Giant anterior mediastinal mass anesthesia management

Tran Duc Hung, Tong Xuan Hung, Nguyen Minh Ly

108 Military Central Hospital

Summary

Difficulty in anesthesia management for patients suffered from giant anterior mediastinal mass has been described in the medical literature since 1969. Giant anterior mediastinal masses are not common in anesthesia practice. However, as one of the biggest hospitals in the north of Vietnam and the largest military hospital, we occasionally have to face with these challenged cases. Anesthesia managements for this difficult scenario is not only in the operation theatre when performing definitive treatment but also out of theatre when we need to perform diagnostic imaging or biopsy. Understanding the pathophysical changes during anesthesia is essential cause it can be associated with important cardiovascular and respiratory collapses which can lead to death of the patients.

Keywords: Giant anterior mediastinal mass, anesthesia management.

1. Complications and risk factors

Complete airway obstruction and cardiovascular collapse are the most - feared complications that can occur during general anesthesia in patients with mediastinal masses. Exacerbation of the compressive effects on the major airways and cardiovascular structures (heart, pulmonary artery, superior vena cava) can result in profound hypoxemia and hypotension. They can occur unexpectedly at any time during anesthesia including preinduction, induction, positioning, surgery, emergence and extubation, or postoperatively in the ICU.

2. Preoperative evaluation

The most important aim of preoperative investigation is to identify the size, the relations of the mediastinal mass to the tracheobronchial tree and vital vascular structures, and the location and extent of any compressive effects. CT scans of the thorax provide accurate assessment of the tumor, its nature, size, extent, location, relations to the tracheobronchial tree and major cardiovascular structures, and airway diameters. They are most useful for determining the precise level and extent of tracheobronchial or cardiovascular compression, and this information is essential for formulating the anesthetic plant. Lung function tests and flow volume loops, blood gas analyse have been used, their purported ability to quantify the degree of impairment and differentiate extrathoracic from intrathoracic obstruction.

2.1. Respiratory affectation

An anterior mediastinal mass can narrow the airway importantly. Many patients present with some degree of dyspnea. Some even can not sleep at prone position but lateral position or semi-sitting position. Although the mass only

Correspondence to: Tran Duc Hung - Department of Anesthesiology, 108 Military Central Hospital
Email: bstranduchung108@gmail.com

compress the airway from the outside, with lost of chest wall tone after administrating of muscle relaxants and the effect of gravity at the prone position this compression can become completely. Induction for patient with giant mediastinal mass is an induction without muscle relaxant. Spontaneous respiration must be maintained as long as possible. Therefore, ketamine and volatile anesthetics are good choices. When the airway is compressed or distorted, a tracheal intubation orifice of the intubation tube can impinge the tracheal wall (which is firstly compress by the mass). A long thin tube is saver in this case.

Occasionally, when intubation distal to the tracheobronchial obstruction is not possible, other measures which may be useful include distal jet ventilation catheter via a proximally intubated trachea and rigid bronchoscopy provides a conduit for jet ventilation.

Positioning changes may be necessary to alleviate airway. All cases in this scenario have to be prepared with a cook tube of a brochotube. A rescue position is very important because in many circumstances, airway obstruction can be relieved with an appropriated position (which can be left lateral, right lateral or sitting position). Therefore, when doing preanesthetic examination, clinician have to ask patients at which position they feel most comfortable. This comfortable position is not only rescue for patient but also for the anesthesiologist.

2.2. Cardiovascular affectation

Superior vena cava (SVC) obstruction is often affected. Respiratory symptoms often accompany SVC obstruction. The reason is not clear, but these symptoms may represent coincident airway involvement by engorged veins or the tumour. SVC obstruction can worsen during induction. Inferior vena cava (IVC) obstruction is less described in the literature because its length in the thoracic cavity is limited. Many authors are agreed that if the SVC is affected it is commonly a malign lesion. Dissection and removal of SVC is sometime performed. Therefore, in case, there is a presence of SVC compress syndrome, consider to put central line in the femoral vein to prevent complete SVC obstruction after anesthesia induction or to preserve a central line in case SVC removal is performed. Although the pulmonary artery (PA) is less affected than SVC, its compression can bring serious implications for the anaesthetist; any reduction in cardiac output or perfusion pressure may reduce pulmonary perfusion, and developes cyanosis during induction. Vasopressor and inotrope should be used in the early stage to treat vasodilation and increase cardiac output.

2.3. Roles of cardiopulmonary bypass

As discussed, severe cardiovascular and respiratory collapses can occur in anesthesia, especially in induction. A femoral cannula is some times performed under regional anesthesia to deal with these complications. But it is important to remember that it can cause severe bleeding with heparin utilization.

3. Anesthesia strategies

A careful and throughout preoperatory is really important. It is time to find out which position may be a rescue position. It is also time to classify patients in three categories of risks: light, moderate, and high. Light risk patients are those who have anterior mediastinal mass but not presenting any signs of obstruction clinically and radiologically. Those patients do not have risk to develop cardiopulmonary collapse during surgery. Intermediate risk patients have mild to moderate postural symptoms, and tracheobronchial compression < 50%. High risk patients include patients with severe postural symptoms, tracheobronchial compression > 50% or tracheobronchial compression with associated hemodynamic symptoms. These patients have very high risks to develop severe cardiopulmonary collapses during anesthesia. This risk stratification may guide the utilization of perioperative pre-emptive measures and

precautions, like the safest form of anesthesia. In light risk patient we can perform a traditional anesthesia with muscle relaxants and a normal tracheal intubation. Instead of high risk patient have to be anesthetized with no muscle relaxants induction or the potential assistance of extracorporeal circulation (ECC).

Radiologically signs are important to classify risk of patients. In the past, there are some authors recommend doing a penetrated lateral chest X-ray to evaluate tracheal compression. In modern medical practicing, it is no longer used. With the wild availability of chest tomography, a chest CT is then used. Because the malign tumor grows rapidly, it should be a new chest CT (less than 1 week). Some authors also suggest using bronchoscopy to find out the degree of airway obstruction. It is a value diagnostic tool but quite difficult to perform and maybe should perform in the operation room, during induction, to help intubation. If the compression is too important, maybe we have to request for a period of chemotherapy or radiotherapy to reduce the size of tumor before the surgery.

As discussed previously, tracheal compression can be worse during anesthesia induction. Intubation should be performed while maintaining maximally spontaneous breathing. Many different strategies have been described in the literature. Some authors suggest use volatile anesthetics for induction. Others think ketamine can be a good choice because it reduces pain and has little effect on respiratory function. Importance is avoiding muscle relaxants in high and moderate risk patients. This idea has been pronounced since the 1960s. Now we have another option is using fibroscope intubation. Fibroscopy helps us to determine the smallest diameter of the tracheal and then can be a guide to intubate across the compressed level.

In patients present with signs of SVC compression like superficial vein distention, the central line should be placed on the lower limb. For same reason, large-bore venous access should be secured in the lower extremity (preferably the femoral vein) rather than the upper extremity in all patients. A cardiopulmonary bypass cannula may be placed at the lower limb too to anticipate important cardiopulmonary collapse in high risk patients. Large-bore venous access should be secured in the lower extremity (preferably the femoral vein) rather than the upper extremity in all patients, regardless of risk category.

When intraoperative acute respiratory and hemodynamic decompensation does occur, theoretically, mechanical compression of vital mediastinal structures should be relieved immediately. But it is not so easy, all mediastinal removal need a sternum open and there is a lot of case which the tumor is rigid and not easy re remove. For this reason, at the first stage, the operating table should be rapidly tilted to the before determined rescue position. In the event of airway compression or obstruction, we have to choose between waking the patient up, use a thin long tube to intubate the patient or use rigid bronchoscopy in replacement. For initial hemodynamic stabilisation, the basic principles of cardiac tamponade treatment should be followed, including the administration of appropriate fluids, vasopressive and inotrope medication. Following these steps, if the patients is stabilized, continue the surgery and ask the patients to remove the mechanical compress structure as soon as possible. In another case, the patients are still very unstable, you should consider cardiopulmonary bypass as the last resource. However, even with a primed ECC circuit and perfusionist present in the operating room, it will still take 5–20 minutes before emergency cannulation of the femoral vessels is performed and ECC is initiated; this time interval likely to result in significant neurological injury. A ready canula at femoral vein will help to reduce the waiting time and then reduce risk of neurological injuries. Therefore, always ask the surgeon to present in room during induction and in high risk

case, always discuss with them about putting in place a femoral cannula before the surgery.

4. Conclusion

Giant anterior mediastinal mass is not common in our practice. But once it occurs, it need a careful and understanding management to assure safety of patients. Anesthesiologist plays an important role. Cardiopulmonary collapses can occur at any stage of anesthesia and surgery. Finding a rescue position, maintaining maximally spontaneous breathing, awareness of SVC obstruction, and readiness of cardiopulmonary bypass are some key points to remember.

References

1. Mackie AM, Watson CB (1984) *Anaesthesia and mediastinal masses: A case report and review of the literature*. Anaesthesia. 39(9):899-903..
2. Pullerits J, Holzman R (1989) *Anaesthesia for patients with mediastinal masses*. Can J Anaesth 36(6): 681-688.
3. Kanellakos GW (2012) *Perioperative management of the pregnant patient with an anterior mediastinal mass*. Anesthesiol Clin. 30(4): 749-758.
4. Dalar L, Eryüksel E, Koşar F, Karasulu AL, Urer N, Sökücü SN, Altın S (2012) *Central airway obstruction due to malignant fibrous histiocytoma metastasis in a case with Mounier-Kuhn syndrome*. Tuberk Toraks 60(2): 167-171.
5. Li WW, van Boven WJ, Annema, Eberl S, Klomp HM, de Mol BA (2016) *Management of large mediastinal masses: surgical and anesthesiological considerations.* J Thorac Dis 8(3): 175-184.
6. Narang S, Harte BH, Body SC (2001) *Anesthesia for patients with a mediastinal mass.* Anesthesiol Clin North America 19(3): 559-579.
7. Valladares Otero G1, Pérez Ferrer A, Gredilla Diaz E, de Vicente Sánchez J (2006) *Perioperative respiratory complications in pediatric patients with mediastinal masses: a report of 2 cases*. Rev Esp Anestesiol Reanim 53(10): 657-660.
8. Ul Huda A, Siddiqui KM, Khan FH (2007) *Emergency airway management of a patient with mediastinal mass.* J Pak Med Assoc 57(3): 152-154.
9. Monteiro R, Alfaro TM, Correia L, Simão A, Robalo Cordeiro C, Carvalho A, Costa JM (2011) *Mediastinal masses: Case series.* Acta Med Port 24(6): 899-904.