HEMOPTYSIS
Definition

- Expectoration of blood from the respiratory tract

- The word “Hemoptysis” comes from the Greek word “Haima”, meaning “Blood”, and “Ptysis”, which means the spitting.
Definition

- Bleeding that results in respiratory distress and altered gas exchange is life-threatening, regardless of amount of blood loss.

- **Amount of blood expectorated not necessarily represents the total amount lost into the airspaces**
Definition

Assessment of severity of hemoptysis can be based on amount of blood lost during episode:

- **MILD:** <5cc in 24h
- **MODERATE:** 5-600cc in 24h
- **MASSIVE:**
  - >600cc in 24h
  - 100cc <24h to 1000 cc over several days
  - >50cc in single expectoration
When blood originates outside of the respiratory tract, the spitting is commonly known as "pseudohemoptysis."
Pseudohemoptysis

- Every patient with problem of hemoptysis should receive a careful evaluation of origin of bleeding from outside of the respiratory tract.

- Blood from the throat which comes in contact with larynx can cause coughing and seemingly hemoptysis
## Where is it from?

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Hemoptysis</th>
<th>Pseudo Hemoptysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin of blood</td>
<td>Respiratory tract</td>
<td>Oral cavity, Larynx, esophagus, stomach, Factitious</td>
</tr>
<tr>
<td>Cough</td>
<td>More likely</td>
<td>Less likely</td>
</tr>
<tr>
<td>Respiratory symptoms</td>
<td>More likely</td>
<td>Less likely</td>
</tr>
<tr>
<td>Esophagastric Symptoms</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
<tr>
<td>Alcohol use, hepatic disease</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
<tr>
<td>Vomiting, Nausea</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
<tr>
<td>Hematemesis and malena</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
<tr>
<td>Colour of expectorated blood</td>
<td>Bright red</td>
<td>Brown or black</td>
</tr>
<tr>
<td>Consistency of expectorate</td>
<td>Clotted or liquid</td>
<td>Coffee ground appearance</td>
</tr>
<tr>
<td>Frothiness of expectorate</td>
<td>Usually</td>
<td>Never or seldom</td>
</tr>
<tr>
<td>pH of expectorate</td>
<td>Alkaline</td>
<td>Acidic</td>
</tr>
<tr>
<td>Alveolar macrophages in sputum</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Food particles in expectorate</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Asphyxia</td>
<td>Common</td>
<td>Unusual</td>
</tr>
</tbody>
</table>
Rarely, hemoptysis may be self-inflicted as a form of malingering.

Patients may seek hospital admission late at night by claiming hemoptysis (“Midnight hemoptysis”)
Serratia Marcescens is an aerobic microorganism which characteristically produces a red pigment insoluble in water.

Broad spectrum antibiotics may so after the environment that this organism will grow in the respiratory tract producing a "red-sputum" simulating hemoptysis.

***Gate and Lord – JAMA 164:1328, 1957

*Robinson and Woolley – Lancet
Where is it from?

- Blood from the upper GIT can be aspirated and coughed up
- Blood from the lungs can be swallowed and vomited
Intrapulmonary Blood Circulation: Schema

Terminal bronchiole
Bronchial artery (from left heart via thoracic aorta)
Pulmonary vein (to left heart)
Pulmonary artery (from right heart)
Respiratory bronchioles
Pulmonary vein to left heart
Capillary clusters within alveolar wall
Septum
Visceral pleura and subpleural capillaries
Capillary bed within alveolar wall (cut away in places)
VASCULAR ORIGIN OF HEMOPTYSIS

- Blood traversing the lungs can arrive from
  - pulmonary arteries (arise from right ventricle) — 98%
  - bronchial arteries (arise from descending aorta & intercostal arteries) — 1-2%
VASCULAR ORIGIN OF HEMOPTYSIS

- Virtually the entire cardiac output courses through the low-pressure pulmonary arteries and arterioles en route to being oxygenated in the pulmonary capillary bed.

- In contrast, the bronchial arteries (1-2%), are under much higher systemic pressure but carry only a small portion of the cardiac output.
VASCULAR ORIGIN OF HEMOPTYSIS

- Despite the quantitatively smaller contribution of the bronchial circulation to pulmonary blood flow, the bronchial arteries are generally a more important source of hemoptysis.

- In addition to being perfused at a higher pressure, they also supply blood to the airways and to lesions within the airways.
Significance

- Hemoptysis is an important sign of an underlying disease
- Massive hemoptysis is life threatening due to Asphyxia
- Mortality rate can be as high as 30%
Airways diseases

- The most common source of hemoptysis is airways disease

  - **Inflammatory diseases** - bronchitis, bronchiectasis
  - **Neoplasms** - 1° bronchogenic carcinoma, endobronchial metastatic carcinoma or bronchial carcinoid
  - **AIDS** - Kaposi's sarcoma involving the airways or the pulmonary parenchyma
  - Foreign body & Airway trauma
  - Fistula between a vessel and the tracheobronchial...
Pulmonary parenchymal diseases

- **Infection**-tuberculosis, pneumonia, aspergilloma, lung abscess
  - Hemoptysis, which can be life-threatening, complicates the course of 50 to 85 percent of patients with an aspergilloma
  - Active disease can cause sudden rupture of a Rasmussen's aneurysm (aneurysm of the pulmonary artery that slowly expands into an adjacent cavity because of inflammatory erosion of the external vessel wall until it bursts)
  - **Tuberculosis** can cause massive hemoptysis through multiple mechanisms - active cavitary or noncavitary lung disease can cause small or large amounts of
Pulmonary parenchymal diseases

- **Inflammatory or immune disorders**
  - Goodpasture's syndrome, idiopathic pulmonary hemosiderosis, and Wegener's granulomatosis

- **Coagulopathy**
  - thrombocytopenia or use of anticoagulants

- **Iatrogenic** - percutaneous or transbronchial lung biopsy
  - Hemoptysis, which is usually minor and transient, occurs in five to 10 percent of percutaneous lung biopsies, but massive hemorrhage and death have also been reported
Miscellaneous causes of pulmonary parenchymal hemorrhage

- **Cocaine-induced pulmonary hemorrhage**
  - Hemoptysis has been described in six percent of habitual smokers of free-base cocaine ("crack") and has been associated with diffuse alveolar hemorrhage.

- **Catamenial hemoptysis**
  - Hemoptysis that is recurrent and coincident with menses. The cause is intrathoracic endometriosis, usually involving the pulmonary parenchyma but occasionally affecting the airways.
Pulmonary vascular disorders

- Pulmonary embolism
- Pulmonary AV malformation - either with or without underlying Osler-Weber-Rendu syndrome
- Elevated pulmonary capillary pressure
  - mitral stenosis
  - significant left ventricular failure
  - Congenital heart disease
  - severe pulmonary hypertension
- Iatrogenic
  - pulmonary artery perforation from a Swan-Ganz catheter
Depending upon the study, up to 30 percent of patients with hemoptysis have no cause identified even after careful evaluation.

In a series of 67 patients with cryptogenic hemoptysis, the prognosis was generally good, and most patients had resolution of bleeding within six months of evaluation.

Causes of Massive Hemoptysis (<5%)

- Tuberculosis
- Bronchiectasis
- Fungal Infections
- Other Lung Infection
- Bronchogenic Carcinoma
- Chemotherapy and Bone Marrow Transplantation
- Immunologic Lung Disease
- Cardiac or Vascular Disease

Postgrad Med. 2002 Oct;112(4):101-6, 108-9, 113
Bronchitis and bronchiectasis

- Bronchitis - mild hemoptysis
  Inflammation of the airways leads to mucosal hyperemia, and disruption of small mucosal vessels blood-streaked sputum.
Dry Bronchiectasis attributed to chronic granulation or ulcer of bronchi.

Moist bronchiectasis are associated chronic inflammation of the lung, with local bronchial arterial proliferation and increased blood flow.

Inflammation leading to erosion of these bronchial vessels can result in severe hemorrhage.
Lung cancer

- Hemoptysis is usually mild, resulting in blood-streaked sputum.

- Cause - erosion of small, friable mucosal vessels in airways involved by tumor.

- Massive hemoptysis in patients with lung cancer is typically caused by malignant invasion of central pulmonary vessels by large central tumors.
Causes of hemoptysis in pulmonary tuberculosis

- Bleeding from cavity wall
- Rupture of rasmussen’s aneurysm.
- Direct erosion of capillaries/arteries by granulomatous inflammation.
- Tuberculosis endobronchitis.
- Post –tuberculosis bronchiectasis aspergilloma.
- Broncholith, cavernolith
- Scar carcinoma.
Tuberculosis

- Endobronchial tuberculosis may cause local airway bleeding.

- Calcified tuberculous lymph nodes can compress and erode lobar and main stem bronchi, causing local bleeding and expectoration of gritty calcified debris called broncholiths in the sputum.
Tuberculosis

- Large cavitary lesions in patients with advanced tuberculosis often do not fully close despite successful antituberculosis treatment; these lesions sometimes are colonized by *Aspergillus*.

- Bronchial arterial bleeding from inflammation in the walls of cavities containing aspergilloma can be massive.
Other causes

- Chronically elevated pulmonary venous pressure.
- Inflammation in areas of necrotizing pneumonia, such as invasive aspergillosis
- Immunologically mediated alveolar hemorrhage syndromes—Goodpasture's syndrome, Wegener's granulomatosis, SLE, and pulmonary hemosiderosis
## SUMMARY OF TYPES OF HEMOPTYSIS

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>BLEEDING</th>
<th>TYPE</th>
<th>ANATOMICAL SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recurrent</td>
<td>Episodic</td>
<td>Streaking</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Bronchiectasis Sicca</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Bronchiectasis Suppurative</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>Pulmonary Abscess</td>
<td>X</td>
<td>X</td>
<td>XXX</td>
</tr>
<tr>
<td>Chronic Bronchitis</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>Mediastinal Neoplasms</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Trauma</td>
<td>X</td>
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<tr>
<td>Empyema</td>
<td>X</td>
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<tr>
<td>Adenoma</td>
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<tr>
<td>Pneumonia</td>
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<tr>
<td>Pneumonitis</td>
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<td></td>
</tr>
<tr>
<td>Idiopathic</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Hemoptysis with Normal Chest Film

Case 1: Female 55-year-old, cough with hemoptysis infrequently for some months.
A chest CT scan is performed, L apical mass found, confirmed by endoscopic BAL (bronchoalveolar lavage) examination
No mass found in the bronchial lumen, only hemorrhage detected on L upper lobe bronchus (arrow). BAL was done
Pulmonary Adenocarcinoma
Case 2:
Male 70-year-old, heavy smoker, cough with wheezing, expiratory rale, hemoptysis for some month. Spirometry: Obstructive syndrome improving after bronchodilator.
Case 2: lateral chest film: normal
Case 2: Chest CT scan performed: Narrowing of the L main bronchus noted, may be due to a parahilar mass
Case 2: L main bronchus stenosis due to submucosal induration confirmed by pathological result: adenocarcinoma
Case 3: female patient 31-year-old, small amount hemoptysis for 5 years. Normal chest XR
Case 3: CT scan 3D reconstruction gives a nice picture of intraluminal mass (red arrow) confirmed by endoscopic examination.
Case 3: Endoscopic picture of intraluminal mass proved by pathological result as adenoma.
Case: Female patient 57-year-old with long lasting moderate hemoptysis.
lateral chest film: No abnormality detected
A Helical CT scan demonstrated metallic FB in L 6th segment.
Best of Luck..