Airway Management in Massive Hemoptysis

a report by
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Patients with hemoptysis may present with critical airway management challenges. The volume of the central conducting airway measures only approximately 150ml, which can fill rapidly with blood and blood clots during massive hemoptysis. If this occurs, ventilation and oxygenation are compromised. During massive hemoptysis, death is usually a result of asphyxiation rather than from exsanguination. It is important to follow a quick, defined, yet flexible management guidelines in managing patients with massive of hemoptysis.

There are a number of ways to classify hemoptysis based on the volume of the expectorated blood. On the one extreme, scant hemoptysis refers to small specs of blood-tinged sputum or sputum mixed with occasional small blood clots, and there is usually no urgent airway issue. At the other extreme, massive hemoptysis has a wide-ranging volume definition of expectoration of blood, from 100 to 1,000ml per day. The rapidity of the blood loss and the general condition of the patient are important factors to consider properly triaging the patient and deciding the aggressiveness of the intervention. A patient who expectorates most of the daily volume of 200ml in the last two hours is likely to have a more urgent problem than another patient who expectorates the same amount of blood in 24 hours in small amounts throughout the day. A recent change in the rapidity of the hemoptysis volume may be a warning sign of an impending massive hemoptysis and airway compromise. Mortality increases as the rate of hemoptysis increases.

A rapid global clinical survey of a patient who presents with hemoptysis within the first few minutes of the encounter should be performed. A decision is then made regarding the acuity of the patient's condition, and whether an emergent or urgent intervention in an in-patient setting is indicated, or an out-patient evaluation is appropriate. In a stable patient with scant hemoptysis, there is usually no urgent airway issue, and a complete evaluation with detailed pulmonary history, physical examination, and ancillary studies can be undertaken. In a patient with massive hemoptysis, early management at the first point of contact usually requires a readiness for active resuscitation, combined with limited data gathering of essential history, physical exam, and ancillary studies. An interventional pulmonologist should be consulted early on. If a patient is potentially a surgical candidate, a thoracic surgeon should also be notified promptly.

The judicious use of opiate-based antitussive agents may be helpful in controlling the hemoptysis. Cough suppression decreases the shear force generated inside the airway, and may decrease the hemoptysis. The patient should still be kept awake and be able to cough up the blood clots within the central airway. The opiate antitussive agents may also help calm the patient down.

Patients with moderate hemoptysis should be scheduled for bronchoscopy. There is a window of time for optimal airway inspection. Bronchoscopy performed during active hemoptysis is often limited in its visibility and may occasionally miss airway lesions. If hemoptysis has completely resolved, bronchoscopy would allow better airway inspection, but is less likely to localize the site of bleeding. Bronchoscopy yields the most diagnostic data when it is performed when bleeding has diminished but not stopped completely.

In addition to the patients who present with clear massive hemoptysis, patients with lesser amounts of hemoptysis in the setting of significant cardiopulmonary disease, coagulopathy, or platelet dysfunction are at high risk of morbidity and mortality. These patients should be closely observed for impending airway compromise, while interventions to stop the bleeding are being pursued.

In a patient with active massive hemoptysis and impending airway compromise, a limited clinical history and physical exam should be obtained, while a frontal chest radiograph, routine blood count with platelet counts, coagulation studies, and blood product cross-matching are being obtained. It is important to evaluate the possible source of bleeding in the oropharynx or the posterior nasal passage. The ability to walk for two blocks and climb two flights of stairs

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suggests the patient may be able to tolerate lung resection, if necessary. An emergent bronchoscopy should be set up while the rapid assessment is taking place. Immediate attention should be given to the adequacy of airway patency, breathing, and the circulatory system. Two large-bore peripheral intravenous accesses should be placed. Any known coagulopathy or platelet abnormality should be corrected, and the lost blood volume replaced.

In massive hemoptysis, bronchoscopic intubation is preferred to rigid laryngoscopic intubation, so that the proximal airway, including the larynx and the proximal trachea, can be assessed prior to the placement of an endotracheal tube. Intubation and bronchoscopy should be performed under adequate sedation. The largest diameter endotracheal tube available, should be used to allow a therapeutic bronchoscope to pass through and to remove large blood clots. Only oral intubation should be conducted. Nasal intubation should be avoided to prevent nasal trauma and bleeding, and to allow the extra length of the tube, in case a selective main bronchus intubation is needed. A double lumen tube should not be used for massive hemoptysis due to its difficulty in positioning requiring a tiny bronchoscope, and the inability to pass a large suction catheter or a therapeutic bronchoscope to evacuate blood clots from the central airway.

Evacuation of blood clots from the central airway may be necessary to fully evaluate the airway and source of bleeding, and to provide adequate gas exchange. Fresh blood clots are often difficult to remove. Sometimes, the clots have to be removed using a cryoprobe through the bronchoscope. Small airway tumors may be missed when active hemoptysis and blood clots are present. If a unilateral source of bleeding is suspected from the chest radiograph or prior history, the patient should be placed in a lateral decubitus position with the diseased side down. If the site of bleeding is not obvious, small aliquots of saline can be washed into each segmental bronchial orifice to localize an area of persistent bloody return. Once a site of bleeding is identified, the bronchus leading to the site can be washed with diluted epinephrine solution, ice saline lavage, or topical thrombin. There is a variable success rate with these approaches. If bleeding persists, additional airway manipulation is needed.

The endotracheal tube may be advanced under direct bronchoscopic vision to the non-bleeding side to allow protected gas exchange to take place, while a more definitive intervention is planned. Alternatively, the bronchus leading to the bleeding site may be obliterated using an endobronchial blocker. In our practice, we prefer to pass an endobronchial blocker outside of the endotracheal tube, at the anterior commissure of the vocal folds under direct laryngoscopic view, so as to allow the endotracheal tube open for a therapeutic bronchoscope to pass through unobstructed. The endobronchial blocker is advanced under direct bronchoscopic vision to the site of the bleeding. The balloon of the blocker is inflated and the distal bleeding site is allowed to tamponade. The least amount of volume and pressure needed to inflate the balloon to seal the bronchus should be used to prevent mucosal ischemia and subsequent bronchial stenosis or bronchomalacia. At this stage, the rest of the airway should be free of bleeding, and a more thorough airway inspection and clot removal may be undertaken.

Once the airway is secured and gas exchange is adequate, a more definitive intervention is planned. These include bronchial artery embolization, pulmonary artery embolization, or surgical resection of a focal lesion. The endobronchial blocker balloon should be deflated after bronchial artery embolization is successful in stopping the bleeding.

Sometimes the bleeding comes from multiple segments or lobes, such as in the case of alveolar hemorrhage. In this case, bronchoscopic airway intervention is less useful, unless all the involved areas are on one side. When both lungs are involved in diffuse alveolar hemorrhage, only appropriate medical therapy can halt the bleeding, and the patient may need frequent suctioning or intermittent bronchoscopy to clear the airway from blood clots.

Less commonly, the source of bleeding may be a large endobronchial tumor. A highly vascular tumor in the main bronchus or more distal area may be amenable to partial or single lung resection. An actively bleeding vascular tumor in the trachea is not surgically resectable. The latter should be brought to the operating room emergently for rigid bronchoscopic intervention, with laser photocoagulation and mechanical bronchoscopic tumor resection.

In summary, a patient with massive hemoptysis usually presents with an emergent airway management challenge with high risk for morbidity and mortality. A methodical yet flexible approach with rapid initial assessment is needed. Securing the airway with a large single lumen tube by oral intubation is the first priority. Bronchoscopic intubation is preferred to laryngoscopic intubation when a bronchoscope is readily available. Once a bronchial source of bleeding is identified, the airway can be secured by selective intubation of the non-bleeding side, or by selective placement of an endobronchial blocker to the bleeding side. ■