Case Report

Airway Management in a Child with Anterior Mediastinal Mass Complicated by Cardiac Tamponade - Role of Spontaneous Ventilation

Abstract

Induction of general anesthesia in patients with mediastinal mass can lead to life threatening respiratory and cardiovascular complications during induction, maintenance and emergence. The inability of pediatric patient to cooperate for local anesthesia further complicates the management of such cases. Here we report the management of a child with anterior mediastinal mass causing airway compression and massive pericardial effusion posted for right pleuropericardial window.

Keywords: *Mediastinal mass, spontaneous respiration, tracheal compression*

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Introduction

The management of pediatric patients with mediastinal mass is complicated as they cannot cooperative for diagnostic procedure under local anesthesia. Induction of general anesthesia in such cases can result in airway collapse especially due to the narrow diameter of airways. The importance of maintaining spontaneous respiration has always been emphasized during inducing such cases here we wish to emphasize its role during extubation where the compressing mass is still *in situ*.

Case History

A 12-year-old boy weighing 42 Kg presented to the emergency department with a 10 × 5 cm swelling in the lower part of neck for past 10 days associated with history of dyspnea on exertion, more on supine posture and noisy breathing during sleep. No facial or neck congestion was present. The ECG showed electrical alterans and Contrast Enhanced CT (CECT) scan of chest showed an undefined, soft tissue mass lesion in anterior, and superior mediastinum (12 × 11 × 5 cm), extending from C6 to T4 compressing tracheal lumen [Figure 1]. Moderate pericardial effusion with bilateral moderate pleural effusion was present. Transthoracic echo revealed a large pericardial effusion with right atrial collapse and impending right ventricle collapse in early diastole with early cardiac tamponade. As pericardiocentesis under local anesthesia could not be performed due to the presence of hepatomegaly and lack of patient cooperation he was posted for emergency right pleuro pericardial window by subxiphoid approach under general anesthesia.

After obtaining informed high-risk consent from parents, patient was shifted to the operation theatre in propped up position with oxygen by mask and standard monitors were attached. Ketamine 10 mg was administered intravenously to enable cooperation of the child for further procedure. A left radial arterial line was secured under local anesthesia which depicted an arterial waveform of varying amplitude with respiration suggestive of pulsus paradoxus. Another 18G cannula was secured in the lower limb and 400 ml of crystalloid was administered. We planned to maintain spontaneous respiration with sevoflurane and secure airway under deep anesthesia. Ketamine 10 mg incremental boluses were administered intravenously to maximum of 50 mg and sevoflurane was introduced while breathing 100% oxygen through face mask. During induction at deep plane of anesthesia, we noted sternal retractions, so the breathing was assisted with bag and mask ventilation. Assisted ventilation was possible but with high airway pressures. Subsequently airway was secured with

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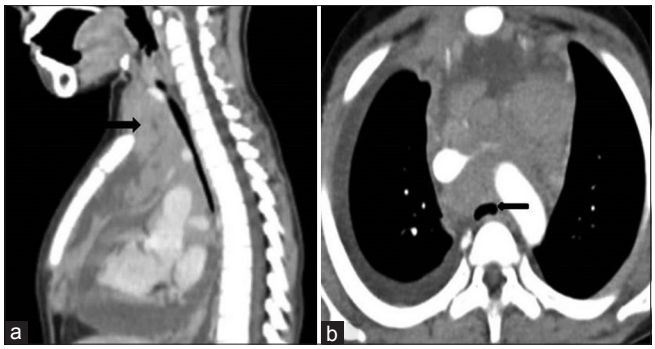

Figure 1: (a) CT scan (sagittal view) showing the extent of mass from C7 to T4 (b) cross sectional view showing tracheal compression

6 mm ID PVC endotracheal tube (ETT) which was initially introduced till 24 cm to by-pass the obstruction but then gradually withdrawn and fixed at 20 cm due to reduced air entry at left side. Post intubation desaturation occurred needing manual ventilation at higher pressure with 100% oxygen with that saturation improved to 96%. The peak airway pressure was in the range of 30–32 cm H_2O with assisted ventilation at a tidal volume of 300 ml and SpO_2-96% with 100% oxygen Anesthesia was maintained with sevoflurane upto MAC 1.5-1.7 and muscle relaxants were avoided.

In view of desaturation surgeon immediately proceeded after local infiltration. Using subxiphoid approach 600 ml of pericardial fluid was drained with improvement in hemodynamics. With drainage of pleural cavity there was some reduction in airway pressure but still higher Fio_2 was required to maintain saturation.

Flexible bronchoscopy showed collapse of tracheal wall and left bronchus. The ETT was then advanced till two rings above carina to bypass the collapsed segment but without any improvement in the airway pressures as compression of left bronchus was still present. We noted bronchial collapse was more prominent during PPV and the lumen improved during spontaneous breaths. Initially our plan was to continue ventilator support postoperatively as the compressing mass was still present, but as elevated airway pressures and higher Fio2 with PPV were required even after drainage was done we waited patiently till the return of spontaneous respiration. Once spontaneous respiration started there was a marked decrease in oxygen requirement and improvement in measured tidal volumes.

After adequate recovery, the trachea was extubated once patient was fully awake. In view of mild noisy breathing adrenaline nebulization was given with which it subsided. Patient was shifted to PACU and observed for any airway obstruction.

Post -operative course was uneventful and the USG guided biopsy performed later revealed it to be T cell acute lymphoblastic leukemia.

Discussion

General anesthesia is often required for any diagnostic or therapeutic surgical procedures in children with mediastinal mass. Incidents of cardiorespiratory complications intra operatively have been reported especially in children due to the smaller caliber and complaint nature of the major airways and inability to cooperate for awake intubation.[1,2] Awake flexible bronchoscopy is the technique of choice to secure airway in such cases as it maintains the tone of airway, allows visualization of the extent of collapse and positioning of tube beyond the collapse site but this was not an option in this case due to the age group of patient.

Induction and extubation in such cases is fraught with danger. Safest approach is to undertake diagnostic and therapeutic procedures under local anesthesia.[3] But in our scenario the presence of impending tamponade and lack of cooperation for pericardiocentesis made general anesthesia essential. CT scan is the investigation of choice to determine the exact size, nature of mass and underlying collapse of airway and vascular structures.[4] Understanding the pathophysiology of the patient is essential for the successful anesthetic management of these cases.

In a patient with massive pericardial effusion, the high intrapericardial pressure restrains right ventricular filling and reduces cardiac output. This reduced cardiac output is compensated by tachycardia and peripheral vasoconstriction secondary to sympathetic stimulation. Our anesthetic goals in this patient was to maintain the physiology by maintaining the high heart rate, myocardial contractility (to maintain cardiac output), optimal preload and after load (to maintain the coronary perfusion). The placement of an arterial line prior to induction provides beat to beat assessment of hemodynamic parameters following induction in such cases with risk of cardiovascular collapse.

GA and PPV will cause a cephalad displacement of the diaphragm and abdominal muscles reducing the functional residual capacity and a decrease in the tone of tracheal and bronchial smooth muscles leading to its compression by the weight of the mass.[5] In spontaneous respiration, the diaphragmatic tone maintains the normal transpulmonary pressure gradient causing inspiratory dilatation of the airways and allows venous return.[6] Hence maintaining spontaneous ventilation and avoiding muscle relaxants will favor the maintenance of airway patency. Choosing an anesthetic agent like Ketamine is favorable since it maintains the ventilatory drive of the patient, muscle tone and also provides an analgesic effect. Due to the associated SVC obstruction in anterior mediastinal masses it is favorable to secure IV access in the lower limb. In diagnostic or therapeutic procedures, where the primary cause of airway compression i.e., the mass still persists at the end of the procedure like in our case, extubation may also be complicated by airway collapse.

Besides induction, the role of spontaneous breaths becomes important during extubation too. Here we want to emphasize the role of spontaneous respiration in improving ventilation in this scenario. Impaired ventilation even after positioning the ETT beyond airway collapse could be due to the presence of bronchial compression. Even pushing the tube further would have led to endobronchial intubation and collapse of the other lung. The dynamics of airway improved markedly with onset of spontaneous respiration even with the mass *in situ*, which encouraged us to go ahead with on table extubation. In a similar patient planned for excision of mass placement of a left sided DLT under spontaneous breathing would be a better option to overcome left bronchus collapse. Understanding the altered physiology and formulating a plan specific to each patient will be the key for successful management of these patients.

Conclusion

The management of children with mediastinal masses is fraught with risk of airway and hemodynamic collapse under general anesthesia. Though local anesthesia is the safest option for various diagnostic and therapeutic procedure in cooperative adult patients with mediastinal mass, children often need general anesthesia. Maintenance of spontaneous ventilation or restoring the spontaneous ventilation in case of impending airway obstruction is the key to the safe airway management of those such children.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Victory RA, Casey W, Dorothy P, Breatnach F. Cardiac and respiratory complications of mediastinal lymphomas. Anaesth Intensive Care 1993;21:366-9.
2. Slinger PD, Campos JH Anesthesia for thoracic surgery. In: Miller RD, editor. Miller Anesthesia. 8th ed. Philadelphia: Elsevier Saunders; 1997-1998.
3. Chait P, Rico L, Amaral J, Connolly B, John P, Temple M. Ultrasound guided core biopsy of mediastinal mass in children. Pediatr Radiol 2005;35:S76.
4. Takashi K, Al-Janabi NJ. Computed tomography and magnetic resonanace imaging of mediastinal tumours. J Magn Reson Imaging 2010;32:1325-39.
5. Erdos G, Tzanova I. Perioperative anaesthetic management of mediastinal mass in adults. Eur J Anaesthesiol 2009;26:627-32.
6. Slinger P, Karsli C. Management of the patient with a large anterior mediastinal mass: Recurring myths. Curr Opin Anaesthesiol 200;20:1-3.