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Massive Hemoptysis after the Initiation of Positive Pressure Ventilation in a Patient with Pulmonary Tuberculosis

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RESPIRATORY tract hemorrhage in a patient with old pulmonary tuberculosis after positive pressure ventilation during general anesthesia is an unusual but often lethal complication. We describe a case of massive hemoptysis induced by positive pressure ventilation during general anesthesia. After successful resuscitation, the patient received an epidural anesthesia with spontaneous ventilation while undergoing low anterior resection for rectal cancer.

Case Report

A 78-yr-old 60-kg man was to undergo low anterior resection for rectal cancer. He had history of pulmonary tuberculosis for 20 yr. On physical examination, a partially collapsed right upper lobe and cavity

were noted at chest roentgenogram. He had no history of abnormal hematologic data. Preoperative pulmonary function test showed to have mild chronic obstructive pulmonary disease with positive response to bronchodilators.

No premedication was administered. After the patient's arrival in the operating room, intravenous access was established. Induction of general anesthesia was accomplished with vecuronium bromide, fentanyl, and propofol. Tracheal intubation was facilitated by the administration of succinylcholine. Neuromuscular blockade was maintained with vecuronium bromide after induction. Anesthesia was maintained with 50%N₂O/50%O₂. Mechanical ventilator settings were tidal volume of 600 ml and a respiratory frequency of 10 breaths per minute.

Shortly after beginning positive pressure ventilation, massive amounts of fresh blood were noted refluxing from the endotracheal tube. The patient's hemodynamic status deteriorated into pulseless electrical activity within minutes, and resuscitative efforts including chest compressions, intravenous epinephrine, and 1000 ml whole blood replacement were initiated. Then the patient was transported emergently to the angiographic room for embolization. After embolization of the bleeding right superior bronchial artery, the patient was returned to the operating room. The patient was extubated subsequently in the operating room and the surgical procedure was canceled. The patient was transported to the intensive care unit for postoperative care and recovered without obvious neurologic sequelae. The postoperative chest roentgenogram showed total collapse of the right upper lobe with the typical air bronchogram sign and pneumonic consolidation change.

The patient was rescheduled to undergo surgery again 1 week later. After insertion of an intravenous catheter, he received 25 mg pethidine and 5 mg midazolam intravenously. With the patient in the left lateral knee-chest position, the epidural catheter was inserted at the L₂-L₃ interspace with loss of resistance technique. Lidocaine 2% with 1:200,000 epinephrine was administered in incremental dose of 5 ml to a total of 40 ml. A surgical level of sensory anesthesia was obtained from T₄ to S₅.

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Key words: Centroneuraial blockade; pulmonary hemorrhage; suffocation.

CASE REPORTS

After induction, he felt comfortable. He became mildly hypotensive, but this was easily corrected with fluids and ephedrine. To maintain surgical anesthesia, a total of 5 ml of 2% lidocaine with 1:200,000 epinephrine was administered in incremental doses throughout the 1-h operation to a total of 60 ml for the approximate 4-h surgical procedure. The patient received epidural morphine for postoperative pain control. The epidural catheter was removed 3 days after surgery without any complications.

Discussion

Hemoptysis is a nonspecific sign associated with much pulmonary disease. A brief list of causes includes infectious (e.g., tuberculosis, bronchiectasis, bronchitis, fungal infection, pneumonia, lung abscess), neoplastic (e.g., bronchogenic carcinoma or bronchial adenoma), cardiovascular (e.g., mitral stenosis, pulmonary thrombo-embolism, pulmonary vascular malformation, left ventricular failure, Wegener's granulomatosis, Goodpasture's syndrome, cardiogenic pulmonary edema), traumatic (lung contusions and foreign body), or unknown. In many patients, determining the cause of hemoptysis and quantitating the amount of bleeding are often difficult because blood may be mixed with sputum, saliva, or a swallowed or aspirated substance. The physical examination may be useful in assessing the cause and severity of hemoptysis but is rarely a reliable means to localize the bleeding site. Asphyxiation by aspirated blood associated with severe hypoxemia and hypotension is the major cause of immediate mortality in patients with massive hemoptysis.

Massive hemoptysis, as defined by Purael and Lindskog,¹ is a single expectoration of more than 500 ml or expectoration of more than 1000 ml in small increments during several days, as was the case in this patient. Treatment mainly depends on the severity and persistence of hemoptysis and its likelihood of recurrence. It can be controlled by some emergent therapies that include medical treatment, bronchial artery embolization, and surgical procedure. Definitive therapy may require medical treatment of infections or bronchial artery embolization. Double-lumen endobronchial tubes are rarely indicated if the patient needs to be intubated because the small lumen diameters limit suctioning and airway clearance. Cough suppression with codeine or opioid is indicated to prevent dislodging of hemostatic clots. If bleeding persists after medical management, large bronchial-pulmonary artery fistula may have occurred and bronchial artery embolization would be arranged. Bronchial artery embolization was performed for the first time in 1974 by Renny² and is still an important tool

today in the control of hemoptysis. Various types of surgical pulmonary resection may be required for continuing massive hemoptysis from a localized site or as definitive therapy. Its indications³ include (1) an amount of hemoptysis more than 600 ml per 24 h, unresponsive to medical treatment, (2) repeated massive hemoptysis or a history of suffocation, (3) irreversible lesion in the lung with the bleeding site identified accurately, and (4) the general condition and vital signs of the patient would permit surgical therapy.

In 1868, Rasmussen originally described massive hemoptysis in patients with tuberculosis as bleeding from the erosion of an artery in a thick-walled cavity. Cudkowicz,⁴ citing this study, showed the dilated vessels were of bronchial artery origin. Subsequently, massive hemoptysis in patients with tuberculosis has been described most often as secondary to unilateral cavitary disease or aspergilloma.^{5,6} In our case, the collapsed right upper lobe and cavity formation were noted at chest roentgenogram. Massive hemoptysis after induction was associated with positive pressure ventilation during the first general anesthesia. Presumably, reexpansion of the collapsed right upper lobe resulted in the tearing of a bronchial artery followed by massive hemoptysis.

After reviewing articles about hemoptysis in patients with pulmonary tuberculosis under general anesthesia with positive pressure ventilation, pulmonary and ventilation dysfunction may occur because of the patient drowning in his or her own blood by massive hemoptysis during the operation. A high mortality rate was reported in these patients who did not receive emergency medical or surgical treatment.^{7,8} We recommended the technique of a continuous epidural anesthesia for this patient with spontaneous breathing during the surgery to avoid pulmonary rebleeding complication under general anesthesia with positive pressure ventilation occurring again.

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Thoracic Epidural Anesthesia for Thoracoscopy, Rib Resection, and Thoracotomy in a Patient with a Bronchopleural Fistula Postpneumonectomy

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THE induction of anesthesia in a patient with a bronchopleural fistula (BPF) postpneumonectomy can be quite difficult. This is because positive pressure ventilation can force gas through the fistula and lead to inadequate ventilation. The choice of endotracheal tube and insertion technique are important considerations in these patients. The placement of a double lumen tube or a single lumen tube inside the normal main stem bronchus may be technically difficult after a lung resection and is at risk of being malpositioned through the bronchial stump. A single lumen tube can be placed above the carina in a patient breathing spontaneously (awake or asleep); however, positive pressure ventilation, if needed, may impair ventilation. Also, it will not prevent contamination of the remaining lung. A bronchial

blocker proximal to the fistula risks perforating the bronchial stump if it migrates distally.

We report a case of a patient with a BPF postpneumonectomy who had a thoracoscopy, mini thoracotomy, and rib resection performed under thoracic epidural anesthesia and intravenous sedation without instrumenting the airway and without positive pressure ventilation.

Case Report

A 68-yr-old male was readmitted to hospital 1 week after discharge after an uneventful right pneumonectomy for squamous cell carcinoma. He presented with worsening dyspnea, hemoptysis, and productive cough. Examination revealed a respiratory rate of 22, heart rate of 100, and blood pressure of 130/78. The trachea was midline and there was good air entry to the left lung with some rales in the left lower lobe. Oxygen saturation was 83% on room air and 91% on 2 l nasal prong oxygen. The chest x-ray revealed a right hydro-pneumothorax, a midline trachea and mediastinum, and no air space disease.

The patient was started on intravenous ampicillin and gentamicin. On the third day, a right-sided chest tube was inserted that drained 250 ml of fluid in the first 24 h and demonstrated a persistent air leak. Follow-up chest x-rays revealed persistent loculated air fluid levels on the right hemithorax and a clear left lung field. The chest tube was left open to air to drain any remaining empyema. Throughout this period the patient did not show signs of sepsis.

Bronchopleural fistula caused by a persistent bronchial stump leak was diagnosed. The patient was scheduled to undergo a thoracoscopy and rib resection to allow for the insertion of a large caliber drainage tube. The surgeon preferred that the patient's airway not be instrumented. After reviewing the anesthetic options with the surgeon and patient, the decision was made to proceed using a thoracic epidural for anesthesia and postoperative analgesia.

A thoracic epidural catheter was inserted at the T7-8 interspace using the paramedian approach in the sitting position. Carbonated lidocaine (equivalent to 2%) was titrated in 2 ml aliquots to a total dose

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Key words: Bronchial stump; empyema; neuraxial block; thoracic surgery; pneumonectomy.