

Anesthetic Considerations in a Trauma Patient with a Large Incidental Anterior Mediastinal Mass

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ABSTRACT

Mediastinal masses naturally pose a certain degree of challenge to anesthesiologists. Specifically, incidental mediastinal masses discovered in an acute setting, such as during a trauma, prove to be even more challenging. Our case report describes anesthetic considerations and acute pain management in a trauma patient with a large incidental anterior mediastinal mass in need of an urgent orthopedic intervention. The types of mediastinal masses, the risks/benefits of regional versus neuraxial techniques, and the safety concerns for general anesthesia are also discussed.

Keywords

Anterior Mediastinal Mass, Incidental, Trauma.

Introduction

Large mediastinal masses pose a unique challenge in airway management, given its compressive effect on surrounding airway and cardiopulmonary structures. Thus, it is imperative to develop a viable plan that includes preoperative testing and alternative options for intraoperative and postoperative care.

The mediastinum is divided into three compartments [1]. The anterior mediastinum is delineated between the posterior sternum and anterior to great vessels and pericardium. Fifty percent of masses develop in this region, and the most common are thymic masses [2]. The middle mediastinum extends from pericardium anteriorly to ventral surface of thoracic spine. Lymphomas in this region are most commonly found in young males. The posterior mediastinum comprises the spine. Twenty percent of all mediastinal masses develop in this region and tend to be neurogenic [2]. Compressive symptoms from the masses can range from mild cough to life-threatening hypotension (i.e. secondary to tamponade) [3].

Airway collapse can result from either sedation alone or with

paralysis during induction of general anesthesia. This is due to direct reduction in tracheobronchial diameter, increased compressibility of bronchi from smooth muscle relaxation, and sudden drop in trans-pleural pressure gradient secondary to diaphragmatic paralysis [4]. CT imaging and symptom history are the most important determining factors for safety of general anesthesia. An asymptomatic adult with <50% tracheobronchial obstruction (TBO) on CT is considered safe to proceed with general anesthesia [5]. However, the severely symptomatic adult/child, or child with >50% TBO on CT is considered unsafe and does not meet criteria to proceed with general anesthesia [5]. Mild/moderate symptomatic child with <50% TBO on CT; mild/moderate symptomatic adult with >50% TBO on CT; or a patient who is unable to give history, are all considered equivocal [5]. Furthermore, pulmonary function tests may also help determine the nature of the mass and guide anesthetic technique.

Determining the location of the mass in comparison to the endotracheal tube (ETT) is critical. Obstruction immediately distal to the ETT, prevents further advancement of the ETT. If mass is proximal on CT imaging, then awake fiber-optic intubation is an alternative. In all general anesthesia cases, maintaining spontaneous ventilation after an inhaled induction is vital. If the proximity of the mass location is unknown, then local and regional

techniques should be employed where possible.

This case report discusses the anesthetic considerations and acute pain management for a trauma patient with a large incidental anterior mediastinal tumor in need of urgent orthopedic intervention. Consent was obtained from the patient for this discussion.

Case

A 19-year-old male with no significant past medical history presented to the trauma bay after being a restrained passenger in a motor vehicle accident. Radiographic imaging showed a left femoral shaft comminuted fracture and right ulnar styloid avulsion fracture. CT scan of chest/abdomen/pelvis showed a large anterior mediastinal mass 10.6×7.8 cm resulting in the compression of right internal jugular vein and superior vena cava with a resultant mass effect on the trachea and local sternum involvement. The patient was asymptomatic from this mass.

Airway exam showed Mallampati 1, Wilson 0-1 with adequate mouth opening. Both pulmonary and cardiovascular exam were within normal limits. Pre-operative evaluations from the orthopedic team stated the need for urgent repair of the left femur with intramedullary nail. Cardiothoracic surgery was consulted and recommended neuraxial or regional anesthesia for the procedure, since the mass was large and there is an increased risk of tracheal collapse with general anesthesia. They also recommended having cardiopulmonary bypass (CPB) available; should regional anesthesia prove inadequate and patient requires airway protection. However, since the primary procedure was orthopedic, which in itself puts the patient at increased risk of surgical bleeding, the patient was not a suitable candidate for CPB, due to need for anticoagulation, which would be required.

The case proceeded using a combined spinal-epidural anesthetic technique. In order to avoid airway instrumentation and to prevent disturbance of the anterior mediastinal mass, the case proceeded using a combined spinal-epidural anesthetic technique. Patient was given ketamine 30 mg IV to alleviate the pain associated with positioning him into the right lateral decubitus position. However, in this position, the patient developed respiratory distress and his oxygen saturation decreased to the mid-80s, soon after the administration of the ketamine. At this time, an oxygen mask was utilized and his oxygen saturation quickly improved.

A 18-gauge Tuohy needle was placed at L2 without any complications; loss of resistance to air was noted at 5cm. This was subsequently followed by the placement of a 24-gauge spinal needle; CSF was withdrawn for confirmation, 0.75% bupivacaine 1.4 mL was then injected into the intrathecal space. An epidural catheter was threaded to 10 cm to the skin and secured.

Intra-operatively, boluses of 2% lidocaine with epinephrine were administered via epidural catheter throughout the case. The case ended without any surgical or anesthetic complications.

Post-operatively, patient-controlled epidural analgesia (PCEA)

was provided with a continuous infusion of 0.125% bupivacaine and 2 mcg/mL of fentanyl at 10 mL/hr. with a demand bolus of 2 mL, and lockout interval of 20 minutes. Adequate postoperative analgesia was obtained with both PCEA and IV acetaminophen. The patient reported a pain score of 4 on post-operative day one. The epidural catheter was removed on postoperative day one.



Figure 1: CT image of anterior mediastinal mass compressing the right main bronchus.

Discussion

The presence of a mediastinal mass creates a degree of challenges to the anesthesiologist. Managing the airway and ventilation are the primary concern pre-operatively and intra-operatively, and also postoperative pain control is a major concern.

In our case, history was an exception for two reasons. First, the patient lived and functioned completely asymptomatic in spite of the large anterior mediastinal mass, which was an incidental finding on imaging. Second, the patient presented in an acute setting as a trauma victim secondary to a motor vehicle accident. The urgency for the surgical intervention posed as an obstacle since it prevented full medical optimization of the mass prior to surgery. Additionally, the default of CPB on standby if the airway been compromised posed a challenge in the nature of the surgery itself. The intervention was orthopedic, the risk of bleeding was high, and thus the bleeding would have been significantly increased with the heparinization needed for potential CPB. Therefore, our primary approach was to do a combined spinal-epidural. This technique not only was able to provide adequate intra-operative analgesia without a risk of airway compromise, but it also was able to provide post-operative analgesia without respiratory depression secondary to the use of opioids. The epidural was used as PCEA, and it provided sufficient analgesia for postoperative pain. It was removed postoperative day one, due to the primary team concerns to start anticoagulation prophylaxis with low molecular weight heparin.

PCEA's have been used to control pain in laboring patients since the 1980s [6]. More recently, the use of PCEA for analgesia after major abdominal and thoracic surgeries has also been studied [7]. The combination of local anesthetic and opioid in the epidural space have been proven to provide an increase in the quality of dynamic pain relief and also limits the regression of the sensory block seen commonly with the use of pure local anesthetic [7]. A study by Kopacz et al., showed that the combination of levobupivacaine and fentanyl in a PCEA with patients undergoing elective total joint arthroplasty correlated to lower postoperative pain scores [8]. PCEAs cannot be utilized in patients that are coagulopathic, need anticoagulation, or thrombocytopenic. Like many procedures placement of an epidural faces many risks, including nerve root damage, block failure, hypotension, and headache. Overall PCEAs have been shown to dramatically lessen sedation, decrease nausea, shorten hospitalization, and promote early mobilization [9]. In our patient, the PCEA proved to be extremely helpful in controlling both the acute postoperative pain and intraoperative pain in the setting of acute trauma.

Other forms of regional anesthetic techniques could have been considered when doing this case, including lumbar plexus and fascia iliaca blocks. Amiri et al. shows that a lumbar plexus block (LPB) is an adequate alternative in elderly patients undergoing hip surgeries [10]. However, the success of LPBs is primarily operator dependent. Also, elderly patients tend to have a lower muscle mass, therefore the muscle relaxation provided with LPB proved to be efficacious [10]. In younger, more muscular patients, as in the case of our trauma patient, adequate surgical muscle relaxation might not be achieved. This inherently would create the need to either convert the case to general anesthesia, which was not an option with the large mediastinal mass, or use a different regional anesthetic altogether. The fascia iliaca block is a compartment block that targets the sensory innervation over the hip and anterior thigh. It provides adequate analgesia for incision site, however does not provide adequate surgical anesthesia.

Lastly, given the extent and location of the anterior mediastinal mass, our patient was not a candidate for general anesthesia (GA). Therefore, we considered utilizing a regional technique as an alternative. However, if GA is necessary, the follow-up evaluation would include adequate history, CT imaging, location and size of the mass, and pulmonary function tests to determine whether mask ventilation and/or hand assisted ventilation would be possible. If mask ventilation is possible, then it allows the option to proceed with GA [11]. If mask ventilation is impossible, then CPB on standby versus percutaneous cardiopulmonary support (PCPS) should be kept as alternatives on standby [11]. The disadvantage to CPB on standby is that it would take approximately 5-10 minutes

to access the chest and insert cannulas, during which time the patient would remain anoxic [12]. This could result in profound neurologic injury [11].

Although an incidental finding, the anatomical extent of the mediastinal mass (with tracheal, right internal jugular, and superior vena cava compression) as well as the acuity of the procedure posed major challenges to the anesthetic team. However, with close workup and consideration of the risks involved, the case was managed successfully intraoperatively with neuraxial anesthesia and with CPB available on standby, as well as post-operatively with PCEA.

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