Myths of anterior mediastinal masses

Castillo M, MD
Mt. Sinai Hospital, New York, USA
Slinger P, MD, FRCPC
University of Toronto, Canada
Correspondence to: Peter Slinger, e-mail: peter.slinger@uhn.on.ca
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Abstract

This lecture will discuss the risks that are associated with the management of patients with anterior mediastinal masses. A plan for risk stratification and preoperative evaluation of such patients will be developed. The indications and available options for anaesthetic management will also be reviewed. Myths about the perioperative management of such patients will be highlighted, specifically flow-volume spirometry and standby cardiopulmonary bypass.

Introduction

A 42-year-old man with an anterior mediastinal mass is scheduled for sternotomy for resection of the mass. The patient has no other medical issues, and until four weeks ago was able to walk up three flights of stairs without any problem. When you meet him in the holding area, he is sitting upright in the stretcher.

Questions for consideration

1. What information would be important to elicit regarding this patient's symptoms? What concerns might you have upon seeing the patient sitting upright?
2. What tests and studies would be useful in order to assess this patient's anaesthetic risk?
3. The computed tomography (CT) scan shows a 9 x 8 x 8 cm mass in the anterior mediastinum, with tracheal deviation to the right. How will this affect your plan for induction of anaesthesia? And what if there is tracheal narrowing?
4. This patient reports facial and neck swelling. What might concern you about these symptoms? What would the implications be if he presented with tachycardia?
5. You proceed with fibre-optic bronchoscopy with sedation after placing standard American Society of Anesthesiologist (ASA) monitors, two large-bore intravenous lines and an arterial line. If you notice tracheal narrowing, but also collapse of the left mainstem bronchus, what are your options for airway management?
6. You mention your concerns to the surgeon. He says that you must not worry about it, and that "we can just crash onto bypass" if anything happens. Is this a realistic option?
7. Imagine that no tracheal narrowing is noted on CT, and you decide to proceed with general anaesthesia. After placing standard ASA monitors, two large-bore intravenous lines and an arterial line, you pre-oxygenate the patient, then induce with 150 mg of propofol. After approximately 20 seconds, mask ventilation becomes very difficult and the patient's blood pressure falls from 135/80 to 65/40. What would you do?
8. You successfully intubate the trachea and the patient is breathing spontaneously with sevoflurane as the inhaled anaesthetic. At what point would you consider giving a neuromuscular blocking drug?
9. The mass has been removed. You have administered three litres of crystalloid and two units of packed red blood cells over the course of the surgery. Would you try to extubate? Is it more prudent to allow the patient to remain intubated for a short time in the postoperative period?
10. If the procedure was only for a diagnostic biopsy of the mass, how would that affect your anaesthetic management?

Discussion

1. Signs and symptoms may include chest pain or fullness, dyspnoea, coughing, hoarseness, dysphagia, sweating or symptoms of superior vena cava (SVC) syndrome. Increased perioperative risk of airway complications is associated wth dyspnoea, orthopnoea or coughing when supine. Increased perioperative risk of cardiovascular complications is associated with syncopal symptoms or pericardial effusion. Symptoms can be graded as mild, moderate or severe, depending on the patient's ability to lie flat. A patient with severe symptoms will not voluntarily lie supine, even for a short time.[1] You will want to ask this patient if he can lie flat, or if not, how many pillows he needs. Note the most comfortable position for the patient, which may be with the head of the bed slightly elevated, sitting bolt upright, or lateral decubitus. This information could be useful in the event of airway obstruction or severe hypotension under anaesthesia. The "rescue position" in such a situation may be sitting up, lateral decubitus, or even prone, but it may correspond with the position that the awake patient finds to be the most comfortable.[2]

2. A CT scan and a chest radiograph are imperative prior to any surgical procedure. The CT scan can show the site and size of the mass, as well as any airway involvement, compression or compromise. The CT scan will also show any involvement of the heart or the great vessels. The presence of pericardial effusion, which may be associated with increased risk of perioperative complications, is of particular importance.[3] Transthoracic echocardiography may also help to identify pericardial effusion and cardiovascular compression.

   Postoperative complications have been associated with tracheal compression of more than 50% on CT scan and a mixed (obstructive or restrictive) picture of abnormal pulmonary function preoperatively.[4] Although pulmonary function tests may provide some information for risk stratification, flow-volume loops have not been shown to be useful in the management of these patients. This is most likely because they do not add any information that cannot be obtained from the CT scan. This is one of the myths relating to mediastinal masses.[1]

3. Postoperative complications may be associated with tracheal compression of more that 50% on CT scan and a mixed picture of pulmonary function preoperatively.[4] Concomitant compression of the mainstem bronchi can also significantly affect perioperative risk, especially in conjunction with tracheal compression.[2]

   Blank and de Souza suggest the following approach to risk stratification for these patients. Low-risk is considered to be asymptomatic or mildly symptomatic, intermediate risk, mild to moderate postural symptoms and tracheal compression < 50%, while high-risk is when there are severe postural symptoms, stridor, cyanosis, tracheal compression > 50% or tracheal compression with bronchial compression, pericardial effusion or SVC syndrome.[2]

   A prudent approach to patients with severe symptoms would be to avoid general anaesthesia whenever possible, using a local anaesthetic or a local with sedation for procedures such as biopsies. Ketamine and dexmedetomidine have proven useful in achieving deep sedation in some patients. In the above case, sedation is not an option. In this case, the safest strategy would be to maintain spontaneous ventilation until the airway is definitely secured, or until the procedure is finished. Induction can be inhalational with a volatile anaesthetic such as sevoflurane, or by intravenous propofol with or without ketamine. If the CT scan shows an area of noncompressed trachea distal to the affected area, awake fibre-optic intubation can be attempted, during which the endotracheal tube is advanced past the area of compression.[1]

   If muscle relaxation is required, assisted ventilation and positive-pressure ventilation can be endeavoured, and then, if successful, short-acting neuromuscular blocking agents can be administered.

4. Facial and neck swelling may be signs of SVC syndrome. In this case, a large-bore intravenous line should be secured in one of the lower extremities. Tachycardia is worrisome for pericardial effusion. These symptoms of cardiovascular compression are associated with increased perioperative complications, including cardiovascular collapse.[3] Patients with severe symptoms such as these should be considered as candidates for cardiopulmonary bypass (CPB) or extracorporeal membrane oxygenation (ECMO). However, such measures should be instituted before induction of anaesthesia and not considered "standby" because too much time would elapse between catastrophic cardiovascular collapse and institution of these techniques.

5. Tracheal compression together with bronchial compression is an ominous sign. In such a situation, a rigid bronchoscope may be placed to stent the airway. A double-lumen tube can be placed in the most patent bronchus or alternative methods of oxygenation can be used, such as CPB or ECMO.

6. "Crashing onto bypass" is another myth relating to mediastinal masses. Establishing CPB in a collapsed patient is difficult. At least 5-10 minutes is required for

femoral cannulation and to establish adequate circulation and oxygenation, even with a primed pump and a perfusion team ready. In such a situation, if he or she survives, the patient may suffer profound neurological injury from the ischaemic interval. If the patient has such severe cardiovascular or tracheobronchial involvement that CPB is a real possibility, it should be instituted before induction of anaesthesia.

7. At this point the patient can be awakened and other possibilities explored. "Rescue" manoeuvers can be attempted, such as positioning the patient in reverse Trendelenburg, sitting up, lateral decubitus, or even prone. If the patient identified his most comfortable position preoperatively, it is suggested that that position is tried first. Rigid bronchoscopy can be attempted to alleviate the obstruction. If life-threatening cardiovascular collapse does not respond to lightening the anaesthetic, emergency sternotomy and surgical elevation of the mass off the great vessels may be the only solution.[1]

8. The decision to use a neuromuscular blocking agent may depend on the type of surgery and the requirements of the surgeon to optimise the surgical field. If the surgery can be completed when the patient is adequately anaesthetised, but spontaneously breathing, no neuromuscular blocker is necessary. If the decision is made to administer one, a short-acting drug should be chosen once it has been established that ventilation can be assisted, and that the patient can tolerate positive-pressure ventilation. In the case of a patient having to undergo sternotomy, it may be possible for the surgeon to elevate the mass in order to alleviate tracheobronchial or cardiovascular compression, thus easing the administration of positive-pressure ventilation and minimising deleterious effects.[2]

9. Patients with severe preoperative symptoms may be at increased risk of postoperative complications, such as atelectasis, pneumonia and airway obstruction secondary to oedema.[2] If the resection was long, large, complex, technically difficult, or the patient experienced large fluid shifts or significant blood loss, it may be wise to consider a period of postoperative mechanical ventilation and a monitored bed in the intensive care unit.

10. Essentially, any diagnostic biopsy of an anterior mediastinal mass, in any age of patient can be carried out with some form of regional anaesthesia if it is unsafe for the patient to undergo general anaesthesia. Options include local infiltration, intercostal blocks, and paravertebral or epidural anaesthesia.

References

1. Slinger P, Karsli C. Management of the patient with a large anterior mediastinal mass: recurring myths. Curr Opin Anaesthesiol. 2007;20(1):1-3.

2. Blank RS, de Souza DG. Anesthetic management of patients with an anterior mediastinal mass: continuing professional development. Can J Anaesth. 2011;58(9):853-859, 860-867.

3. Bechard P, Letourneau L, Lacasse Y, et al. Perioperative cardiorespiratory complications in adults with mediastinal mass: incidence and risk factors. Anesthesiology. 2004;100(4):826-834.

4. Gothard JW. Anesthetic considerations for patients with anterior mediastinal masses. Anesthesiol Clin. 2008;26(2):305-314.

5. Abdelmalak B, Marcanthony N, Abdelmalak J, et al. Dexmedetomidine for anesthetic management of anterior mediastinal mass. J Anesth. 2010;24(4):607-610.

6. Neuman GG, Weingarten AE, Abramowitz RM, et al. The anesthetic management of the patient with an anterior mediastinal mass. Anesthesiology. 1984;60(2):144-147.

7. Shamberger RC, Hozman RS, Griscom NT, et al. Prospective evaluation by computed tomography and pulmonary function tests of children with mediastinal masses. Surgery. 1995;118(3):468-471.

8. Gardner JC, Royster RL. Airway collapse with an anterior mediastinal mass despite spontaneous ventilation in an adult. Anesth Analg. 2011;113(2):239-242.

9. Berth U, Lichtor JL. Anterior mediastinal mass. Anesthesiology. 2010;112(2):447.

10. Shamberger RC, Holzman RS, Griscom NT, et al. CT quantitation of tracheal cross-sectional area as a guide to the surgical and anesthetic management of children with anterior mediastinal masses. J Pediatr Surg. 1991;26(2):138-142.

11. Prakash UB, Abel MD, Hubmayr RD. Mediastinal mass and tracheal obstruction during general anesthesia. Mayo Clin Proc. 1988;63(10):1004-1011.

12. Keon TP. Death on induction of anesthesia for cervical node biopsy. Anesthesiology. 1981;55(4):471-472.

13. Goh MH, Liu XY, Goh YS. Anterior mediastinal masses: an anaesthetic challenge. Anaesthesia. 1999;54(7):670-674.