Hemoptysis — Etiology and Diagnostic Approach

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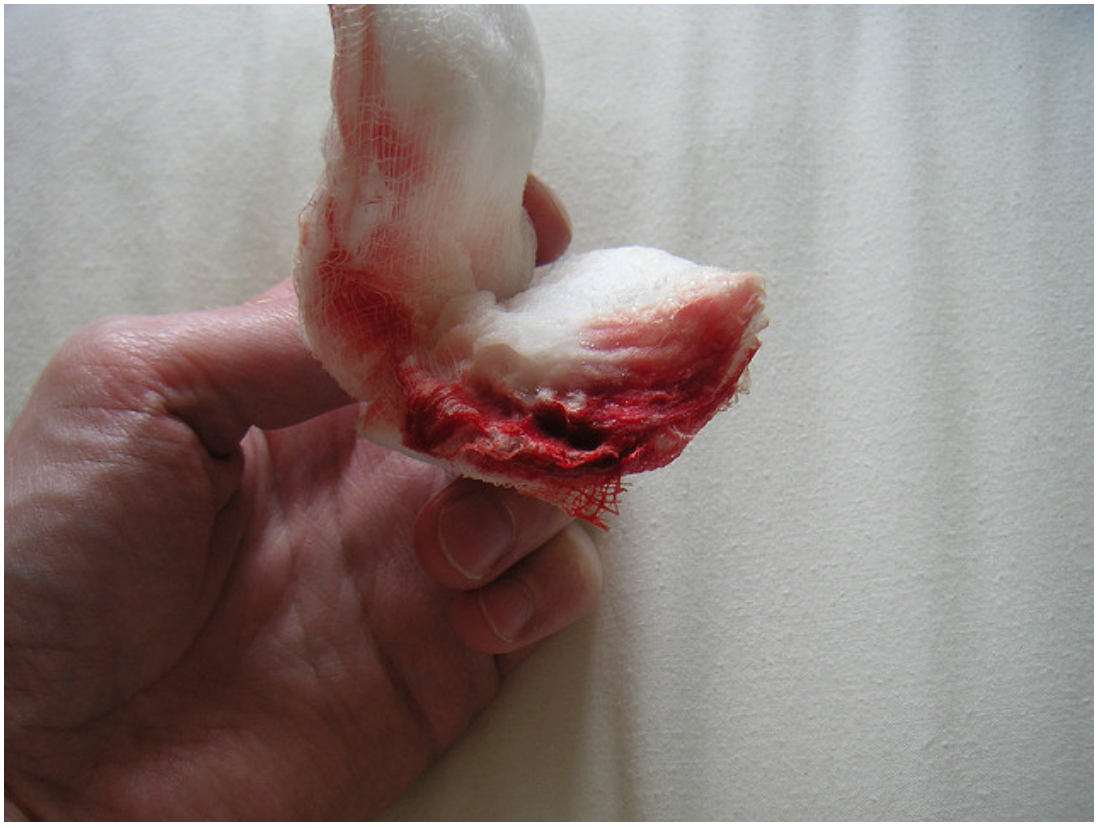
Hemoptysis can be defined as the expectoration of blood during coughing that originates from the lower respiratory tract. Per this definition, coughing of blood from an upper respiratory tract illness can be excluded. While coughing blood can be alarming to the patient, it is usually a self-limiting symptom. In clinical practice, only 5% of the patients who present with hemoptysis are found to have a serious medical condition that needs further treatment.



Etiologies of Hemoptysis

Coughing of blood is a **consequence of a disease process** and not the problem per se. Several causes of hemoptysis are of importance to the general practitioner to exclude. The causes of hemoptysis may be suggested by history taking, physical examination or simple investigations such as chest x-ray. However, procedures such as bronchoscopy, bronchography, and pulmonary angiography may be needed for diagnosis. It is important to understand that minor bleeding may be an indication of severe disease while massive bleeding is associated with high mortality rates. The causes of hemoptysis can be classified into **lung parenchymal diseases**, **airway diseases,** and **vascular**

diseases.

Small-vessel disease and hemoptysis

Certain **immunologic disorders,** such as acute lung allograft rejection, Goodpasture's syndrome, Wegener granulomatosis, and the antiphospholipid syndrome are associated with small-vessel disease injury, hemorrhage and eventually hemoptysis.

Patients with **mitral valve stenosis** and those on **anticoagulant therapy** are also at an increased risk of small-vessel hemorrhage into the intra-alveolar space and hemoptysis.

Rarer causes of small-vessel disease-associated hemoptysis are **pulmonary hemangiomatosis** and **tuberous sclerosis lung disease**.

Large-vessel disease and hemoptysis

It is important to note that the causes of hemoptysis related to small-vessel disease are rare. **Infectious disease**, **cardiovascular diseases**, **congenital malformations**, **malignant lung disease,** and **vasculitis** are usually associated with large-vessel disease and can present with hemoptysis.

Image: "Bronchiectasis." by Arinna'l at Turkish Wikipedia – Transferred from tr.wikipedia to Commons. License: Public Domain

Abscess, **bronchiectasis** and **fungal infections** are the most commonly implicated infectious processes with hemoptysis. On the other hand, patients with uncomplicated **pneumonia** rarely present with hemoptysis. **Arteriovenous malformations**, which can be defined as the abnormal connection between venous and arterial vessels, are commonly found in the lungs.

These abnormal vessels are known to be fragile, hence associated with an increased risk of **hemorrhage** and potentially hemoptysis. **Large pulmonary artery emboli** and **thoracic aortic aneurysm rupture or dissection** are two life-threatening conditions of hemoptysis. Patients with these conditions usually complain of **severe chest pain**, have known risk factors for embolic disease or aortic aneurysmal disease, and are **hemodynamically unstable**.

Certain **congenital conditions,** such as cystic fibrosis and pulmonary artery atresia or stenosis, can also present with hemoptysis. In clinical practice, any patient presenting with new-onset hemoptysis should be evaluated for a possible **neoplastic disease of the lung**.

Bronchial carcinoma, **lung metastasis,** and **adenomas** are known to be associated with hemoptysis. While vasculitis has been described in the small-vessel disease section, it is important to know that these same diseases are also associated with large-vessel disease and related hemoptysis.

Patients with a recent history of **chest trauma** might have lung contusions which can cause hemoptysis.

Cryptogenic hemoptysis

A significant proportion of patients presenting with hemoptysis have **no apparent cause** and such patients are considered as having cryptogenic hemoptysis. While the exact etiology of hemoptysis is impossible to determine in these patients, it has been noted that the majority of them are **smokers;** therefore, the term '**smoke-related hemoptysis'** has been suggested by some experts instead of cryptogenic hemoptysis. **High resolution computed tomography scans** of the lungs can reveal an obscure etiology, even in patients previously diagnosed with cryptogenic hemoptysis.

Common Causes	Uncommon Causes
• Bronchitis • Lung cancer • Bronchiectasis	• Aspergilloma • CHF (especially mitral stenosis) • Goodpasture´s syndrome • Pulmonary AVM • PE/infarction • TB • Wegener´s granulomatosis (GPA)

Diagnostic Approach for Hemoptysis

Patients presenting with hemoptysis should first be evaluated for possible signs of **hemodynamic instability** and the life-threatening causes should be excluded by proper clinical history-taking and physical examination.

Once the life-threatening causes of hemoptysis are excluded, a more sophisticated diagnostic approach should be utilized to reach a proper diagnosis and identify the most likely etiology of hemoptysis.

Most life-threatening hemoptysis originates from the **pulmonary artery**, up to 95% of the cases, and can be linked to **pulmonary embolism** or **arteriovenous malformations**. Hemoptysis should be differentiated from other similar states such as hematemesis. In hematemesis, the disease has a history of nausea, vomiting, features of gastrointestinal disease and rarely induces asphyxia. Lower respiratory tract hemoptysis should be differentiated from the upper respiratory tract due to the difference in management approaches. Blood from the lower respiratory tract induces cough while expectoration of blood without cough is consistent with bleeding from the upper respiratory tract.

Chest X-ray

Chest X-rays should always be used as an **initial step** in the diagnostic approach of the patient presenting with hemoptysis for the following reasons: chest X-rays are readily available, easy to interpret, cheap and do not consume a significant amount of time to obtain. Additionally, the accuracy of chest X-rays in excluding life-threatening conditions of hemoptysis, such as massive pulmonary embolism and aortic aneurysm rupture or dissection, is reasonably high.

It is important to exclude the following causes on chest X-rays of patients presenting with hemoptysis: **masses**, **pneumonia**, **chronic lung disease**, or **alveolar opacities**. Focal or diffuse alveolar opacities can be related to focal or diffuse lung hemorrhage respectively. Additionally, **lung contusions** can be identified on chest X-rays in trauma patients.

Unfortunately, while a **negative chest X-ray** can be reassuring in the exclusion of immediate life-threatening conditions, it is usually not sufficient to exclude other causes of hemoptysis, such as malignant lung disease, therefore, a negative chest X-ray in a patient who is hemodynamically stable warrants further more sophisticated imaging modalities to be used.

Bronchoscopy

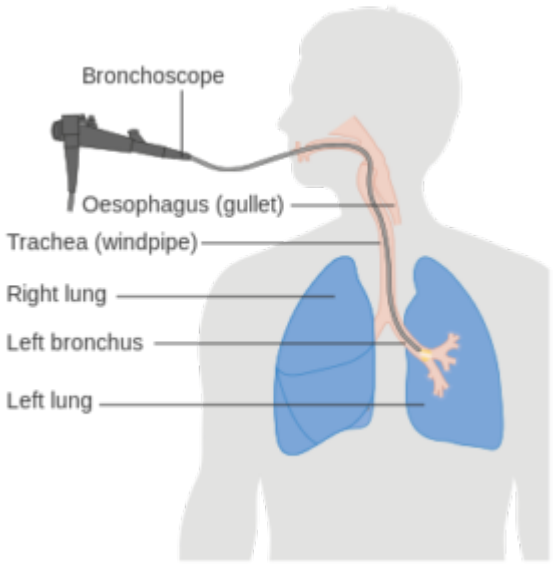


Image: “Diagram Showing a Bronchoscopy.” by Cancer Research UK – Original Email from CRUK. License: CC BY-SA 4.0

Patients with **massive hemoptysis** are good candidates for **rigid or flexible bronchoscopy** which can identify the origin of the bleed and perhaps provide treatment. The role of bronchoscopy in patients with non-massive hemoptysis is questionable due to the fact that a recent study demonstrated the cause of hemoptysis was identified only in 8% of patients presenting with hemoptysis that underwent a bronchoscopy and in 77% of patients who underwent **multi-detector computed tomography** (MDCT).

Therefore, it has been suggested that while MDCT does not provide an option to retain bronchial patency or obtaining a biopsy of the suspected lesion, it can at least provide better identification of the etiology compared to bronchoscopy.

On the other hand, a more recent study showed that while bronchoscopy is inferior to MDCT in the identification of the cause of hemoptysis in the majority of the patients, it can be specifically helpful in patients with **non-conclusive or negative MDCT studies**.

Multi-detector computed tomography

As we have explained, MDCT is **superior to any other diagnostic modality** in the identification of the cause of hemoptysis. Possible etiologies that can be easily identified on MDCT studies are **bronchiectasis**, **pulmonary abscesses**, **lung cancer,** and **large-vessel disease**.

On the other hand, **endobronchial lesions,** such as blood clots from a previous hemorrhage, have been found to be misdiagnosed in MDCT; therefore, the current recommendations are to **combine MDCT with bronchoscopy** for the best results.

MDCT angiography is a more recent technique that can be used to identify the possible origin of bleeding in patients presenting with **hemoptysis due to pulmonary artery disease**.

It can produce the image in a single breath cycle; hence is relatively resistant to a patient's breathing making it optimal for patients who have **tachypnea** due to the etiology of hemoptysis, i.e. patients with pulmonary embolism.

Treatment of Hemoptysis

The treatment of patients presenting with hemoptysis is **tailored to the etiology**. **Surgical treatment** is recommended in patients presenting with hemoptysis due to **chest trauma**. On the other hand, patients presenting with **massive hemoptysis not due to trauma** are possible candidates for **endovascular embolization** of the bleeder artery.

The most common artery to undergo embolization in patients presenting with massive hemoptysis is the **bronchial artery**, which is implicated in 90% of the cases of massive hemoptysis.

Patients presenting with **non-massive hemoptysis** should undergo a **comprehensive diagnostic approach and treatment algorithm**. Usually, if the chest X-ray is positive, treatment for the specific cause of hemoptysis should be started, i.e. **antibiotic** and/or **drainage of a lung abscess**.

Patients with a negative chest X-ray should undergo an MDCT/A plus bronchoscopy study to identify the cause of bleeding. If the cause of bleeding is treatable by surgery, i.e. **adenomas**, other **tumors**, and **arteriovenous malformations**, then **surgery** should be offered.

Other causes of hemoptysis, such as **small-vessel disease**, **vasculitis**, **bronchiectasis,** and **lung cancer,** should be treated according to the currently available guidelines for each condition.

Patients with no identifiable cause of hemoptysis and cryptogenic hemoptysis should be **monitored for recurrent episodes**. If they are smokers, they should be encouraged to **stop smoking** as soon as possible.

References

Diagnosis and management of hemoptysis via nih.gov

Notes