Massive Airway Hemorrhage

Sai Yendamuri, MD[a,b,*]

KEYWORDS

• Hemoptysis • Rigid bronchoscopy • Bronchial artery embolization • Thoracic surgery

KEY POINTS

- Massive hemoptysis requires a systematic yet flexible multidisciplinary approach.
- Initial treatment consists of stabilization, securing the airway, and nonsurgical temporization of the bleeding source.
- Rigid bronchoscopy is the best way to secure an airway in patients with massive hemoptysis.
- Delayed surgery after stabilization leads to the best surgical results.

INTRODUCTION

Acute airway hemorrhage represents a challenge to the thoracic surgical team, including the surgeon as well as the anesthesiologist. Although torrential hemorrhage is rare, a stepwise approach to dealing with this catastrophic situation is necessary to salvage patients. This stepwise approach should be built on the availability of necessary infrastructure and expertise. This article examines the cause of airway hemorrhage and provides an overview of the management strategies that the surgical team should be aware of to deal with this surgical emergency.

The airway has a dead space of approximately 150 mL. The mucociliary mechanism and cough reflex can evacuate some amount of blood; but even a modest amount of bleeding can overcome these mechanisms, leading to asphyxiation. The definition of massive hemoptysis varies from 100 to 1000 mL over a 24-hour period; the intent of this quantification being the identification of patients needing immediate intervention.[1–3] However, the urgency of intervention depends on several factors, including the overall functional status of patients, rapidity of bleeding over shorter intervals of time, cause of the disease, and available treatment options. Therefore, investigators have proposed alternative definitions of life-threatening hemoptysis based on the magnitude of the functional effects of the hemoptysis rather than just the measurement of the same.[4] Some criteria suggested for such definitions include the need for hospitalization, transfusion, intubation, hypoxemia, and hypotension.[5–7] These criteria have been at least partly motivated by the practical problem of unreliable patient measurements of hemoptysis.

CAUSE

Airway hemorrhage can be broadly divided as arising from 2 sources. The first source is the proximal airways, such as that arising from the trachea, mainstem bronchi, and proximal lobar bronchi. The second is from the distal airway.

1. Proximal airway bleeding: **Box 1** lists possible sources of proximal airway bleeding. Malignant tumors of the airway are by far the most common sources of tracheobronchial bleeding. An example of one such source is shown in **Fig. 1**. The main implication of identifying proximal airway bleeding is that interventional

The author has no competing interests to declare.
[a] Department of Thoracic Surgery, Roswell Park Cancer Institute, Elm and Carlton Streets, Buffalo, NY 14263, USA; [b] Yashoda Hospitals, Alexander Road, Secunderabad, Telangana 500003, India
* Roswell Park Cancer Institute, Elm and Carlton Streets, Buffalo, NY 14263.
E-mail address: sai.yendamuri@roswellpark.org

Thorac Surg Clin ■ (2015) ■–■
http://dx.doi.org/10.1016/j.thorsurg.2015.04.009
1547-4127/15/$ – see front matter

Box 1
Causes of proximal airway bleeding

- Malignant
  - Squamous cell cancer
  - Adenoid cystic carcinoma
  - Carcinoid
  - Mucoepidermoid cancer
- Benign
  - Iatrogenic
  - Tracheo-innominate fistula
  - Broncholithiasis
  - Inflammatory lesions of the airway
  - Dieulafoy disease of the bronchus
  - Trauma

pulmonary techniques can be potentially used to arrest bleeding. Also, the proximal airway is within reach of a rigid bronchoscope, which is the instrument of choice for managing this situation in the operating room.

2. Distal airway bleeding: There are many more causes of distal airway bleeding as virtually every lung pathology can lead to some amount of bleeding. The more prominent etiologic groups are summarized in **Box 2**. The implication of this etiologic grouping is that bleeding caused by these conditions cannot always be managed by interventional pulmonary methods. Management depends on the treatment of the primary cause.

MANAGEMENT STRATEGY

The management of airway bleeding depends on a structured yet flexible approach by a multidisciplinary team of anesthesia, thoracic surgery, interventional pulmonology, and interventional radiology. One possible schema for an overall management strategy is summarized in **Fig. 2**. This strategy can be divided into 3 steps:

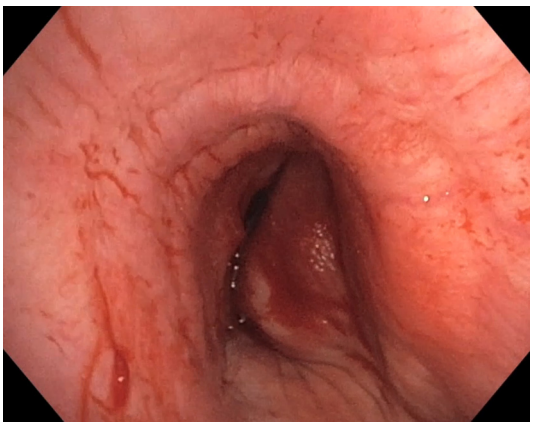

Fig. 1. Endobronchial tumor. Adenocystic carcinoma in distal trachea.

Box 2
Causes of distal airway bleeding

- Vasculites
- Coagulopathy
- Cardiovascular diseases
  - Mitral stenosis
  - Arteriovenous malformations
  - Pulmonary embolism
- Pulmonary parenchymal diseases
  - Lymphangioleiomyomatosis
  - Pulmonary capillary hemangiomatosis
  - Pulmonary hemosiderosis
- Infections
  - Bronchiectasis
  - Aspergillosis
  - Tuberculosis
  - Lung abscess
  - Bronchitis
- Malignancy
  - Primary lung cancer
  - Metastases
- Foreign body
- Iatrogenic (eg, computed tomography–guided biopsy)

STABILIZATION

As in all surgical emergencies, the first step consists of assessing the stability of the airway and the circulatory system. Once this is done, a brief history and physical examination are performed. Bilateral large-bore peripheral intravenous access is obtained; in this process, investigations are sent off for regular blood work, coagulation profile and blood typing, and cross matching. A frontal chest radiograph is obtained; if patients are stable, a computed tomography scan adds invaluable information. The operating room team and the interventional team (thoracic surgeon and/or interventional pulmonologist and the interventional radiologist) are alerted. Opiates are administered judiciously to decrease forceful coughing without altering the sensorium. Any coagulopathy, if