

## POINT:

## Should All Initial Episodes of Hemoptysis Be Evaluated by Bronchoscopy? Yes



CrossMark

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PODCAST

**ABBREVIATIONS:** APC = argon plasma coagulation

Hemoptysis is one of the leading causes for pulmonary admissions and consultations,<sup>1</sup> and can be both frightening (for the patient and provider) and life-threatening (for the patient). One of the first questions the physician will encounter is “should bronchoscopy be performed for all initial episodes?” and if so, when, by whom, and where? Bronchoscopy is a safe and relatively inexpensive procedure that allows the rapid identification and control of the source of bleeding, and can help guide a more definitive treatment if necessary. As such, bronchoscopy has a role in the evaluation of the large majority, if not all, patients presenting with hemoptysis.

## Defining Hemoptysis

Excluding the cases in which hemoptysis is a debatable diagnosis (ie, epistaxis, hematemesis) and for which bronchoscopy can be used to rule out the airways as a source of bleeding, the physician will encounter four distinct clinical scenarios: (1) massive hemoptysis, (2) nonmassive hemoptysis with abnormal imaging studies,

(3) nonmassive hemoptysis with risk factors for lung cancer with normal chest radiograph, and (4) cases of self-limited nonmassive hemoptysis with both normal chest radiograph and *without* risk factors for lung cancer. We propose that all, aside from the last group, would benefit from bronchoscopy. In the first group, bronchoscopy can be life-saving, providing isolation of the “good lung.” As chest imaging in this scenario often shows diffuse airspace disease due to aspirated blood, bronchoscopy can identify the source of bleeding and serve as a temporizing measure prior to more definitive therapy.<sup>2</sup> In the second and third groups, bronchoscopy is valuable in both identifying the source of bleeding and providing a tissue-based diagnosis. In patients with hemoptysis with normal chest radiograph and risk factors for lung cancer, the incidence of underlying malignancy is approximately 10%. Thus, further workup including a CT scan of the chest followed by early bronchoscopic evaluation is recommended.<sup>3</sup> In this setting, the CT scan can serve as a “road map” for the bronchoscopist and should be performed prior to the bronchoscopy.

## Bronchoscopy vs CT Chest Scan

The diagnostic role of bronchoscopy vs various imaging modalities has been evaluated extensively in the literature. Chest radiographs can identify the side of bleeding in 33% to 82% of patients with hemoptysis.<sup>4</sup> The reason for this low yield may be explained by the presence of subtle endobronchial or parenchymal abnormalities that might be missed with this modality, or aspiration of blood into a nonbleeding segment, including the contralateral lung.<sup>5</sup> Chest CT scanning plays a crucial and complementary role to bronchoscopy in cases of hemoptysis, with an ability to identify the site, side, and cause of bleeding of up to 92%.<sup>6</sup> The superiority of chest CT scanning over bronchoscopy is explained by the fact that a CT scan can identify lesions in the lung parenchyma, as well as vascular abnormalities that cannot be visualized bronchoscopically. Recently, it has been suggested that chest CT scans could stand alone as the diagnostic workup in cases of nonmassive hemoptysis in the outpatient setting.<sup>6</sup> Bronchoscopy, however, is superior in diagnosing mucosal abnormalities in the central airways, is equivalent to a CT scan of the chest in localizing the site of bleeding, and perhaps most

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importantly, can provide a tissue-based diagnosis to guide further therapy.<sup>7</sup> Clearly, it is inadvisable to transport an unstable and actively bleeding patient to the CT suite unless a secure airway is in place. We believe that CT scanning and bronchoscopy should be considered complementary techniques, both offering valuable information.

### Benefits of Performing Bronchoscopy in Patients With Hemoptysis

The clinical reasoning supporting the bronchoscopic evaluation of a patient with hemoptysis includes allowing the physician to:

- Identify the anatomic site and side of the bleeding<sup>8</sup>
- Assess the nature of the bleeding source (endobronchial lesion, central vascular fistulas [ie, Dieulafoy's disease of the bronchus], vs parenchymal)<sup>8</sup> (Table 1)
- Assess the severity of bleeding<sup>8</sup>
- Evaluate the feasibility of therapeutic bronchoscopic intervention if required<sup>8</sup>
- Collect samples for cytologic, pathologic, and microbiologic purposes, which will impact the treatment and prognosis

From the therapeutic perspective, if the source of bleeding is endoscopically visible, the bronchoscopist can achieve hemostasis (using laser, argon plasma coagulation [APC], electrocautery, or cryotherapy). In those cases in which the source of bleeding is a peripheral airway, the operator can both identify the segmental bronchus and isolate the airway if needed.<sup>8</sup> It should be noted that the data for using instilled epinephrine, iced saline, thrombin with or without fibrinogen, and cyanoacrylate or tranexamic acid to stop parenchymal bleeding come from very small case series,<sup>9-14</sup> and as such, in the setting of moderate to massive hemoptysis, we typically recommend using a bronchial blocker to achieve lung isolation until definitive therapy (embolization/surgery) can be performed.

The treatment of massive hemoptysis should be done via a multidisciplinary team including the pulmonologist, interventional radiologist, and thoracic surgeon (Fig 1). If the patient is stable enough and the source is known, bronchial artery embolization can occur prior to bronchoscopy; however, we stress that airway isolation be considered prior to sending the patient to the interventional radiology suite as these patients can become unstable quickly. In addition to providing lung isolation, bronchoscopy can help guide embolization by directing the radiologist to the appropriate segment, minimizing the duration of the

**TABLE 1 ] Major Causes of Hemoptysis**

• Tumors
◦ Malignant: Lung cancer, bronchial adenomas, and metastatic disease to the lungs/airways (including lung cancer, thyroid, breast, renal, colon, melanoma, etc.)
◦ Benign: Carcinoid tumor (typical and atypical)
• Bronchiectasis
• Infections
◦ Mycobacterial (especially tuberculosis)
◦ Aspergillosis
◦ Necrotizing bacterial pneumonias and lung abscesses
• Vascular
◦ Pulmonary arterial aneurysm
◦ Pulmonary sequestration
◦ Tracheovascular fistulas
◦ Arteriovenous malformation
◦ Iatrogenic
• Vasculitis
◦ Granulomatosis with polyangiitis
◦ Behçet's disease and Hughes-Stovin syndrome
◦ Takayasu's arteritis
◦ Systemic lupus erythematosus
◦ Diffuse alveolar hemorrhage (due to infection/capillaritis)
• Trauma
◦ Post-transbronchial biopsies and trans-tracheal aspirates
◦ Post-traumatic hematoma
◦ Pulmonary erosion from a rib fragment
• Cardiovascular abnormalities
◦ Eisenmenger's syndrome
◦ Mitral stenosis
• Bronchial circulation abnormality
◦ Dieulafoy's lesion
◦ Bronchial artery hemangioma
• Coagulopathy
◦ von Willebrand's disease, hemophilia
◦ Anticoagulant therapy
◦ Thrombocytopenia, platelet dysfunction
◦ Disseminated intravascular coagulation
• Others: Foreign body, broncholith, catamenial endometriosis
• Cryptogenic

Bronchiectasis, tumors, tuberculosis (acute and late complications), and cryptogenic causes account for more than 80% of the causes of hemoptysis. (Modified with permission from Khalil et al.<sup>1</sup>)

procedure. Likewise, bronchoscopy can be beneficial prior to surgical resection by identifying endobronchial sites of disease that may impact resection. It should also

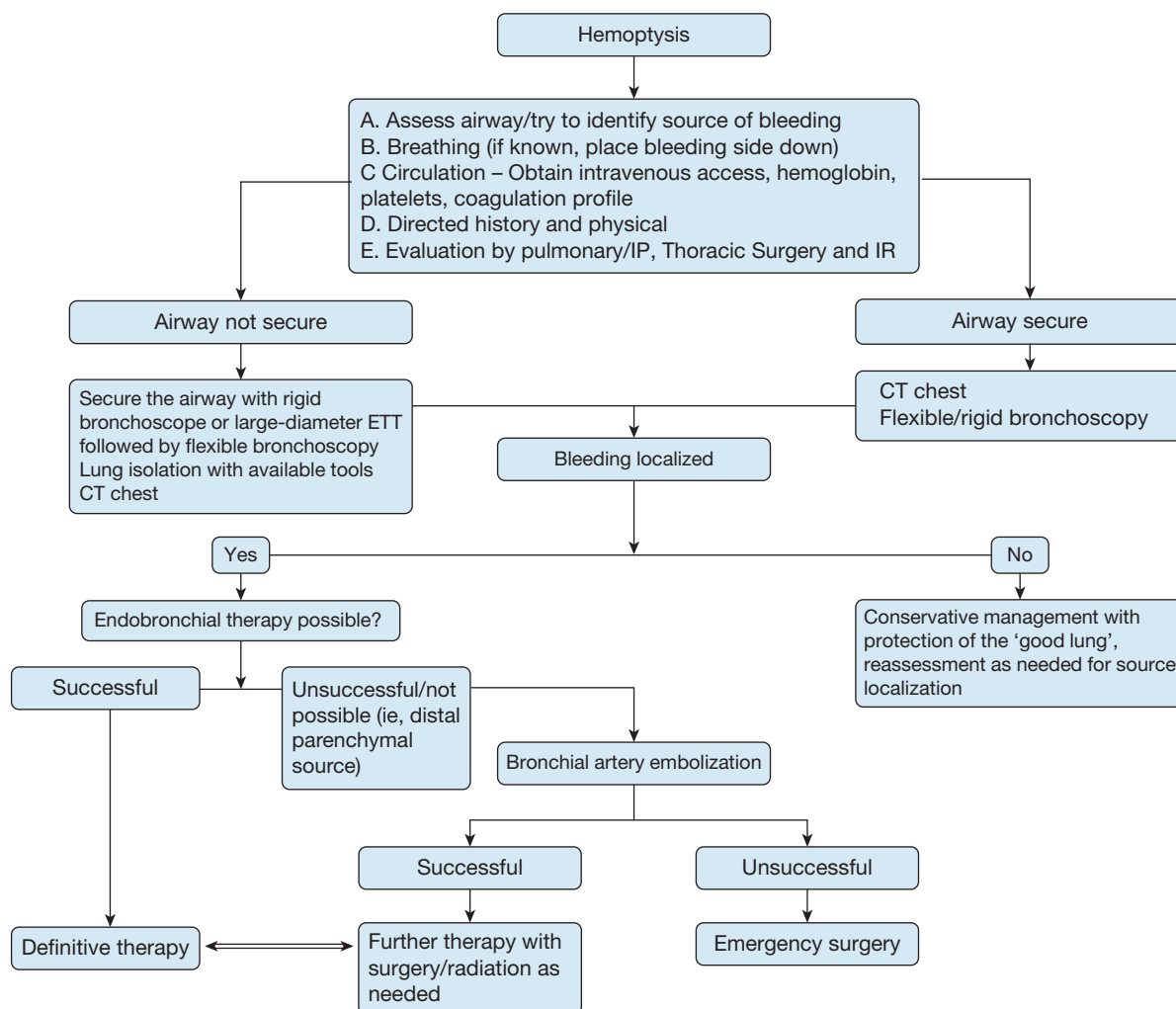


Figure 1 – Algorithm for treatment of hemoptysis. (Modified from Yendamuri.<sup>2</sup>) ETT = endotracheal tube; IP = interventional pulmonology; IR = interventional radiology.

be noted that embolization is associated with 60% to 90% short-term success, an up to 40% incidence of rebleeding, as well as a 1.4% to 6.5% risk of transverse myelitis due to the anterior medullary artery arising from the right (or left) intercostal bronchial trunk.<sup>15,16</sup> Likewise, although surgery can be life-saving, it is often used for cases that are refractory to bronchoscopy/embolization and is associated with a mortality rate of 15% to 38%.<sup>17,18</sup>

### Where, When, and Who Should Do the Bronchoscopy?

Bronchoscopy is underutilized in the vast majority of cases of hemoptysis because of the common misconception that it is a risky procedure to be performed only in a high-risk patient. Ost et al<sup>19</sup> have shown that when an experienced team performs bronchoscopy in high-risk patients (with central airway

obstruction), this procedure has a good safety profile with a low rate of complications (< 4%). There are no specific data regarding the safety of bronchoscopy in patients with hemoptysis. As such, the location of bronchoscopy (ICU vs operating room vs endoscopy suite) should be dependent on local resources/expertise.

The timing of bronchoscopy after an episode of hemoptysis should also be considered, as the diagnostic yield of bronchoscopy will be lower the longer the time since the last event. This highlights the importance of early bronchoscopic evaluation, even in the setting of nonmassive hemoptysis.

The creation and training standardization of several dedicated interventional pulmonology fellowship programs, across the United States, has led to the increased availability of interventional pulmonologists in many large academic and private hospitals in the

country.<sup>20</sup> The training emphasizes rigid bronchoscopy and other therapeutic interventions to control life-threatening airway emergencies such as massive hemoptysis. The benefits of rigid bronchoscopy include obtaining an airway to allow for oxygenation and ventilation, as well as the use of large-bore suction and ability to apply the techniques listed above (ie, laser, APC) that can be used with the flexible bronchoscope as well. Whether rigid or flexible, bronchoscopy should be performed by an experienced endoscopic team. Although having advanced modalities such as APC can be helpful, bronchial blockers should be available in all bronchoscopy suites, operating rooms, and ICUs. Likewise, we encourage all bronchoscopy units to occasionally drill/practice what they would do in the setting of massive hemoptysis. This includes knowing one's specific roles, such as where to rapidly find necessary equipment.

In conclusion, in experienced hands, bronchoscopy is a safe, readily available tool that plays a key role for both diagnosis and treatment of hemoptysis. It is complementary to a CT scan of the chest and should be considered for all patients with massive hemoptysis and those with nonmassive hemoptysis and abnormal imaging studies or risk factors for lung cancer. That being said, as the eighteenth century British philosopher William Hazlitt said, "Never say 'never' and always avoid 'always.'" We should treat each patient on an individual basis depending on the clinical scenario and local expertise.

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## COUNTERPOINT:

### Should All Initial Episodes of Hemoptysis Be Evaluated by Bronchoscopy? No

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