in terms of risk anticipation and the availability of advanced resources for potential intraoperative decompensation.

CONCLUSION

Pediatric patients presenting with AMMs require a thorough history and physical examination. The presence and severity of cardiopulmonary compression and associated signs and symptoms must be elucidated. A multidisciplinary team approach is paramount to understanding the patient specific risks of general

anesthesia. Despite the availability of multiple anesthetic techniques, maintaining spontaneous ventilation is considered the safest. Preoperative preparedness is the key to manage such cases. Backup plans may include rigid bronchoscopy, emergent sternotomy and cardiopulmonary bypass.

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