Case Report

Anaesthetic management of two different cases of mediastinal mass

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ABSTRACT

We report the management of two paediatric cases undergoing median sternotomy and right lateral thoracotomy for mediastinal mass. An 8-year-old boy presented with a history of intermittent fever and episodes of respiratory illness since 3 years and a 16-year-old girl presented with dyspnoea, cough, fever and dysphagia for solid foods. Radiological investigation confirmed the diagnoses. Absence of pressure symptoms pointed towards a compressible mass in the boy and indicated a non-compressible mass in the girl. We discuss the anaesthetic management of the younger patient with an uneventful course as opposed to the older patient where airway obstruction ensued soon after induction and led to near-cardiopulmonary arrest necessitating rescue measures. Swift measures at securing airway while simultaneously resuscitating the patient served to successfully revert an otherwise fateful eventuality.

Key words: Airway obstruction, general anaesthesia, lateral thoracotomy, median sternotomy, mediastinal mass

INTRODUCTION

Anaesthesia for mediastinal masses presents a topic for debate as to the questionable advantages of general anaesthesia (G.A.).[1] However, successful management with minimal complications is reported of late due to well-balanced G.A. in such surgeries.[2] Complications can be in the form of bronchospasm or difficulty in ventilation.[3]

The mediastinum is the most common site of chest masses in children.[4,5] Of the many intrathoracic sites where chest masses are seen, the anterior mediastinum poses a greater risk in terms of life-threatening complications arising from compression of airway and vascular structures.[6] These require removal by median sternotomy under G.A. However, G.A. is not without risks.[1] We present two cases, one with an anterior mediastinal mass suspected to be a lymphangioma for excision by median sternotomy and another with a non-compressible mediastinal mass electively taken up for right lateral thoracotomy; both procedures were

performed under G.A. Several of the complications encountered are discussed as possible forewarnings against future misadventures.

CASE REPORTS

Case 1

An 8-year-old boy weighing 16 kg scheduled for median sternotomy for excision of anterior mediastinal mass had intermittent fever for 3 months and dry cough for 2 weeks associated with breathlessness on exertion. Chest X-ray, computer tomography (CT) scan, magnetic resonance imaging (MRI) and echocardiogram were performed to assess the mass and its compression on vital structures. Biochemical investigations were normal.

Intravenous (I.V.) access was established in the right and left hands with a 22G I.V. cannula in addition to a femoral vein catheter for central venous access. The child was pre-medicated and induced with 5 mg/kg of thiopentone I.V. After confirming mask ventilation,

suxamethonium 1.5 mg/kg was used for intubation. Intubation was performed with a 5.5-mm I.D. cuffed reinforced oral endotracheal tube connected to Bain's system. Anaesthesia was maintained with $N_2O:O_2$ (50:50) and sevoflurane 0.8-2.0%. Relaxation was achieved with vecuronium bromide 0.1 mg/kg. Analgesia was achieved with I.V. morphine 0.1 mg/kg. Normocapnia was maintained with suitable ventilatory frequency and tidal volume. Five hundred millilitres of Ringer's lactate was administered over 2 h.

Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation, end-tidal carbon-di-oxide ($EtCO_2$) and electrocardiography (ECG) with ST segment analysis were recorded. Anterior mediastinal mass was removed. Minimal compression was noted on innominate vein and addressed intra-operatively. Sternum was closed in midline. The patient was electively ventilated in a paediatric Intensive Care Unit (ICU) for 3 h, reversed and extubated. He was haemodynamically stable. Later, he had an uneventful course in the hospital before discharge.

Case 2

A 16-year-old female weighing 37 kg, with dyspnoea on exertion that worsened in the supine position, had productive cough, intermittent fever and dysphagia for solid food for 1 month; hence, she was referred to a pulmonologist for management of her condition. On treatment with antibiotics and bronchodilators, the breathlessness reduced and she was able to lie supine without discomfort. Her haemoglobin improved from 7.3 gm% to 11.5 gm% after transfusion of 2 units of packed red blood cells (PRBCs). Her pulse rate was 110/min and her blood pressure was 110/60 mmHg. On examination, her trachea was central and the apical impulse was in the 5th left intercostal space in the mid-axillary line and there was reduced air entry in the right supraclavicular, infraclavicular, mammary and subscapular areas and dullness on percussion. Clinically, the other systems were normal. ECG showed sinus tachycardia. The chest X-ray showed mediastinal widening to the right of the midline obscuring the right cardiac border [Figure 1].

Fibreoptic bronchoscopy (FOB) performed pre-operatively by a pulmonologist with the aid of oral local anaesthetic gargle and spray showed no extrinsic compression on the airway. CT scan of the thorax revealed a lobulated heterogeneous solid cystic mass on the right side of the superior mediastinum,
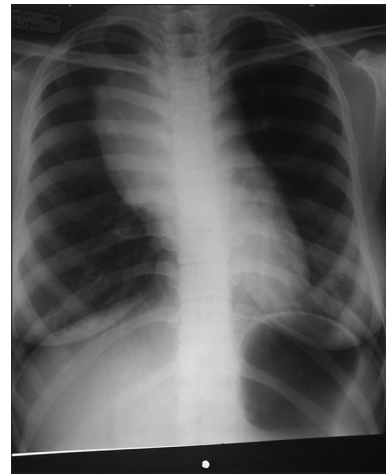

Figure 1: Obscured right heart border

extending from the inlet of the thorax to the level of the upper part of the right atrium. The mass showed fat, fluid, soft tissue and calcification. Spirometry showed severe restrictive and obstructive lung disease with peak expiratory flow rate of 26%. Arterial blood gas indicated mild hyperventilation.

After taking informed high-risk consent, the patient was scheduled for right lateral thoracotomy and excision of tumour. She was given Tab. Alprazolam 0.25 mg and Tab. Ranitidine 150 mg previous night with nil-per-oral orders.

Venous cannulation was obtained with a 16G peripheral I.V. cannula. The right femoral vein and the left femoral artery were also cannulated. Inj Ondansetron 0.1 mg/kg and Inj Glycopyrrolate 0.02 mg/kg were administered before induction. Pre-oxygenation with 100% oxygen for 3 min was followed by induction with sevoflurane 8%. After confirmation of mask ventilation, the child was intubated with a 26Fr left-sided double-lumen tube (DLT). Air entry was bilaterally equal inspite of blocking bronchial or tracheal lumen. The tube was then removed and the patient was ventilated using a face mask with 100% O_2. Three attempts of intubation with the 26Fr left-sided DLT failed to achieve single lung ventilation. As the patient started desaturating, ventilation with 100% O_2 and intubation with a 6.00 mm cuffed oral endotracheal tube was performed. Bilateral air entry was not appreciated. As the patient developed bradycardia, Inj. Atropine 0.02 mg/kg was then administered, but there was no improvement. The patient responded to Inj adrenaline (1 mg/kg) I.V. and developed tachycardia (150-170 bpm). Because of the non-availability of a reinforced tube, the 6.0 mm

tube (already *in situ*) was removed as it had failed to establish air entry, and was reintroduced this time with a stylet. This attempt with a stylet was successful at negotiating the compressive obstruction and establishing ventilation, although insufficiently. While the immediate danger of desaturation was addressed, adequate ventilation was not achieved.

To achieve adequate ventilation, the 6.0 mm tube was replaced with a 7.0 mm tube using a tube exchanger, after making sure that the existing tube tip was indeed at the mid-tracheal position with the aid of a flexible FOB.

After 10 min, the patient developed pulmonary oedema for which Inj Furosemide 40 mg I.V. was given and pulmonary oedema was seen to resolve. While risks versus benefit of proceeding with the surgery (in view of pulmonary oedema having occurred, although transiently and the possible need for elective ventilation – should the need arise) were being deliberated by the surgical and the anaesthesiology teams, the patient was placed in a left lateral position for better ventilation. When surgery resumed, the patient was positioned for right lateral thoracotomy. Anaesthesia was maintained with O_2, N_2O, sevoflurane and Inj Atracurium. Intra-operatively, there was one episode of hypotension, which was managed with Inj Noradrenaline infusion. As blood loss was 350 mL, one unit of PRBC was transfused. $EtCO_2$ was high (60-76 mmHg.) until excision of the tumour. After excision of the tumour, the heart rate and $EtCO_2$ improved (36-48 mmHg). The patient was ventilated in the ICU for 24 h. Inotropic support was tapered on the second day and patient was extubated on the third post-operative day. She had an uneventful course and got discharged after 10 days. Histopathology confirmed the mass as benign mature teratoma.

DISCUSSION

Mediastinal masses assume significance due to the anaesthetic complications arising secondary to compression on the surrounding vital structures. As opposed to an adult average of 16% germ cell tumours, paediatric patients present with 19% germ cell tumours. There is a significant higher incidence of neurogenic tumours and a lower incidence of thymomas and thyroid tumours in children than in adults.[7] The incidence of serious life-threatening respiratory and cardiovascular events in the paediatric population is approximately 7-20% intra-operatively

and post-operatively.[8-11] While it is difficult to extrapolate the same in adults, caution is advised.

General anaesthesia for median sternotomy is associated with hazards, many of which are well documented.[12] These risks are due to reduced functional residual capacity (FRC) because of an increased abdominal muscle tone, decreased inspiratory muscle tone,[13] loss of transpleural pressure gradient secondary to paralysed diaphragm, increased compressibility of the airways because of relaxation of the tracheobronchial tree under anaesthesia[12,14] and supine position contributing to an increase in mass size secondary to increased central blood volume. This exacerbates airway compression. In Case 1, factors such as younger age, smaller size of mass and soft compressible nature (lymphangioma) evidently contributed to an absence of complications. In Case 2, although pre-operative FOB failed to reveal compression on airway, compression nonetheless manifested. This is probably explained by time lapse that ensued forth during repeated attempts at securing the airway, first with a DLT, then with a single lumen tube (SLT) of 6 mm without and with the aid of a stylet and eventually with an SLT of 7 mm. Repeated instrumentation probably contributed towards increased vascularity of the mass secondary to venous engorgement. This was further compounded by relaxation of the airway under G.A., which made the airway vulnerable to the compressive effect of the mass. Although increased compressibility of the airways secondary to muscle relaxants can be countered by intermittent positive-pressure ventilation,[15,16] it is of little help in the face of a non-compressible mass.

The fact that on the third attempt a cuffed tube with stylet was successfully negotiated beyond the point of compression serves to illustrate the undeniable value in adequate preparation for such cases. In fact, had a reinforced tube been available, it would have further complemented the useful role of the stylet in a conventional tube.

However, if all else fails, use of a microlaryngeal tube or rigid bronchoscope can be used under extraneous circumstances. In addition, measures such as change of position to lateral or semi-prone, emergency thoracotomy and tumour debulking, femoro–femoral cardiopulmonary bypass, use of helium–oxygen mixture and direct laryngoscopy must be available to address contingencies.

CONCLUSION

The need for exhaustive pre-operative evaluation, meticulous preparation, perioperative anticipation of complications and equipping oneself to meet these requirements is paramount. Airway cart, emergency drugs and fibreoptic aids ought to be available. Spontaneous ventilation should be preferred during induction to preclude the possibility of airway collapse under influence of relaxants, especially while dealing with non-compressible masses. The use of reinforced tubes and stylets serve to negotiate near-fatal airway obstructions intra-operatively. Last but not the least, asymptomaticity in the pre-operative period in no way precludes the possibility of disastrous eventualities like airway compromise or cardiopulmonary arrest intra-operatively.

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