Anaesthetic Management of a Child with a Massive Mediastinal Mass

Ayşe Çağdem Tütüncü, Pınar Kendigelen, Güner Kaya
Department of Anaesthesiology and Reanimation, Istanbul University Cerrahpaşa University School of Medicine, Istanbul, Turkey


Abstract

Mediastinal masses are benign or malignant tumours that originate from the thymus, thyroid, lung, pleura, or pericardium. Cardiovascular and respiratory symptoms may occur because of the compression of surrounding tissues along with growing mass. In this study, we present the anaesthetic management of a 6-month-old child having a massive anterior mediastinal mass that had a compressing effect.

Keywords: Mediastinal mass, pediatric, anaesthesia

Introduction

Mediastinal tumours are the benign or malignant masses that originate from the thymus, thyroid, lung, pleura, pericardium and lymphatic system. The symptoms occur because of the compression of the surrounding tissues as the mass grows. These tumours can lead to serious complications in the airway, heart and vascular structures both in the perioperative and postoperative periods. Compression on the trachea and airway can cause cough and dyspnoea, and compression on the superior vena cava can cause superior vena cava syndrome. Moreover, compression on the oesophagus can lead to dysphagia (1, 2). Here, we present the anaesthesia management of a paediatric patient who was admitted due to the complaint of dyspnoea and had to undergo surgery due to the prior diagnosis of teratoma located in the anterior mediastinum.

Case Presentation

The physical examination of a girl patient (age, 6 months; weight, 7 kg) who visited the Paediatric Emergency Unit with the complaint of dyspnoea revealed tachypnoea, dyspnoea and intercostal and subcostal retractions. In the thoracic tomography, a 93×78-mm cystic-solid mass covering the anterior mediastinum was seen on the left side. She was referred to the Clinic of Paediatric Surgery. It was observed that the mass pushed the trachea to the right side, narrowed the left main bronchus and caused atelectasis in the basal segment of the left lung; the appearance of the heart was normal (Figures 1 and 2). Radiological evaluation showed the mediastinal mass ratio (MMR; maximum length of the mass/maximum width of the thorax) to be 79% and the cross-sectional area (CSA) of the trachea to be 35%. The oxygen saturation level of the patient, whose physical examination revealed orthopnoea and suprasternal retraction, was 90%-92% at room air and 96%-97% with oxygen support. Her auscultation demonstrated crepitant rales in the left lower zones. Her blood pressure was 127/85 mmHg and heart rate was 100–120 beats/minute. The patient was initiated on niphedipine and a diuretic. Echocardiographic evaluation showed that four natural cavities were not affected by compression. In the preoperative period, her arterial pH was 7.15, PaCO₂ was 56.3 mmHg, PaO₂ was 57.8 mmHg, SpO₂ was 91%, heart rate was 150–156 beats/min and blood pressure was 90–85/55–50 mmHg. Following the standard monitoring, anaesthesia induction was administered without using a neuromuscular blocker, and pressure-controlled ventilation was applied. Peak inspiratory pressure values were observed to be between 30 and 35 cmH₂O.
with pressure support to ensure a tidal volume of 55–60 mL. The maintenance of anaesthesia was provided with 2% sevoflurane and 50% oxygen–air mixture. Central venous catheterisation was performed through the right vena jugularis interna. The patient was haemodynamically stable during induction, and her invasive systolic/diastolic arterial pressure was 80–75/55–45 mmHg and heart rate was 150–155 beats/min. After placing in a left lateral position for thoracotomy, her arterial pressure decreased to 60/40 mmHg. Therefore, dopamine 5 µg kg⁻¹ min⁻¹ infusion was started. Hypotension prevention was attempted by adjusting the dose of dopamine according to her haemodynamics until the removal of the mass. When the mass was excised without any complications, the haemodynamic effect of compression disappeared. During surgery, the values of arterial pH, PaCO₂, and PaO₂ were 7.52, 31 mmHg and 155 mmHg, respectively. After surgery, these values were 7.4, 35 mmHg and 180 mmHg, respectively. During surgery, 200 mL crystalloid, 70 mL fresh frozen plasma and 50 mL blood transfusion were needed; the surgery lasted for 140 min.

Considering the possibility of tracheomalacia at the end of the surgery, the patient was sent to the intensive care unit as intubated. The patient was initially ventilated with pressure support ventilation and was subsequently extubated after providing adequate spontaneous respiration at the postoperative 4th hour. During this period, her arterial pH was 7.37, PaCO₂ was 42 mmHg and PaO₂ was 98 mmHg. Because tracheomalacia or laryngomalacia were not detected, the patient was referred to the clinic without any difficulty.

Discussion

In paediatric patients, 35%–55% of mediastinal masses originate from the anterior mediastinum. The masses are quite likely to be of thymus, lymphoma, thyroid and teratoma origin. The clinical course of the mass differs depending on its size and the neighbouring structures. The possibility of anaesthesia-induced complications in mediastinal mass surgery has been reported at different rates in different series, and this rate varies between 9.7% and 15% (3). In these patients, the preoperative risk assessment should definitely be performed in terms of airway and cardiovascular system compression findings. The position in which patient feels comfortable should be detected, and a detailed anaesthesia planning should involve induction, maintenance and postoperative periods. In case of serious tracheal and bronchial compression, preoperative placement of a stent should be considered for providing airway patency. Clinical and radiological findings of patients should be simultaneously evaluated. Low-risk patients are defined as those who are asymptomatic and have no postural or radiological compression findings and moderate-risk patients as those who have moderate postural symptoms and whose tracheal compression is below 50%. Patients with a CSA of 50% or MMR above 45% are defined as those at high risk for airway and compression complications (1, 4, 5). Respiratory system findings of the masses in the anterior mediastinum appear when the lumen is narrowed due to the compression on the trachea and carina. It has been reported that the presence of stridor, particularly in the preoperative period, can be an indicator of possible complications during anaesthesia. Tracheomalacia can be seen due to long-term mass compression. While the lumen of the trachea is open and spontaneous respiration continues in the sitting position, the lumen can be narrowed because of the mass effect and increased intraplural pressure in supine position. Before surgery, arterial blood
gas and spirometric measurements (particularly peak airway flow) in compliant patients will help determine the degree of compression. While cardiovascular symptoms are less frequently seen with anterior mediastinum masses, the presence of superior vena cava compression findings, such as dysphagia, plethora, jugular distension and arterial pressure changes with position, as well as the existence of compression to the heart and pericardial effusion define the high-risk patient group. In the preoperative echocardiographic evaluation, the atrium, ventricles, pulmonary artery outflow tract and wall movements should be assessed in terms of compression, the presence of pericardial effusion should be investigated and ejection fraction should be measured.

Although the compression effect is not so apparent in an awake patient, two basic changes occur during anaesthesia induction: loss of negative intrapleural pressure and compression on the pulmonary artery due to mass effect. In association with them, hypoxia, hypotension, cardiovascular collapse and arrest may develop. Providing a suitable position, such as decubitus or prone, can eliminate the compression effect. It is a safe approach because the protection of spontaneous respiration decreases possible compression on the airway and vascular structures after neuromuscular blockade.

At the beginning of anaesthesia, while remifentanil infusion with propofol and ketamine provides an induction in which safe and spontaneous respiration is preserved, the risk of compression on the airway can be decreased with more normal transpulmonary pressures; awake fiberoptic intubation and laryngoscopy-guided sedation have been reported as choices. Another alternative is rigid bronchoscopy; it is recommended to treat hypotension, which can develop at anaesthesia induction or later, using fluid resuscitation and positive inotropes and vasoconstrictors, such as dopamine and noradrenaline, when necessary. For high-risk patients with serious compression symptoms, the mass is recommended to be excised by performing a cardiopulmonary bypass (2, 4).

For our patient, who was considered to be at high risk based on radiological and clinical findings, spontaneous respiration was preserved and normal laryngoscopy was applied. This method was chosen because it was thought that compared with fiberoptic intubation, more rapid intubation could be performed in the patient whose mask ventilation was uneventful. In the preoperative period, dyspnoea increased in the supine position. Therefore, anaesthesia induction and intubation were performed in the half-sitting position. The problem of hypotension that developed following the lateral position for thoracotomy was resolved using a vasoconstrictor and fluid support. The haemodynamic instability at the beginning of the surgery suggested that the presence of the mass in the left mediastinum increased the compression effect on the heart. The extubation of the patient, who was haemodynamically relieved after the excision of the mass, was planned in the intensive care unit because of long-term compression effect after surgery.

**Conclusion**

The patients having a large mediastinal mass are included in the high-risk group for anaesthesia. Surgery should be planned after necessary preparations with preoperative evaluation of compression and obstruction signs based on radiological and laboratory findings. The continuation of ventilation at spontaneous respiration during anaesthesia, determination of the position decreasing the effect of compression and intensive care support in the postoperative period are the methods used for reducing complications (5, 6).

**Informed Consent:** Written informed consent was obtained from patients’ parents who participated in this case.

**Peer-review:** Externally peer-reviewed.


**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study has received no financial support.

**References**