HEMOPTYSIS

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Key Concepts
- Definition of hemoptysis
- Etiology of hemoptysis
- Pathophysiology of hemoptysis
- Investigations of hemoptysis
- Control of hemoptysis

Abstract: Haemoptysis is a common pathology around the world, occurring with more frequency in low-income countries. It has different etiologies, many of which have infectious characteristics. It is very important to differentiate haemoptysis from haematemesis. The investigations are carried out according to most probable cause on history and examination and usually include chest X-ray, CBC with platelets and ESR, U&Es, coagulation studies, urinalysis, arterial blood gases, sputum cytology and culture, acid-fast bacillus (AFB) smear and culture, D-dimer testing, and HIV test. and may include bronchoscopy. The management depends upon the severity of haemoptysis and patient’s condition at presentation. In most cases haemoptysis is a self-limiting event but in fewer than 5% it may be severe or massive, representing a life-threatening condition that warrants urgent investigations and treatment.

Key words: Haemoptysis, haematemesis, idiopathic or cryptogenic haemoptysis, ‘alarm’ symptoms of haemoptysis, bronchoscopy.

Definition and differentiation of haemoptysis:
Haemoptysis is the coughing of blood originating from the respiratory tract below the level of the larynx. Haemoptysis should be differentiated from:
- Haematemesis - vomiting of blood from the gastrointestinal (GI) tract.
- Pseudohaemoptysis - where a cough reflex is stimulated by blood not derived from the lungs or bronchial tubes. This may be from the oral cavity or nasopharynx (eg, following an epistaxis) or following aspiration of haematemesis into the lungs.

Classifications of severity vary. Although volumes of 100 to 1000 mL of blood have been described as indicative of massive haemoptysis, no specific volume has been universally accepted. However, a large volume of expectorated blood alone should not define massive haemoptysis, but rather an amount of blood sufficient to cause a condition that threatens the patient’s life is usually a more correct and functional definition of severe haemoptysis.\(^1\)

Despite haemoptysis being regarded as an ‘alarm’ symptom, no identifiable cause is found in 15-20% of cases and these are
termed idiopathic or cryptogenic haemoptysis.²

**Etiology**¹
According to source of bleeding:

**Trachea or bronchus**

**Malignancy:**
- Bronchogenic carcinoma.
- Endobronchial metastatic tumour.
- Kaposi’s sarcoma.
- Carcinoid tumour.
- Bronchitis.
- Bronchiectasis.
- Airway trauma.
- Foreign body.

**Lung parenchyma**
- Lung abscess.
- Pneumonia - bacterial (eg, Staphylococcus aureus, Pseudomonas aeruginosa) or viral (eg, influenza).
- Tuberculosis (TB).
- Fungal infection and mycetoma.
- Hydatid cysts.
- Goodpasture’s syndrome.
- Pulmonary haemosiderosis.
- Wegener’s granulomatosis.
- Behçet disease.
- Lupus pneumonitis.
- Lung contusion.
- ‘Crack’ lung.

**Vascular**
- Arteriovenous malformation.
- Aortic aneurysm.
- Pulmonary embolism (PE).
- Mitral stenosis.
- Other cause of pulmonary venous hypertension - eg, left ventricular failure (LVF).
- Trauma.
- Iatrogenic (eg, chest drain malposition, secondary to pulmonary artery catheter manipulation).

**Other**
- Pulmonary endometriosis.
- Congenital or acquired systemic coagulopathy - eg, leukaemia.
- Anticoagulant or thrombolytic agents.
- Factitious haemoptysis.

**Pathophysiology**
Most of the lung’s blood (95%) circulates through low-pressure pulmonary arteries and ends up in the pulmonary capillary bed, where gas is exchanged. About 5% of the blood supply circulates through high-pressure bronchial arteries, which originate at the aorta and supply major airways and supporting structures. In hemoptysis, the blood generally arises from this bronchial circulation, except when pulmonary arteries are damaged by trauma, by erosion of a granulomatous or calcified lymph node or tumor, or, rarely, by pulmonary arterial catheterization or when pulmonary capillaries are affected by inflammation.

Haemoptysis is rare in children and often only presents where bleeding is substantial, as children tend to swallow rather than expectorate their sputum. Respiratory tract infection is the most common cause. Foreign body inhalation is the second most common cause (particularly with younger children) and congenital heart disease and bronchiectasis secondary to cystic fibrosis are other important causes.

**Epidemiology**
Haemoptysis is common. In most cases, it is mild, self-limiting and related to transitory infection but it should be considered a serious symptom due to the risk of underlying pathology.
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The relative contribution of different causes depends on the local population. In Pakistan, the majority of cases of haemoptysis presenting to primary care are due to acute upper and lower respiratory tract infections, with lung cancer a much smaller but significant cause.¹

Presentation

Patients may find it hard to identify the origin of their bleeding.

<table>
<thead>
<tr>
<th>Haemoptysis or haematemesis?</th>
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<tr>
<td>Haemoptysis</td>
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<tr>
<td>No nausea or vomiting</td>
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<td>Concurrent lung disease</td>
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<td>Vomitus is usually frothy</td>
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<td>Sputum has a liquid or clotted appearance</td>
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<td>Haemoptysis is bright red or pink</td>
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<td>Alkaline pH</td>
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<td>Mixed with macrophages and neutrophils</td>
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Symptoms

- Abrupt-onset cough, fever with bloody and purulent sputum - suggestive of acute pneumonia or bronchitis.
- Chronic productive cough - suggestive of chronic bronchitis or bronchiectasis.
- Fevers, night sweats and weight loss - consider TB and other infections or malignancy.
- Anorexia, weight loss and changing cough - think of possible bronchogenic carcinoma.
- Dyspnoea, fatigue, orthopnoea, paroxysmal nocturnal dyspnoea, frothy pink sputum - suggestive of congestive heart failure.
- Dyspnoea and pleuritic chest pain - consider a PE.

Signs

Record vital signs, including oxygen saturation levels. Fever, tachycardia, tachypnoea, weight loss and O₂ saturation are all relevant. Check for cachexia, cyanosis, pallor, ecchymoses, telangiectasias and lymphadenopathy.
- Inspect the nasal cavity and oropharynx for:
- Extrapulmonary causes (pseudohaemoptysis).
- Signs of vasculitis.
- Gingival thickening, mulberry gingivitis, saddle nose, and nasal perforation suggest Wegener's granulomatosis.
- Perform a cardiovascular examination. Significant signs may include:
  - The diastolic murmur of mitral stenosis.
  - Signs of LVF.
  - Tachypnoea, tachycardia, fixed split S₂, pleural rub, and unilateral leg pain or swelling which may indicate thromboembolic disease.
  - Lung signs that may be found with haemoptysis include:
    - Fine inspiratory rales (associated with alveolar blood).
    - Inspiratory and expiratory rhonchi (associated with airway secretions and blood).

Look for evidence of an exacerbation of chronic obstructive pulmonary disease or lower respiratory tract infection. Unilateral wheeze and distal consolidation raise the suspicion of endobronchial tumour. Unilateral wheeze or stridor may also indicate the presence of a foreign body. With apical dullness and cachexia, TB should be considered.
- Digital clubbing can reflect chronic lung disease (lung cancer, bronchiectasis, lung abscess).
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- Supraclavicular lymphadenopathy, cachexia, hoarse voice, Cushing’s syndrome, hyperpigmentation, and Horner’s syndrome may be associated with malignancy.
- Wegener’s Granulomatosis
- Blind Treatment of Bacterial Infection
- BCG Vaccination
- Tuberculosis

Investigations
Bronchoscopy combined with imaging technology usually identifies the bleeding site in the lungs.
- Imaging - CXR +/- CT scan. About 30% of patients with haemoptysis have normal CXRs. A negative CXR warrants other investigations, usually including a bronchoscopy.¹
- A CT scan is more sensitive than a CXR.
- Computed tomography angiography (CTA) can play a crucial role in assessing the cause and origin of the haemoptysis and directing the interventional radiologist prior to treatment.³,¹
- Fibreoptic bronchoscopy enables direct visualisation and is required where there is a mass on CXR, there are risk factors for cancer despite normal CXR, or where diagnosis remains open, particularly in instances of recurrent haemoptysis.
- ECG +/- echocardiogram (ECHO) - if a cardiac cause or PE is suspected.
- Other tests are dependent on the clinical setting but may include FBC, ESR, U&Es, coagulation studies, urinalysis, arterial blood gases, sputum cytology and culture, acid-fast bacillus (AFB) smear and culture, D-dimer testing, and HIV test.

Management
Treatment is according to the underlying cause.

Minor haemoptysis
Effort should be concentrated on determining the origin of the haemoptysis, providing specific treatment where available and excluding serious underlying pathology.
- Normal CXR, history consistent with bronchitis - oral antibiotic, advise smoking cessation and follow-up in a few weeks.
- Consider chest CT scan and bronchoscopy where:
- Haemoptysis lasts longer than two weeks.
- There are recurrent episodes of haemoptysis.
- The volume of haemoptysis is >30 ml per day.
- The patient is a smoker and >40 years old.
- There is suspected bronchiectasis.
- All smokers or ex-smokers aged >40 years with persistent haemoptysis should urgently be referred to a chest physician under the two-week wait rules.⁴

Moderate haemoptysis
Moderate haemoptysis (30-50 ml in the previous 24 hours) requires hospitalisation for observation, due to increased risk of further heavy bleeding.

Major haemoptysis
This is a medical emergency with a high mortality rate.⁵ However, there are few large, good-quality, controlled trials looking at best management to guide practice - particularly in the medical versus surgical dilemma.

Resuscitate according to ‘ABC’ principles. Intubate where there are signs of acute respiratory failure. Selective intubation of the right or left main bronchus with a large single-lumen endotracheal tube or, alternatively, the
use of a double lumen tube should be considered. Maintain oxygenation saturations with high flow oxygen and suction. Obtain IV access and give fluids/blood transfusion as appropriate. Correct any clotting abnormalities. The patient will require admission to intensive care.

Localisation of the bleeding site via radiology and early bronchoscopy. CXR and even CT scanning may not be helpful (due to the presence of aspirated blood). The use of rigid or flexible fibreoptic bronchoscopy remains controversial and tends to depend on local preference and expertise.

Specific therapies to control bleeding:
Angiography and embolisation - endovascular embolisation is the most effective and minimally invasive technique for managing massive and recurrent haemoptysis.²
Bronchoscopic therapy:
• Iced saline lavage.
• Topical agents - eg, use of thrombin or fibrinogen-thrombin glue.
• Endobronchial balloon catheter tamponade.
• Laser photocoagulation.
• Surgical resection:
  • Segmentectomy.
  • Lobectomy.
  • Pneumonectomy.

Under emergency conditions, surgery is difficult, has a high risk of septic complications and a significant mortality rate. Surgery is usually only the treatment of choice in selected cases, such as chest trauma and iatrogenic pulmonary artery rupture. Emergency surgery should therefore be reserved for patients with persistent life-threatening haemoptysis.⁶

Radiotherapy - may be used to treat aspergillomas and vascular tumours.

Antifibrinolytic therapy - although there is currently insufficient evidence to determine whether antifibrinolytics can be used to treat haemoptysis from any cause, there is limited evidence to suggest they may reduce the duration of bleeding.⁶

Palliative care⁷
Haemoptysis is the presenting complaint in 7-10% of lung cancers and about 20-30% of patients with lung cancer will experience it over the course of their illness.

Management of haemoptysis in the context of a malignant disease depends on the volume of blood loss, its cause (bleeding may not be related to tumour progression; thromboembolic disease or infection may also cause it) and prognosis.

Given the bleak prognosis of a massive haemoptysis, active resuscitation may not be desired or appropriate. Under these circumstances, the emphasis should be on the relief of pain and of fear in the patient and supporting witnesses and family:
• Nurse the patient lying on the side of the tumour.
• Administer parenteral opioid and fast-acting benzodiazepine.
• Mask blood with red or green towels.
• In some, the likelihood of such a bleed can be predicted (based on the tumour site, earlier bleeds, etc) and it may be appropriate to discuss and plan for such an eventuality with the patient and their family.
• Where active treatment is desired, management of a major bleed is as above. With more minor haemoptysis, addition-
al palliative care measures may include:
- Oral haemostatics - eg, tranexamic acid.
- Cough suppression.
- Anticoagulation (where PE).
- Antibiotics (where infection).
- Radiotherapy or laser treatment of the tumour site.
- Therapeutic bronchoscopy with balloon tamponade and infusion of vasoactive agents such as adrenaline (epinephrine) may be successful. Bronchial angiography with bronchial artery embolisation can sometimes control haemoptysis.

**Prognosis**
Haemoptysis may be a mild, self-limiting symptom or may herald serious underlying disease. Massive haemoptysis can directly cause death and has a bad prognosis, worse in some groups such as those with an underlying cancer.

**References**