

Approach to Pediatric Hemoptysis

1. General Presentation

Hemoptysis, defined as coughing up blood or presenting with blood in sputum, arises from the lungs. There are two vascular beds that supply the lungs: the pulmonary arterial circulatory system which is a low pressure system, and the bronchial circulatory system which is a high pressure system. Hemoptysis can occur when either of these vascular beds is damaged. Massive hemoptysis, usually suggesting damage in the high pressure bronchial vasculature, is defined as the presence of more than 8 mL/kg of blood over 24 hours.

Hemoptysis is rarely seen in children, especially in children younger than 6 years of age because they tend to swallow their sputum. When evaluating a child presenting with expectoration of blood, it is important to determine the origin of the bleeding, as blood may have come from extrapulmonary sites such as the upper airway or from the gastrointestinal system (hematemesis). This differentiation is important as it alters the investigation and treatment plans. Hemoptysis is characterized by bright red blood that may be frothy with an alkaline pH.

Table 1: Comparison between hemoptysis and hematemesis

Features	Hemoptysis	Hematemesis
Sputum features	-bright red or pink -frothy -pH: alkaline -consistency: liquid with clotted look -content: mixed in with sputum	-dark red or brown if lower in GI tract, bright red if higher up -usually not frothy -pH: acidic -consistency: ground coffee, stale blood appearance -content: may have food particles
History	-no nausea or vomiting -may have history of lung disease -may be associated with coughing or gurgling	-presence of nausea or vomiting -may have history of gastrointestinal or hepatic disease

2. Questions to Ask

History of Chief Complaint:

- Seek information regarding the timing and amount of blood (when did it occur, has it been constant, how much blood is expelled each time)
- Find out about associated symptoms:

- Is there a fever? Is there a recent history of infection or cold symptoms (fatigue, runny nose, sore throat, coughing)?
- Have there been recent choking episodes?
- Has there been recent weight loss or appetite changes?
- Is the child short of breath? Is the child paler than usual or cyanotic (this can point to an underlying cardiac or vasculature problem)
- Is there any pain, either localized or generalized? (this can help determine the location of bleeding)
- Inquire about any episodes of recent trauma or the possibility of aspiration
- Inquire about any medications that the child has or may have taken
- Inquire about travel history **and infectious contacts**

Past Medical History

- **Any complications in the perinatal or neonatal period?**
- Does the child have any known underlying diseases (eg. Cystic Fibrosis, Ciliary dyskinesia, congenital diseases, rheumatic heart disease).
- Is there a history of symptoms that may suggest chronic lung disease (eg. long-term coughing, wheezing, or stridor)
- Are there any surgeries that the child has undergone?
- Is the child's growth and development progressing normally?

Other important details

- Are there any familial disorders?
- Are there any allergies the child has?
- Are the child's vaccinations up to date?
- What do they think is the cause of hemoptysis?

3. Physical Examination

A complete general physical exam that includes vitals (blood pressure, heart rate, respiratory rate and temperature) and **growth parameters** must be carried out.

Inspection: you should observe the patient's body habitus and distress level. Look for any signs of blunt trauma such as bruising or swelling. Observe chest wall expansion during a breath to assess for symmetry or indications of a collapsed lung. Observe the skin colour for paleness or cyanosis.

Palpation: you will want to palpate the chest area for any signs of tenderness or masses. Feel for any swollen lymph nodes.

Tactile fremitus and percussion: you will want to assess the right and left lungs for **tenderness** or any signs of consolidation (dullness to percussion), collapse, or effusion.

Auscultation: Ensure to auscultate the 3 lobes of the right lung and 2 lobes of the

left lung. Listen for abnormal breath sounds including localized wheezing (foreign bodies), pleural rubs (pneumonia), bruits or thrills (arteriovenous malformation), and any heart murmurs (suggests cardiac origin).

4. Differential Diagnosis

- a) Infectious causes: 40% of hemoptysis is due to acute lower respiratory tract infections
 - a. Pneumonia
 - i. Bacteria (eg. pneumococcal)
 - ii. Virus (eg. Respiratory syncytial virus)
 - iii. Fungus (eg. aspergillosis)
 - iv. Parasitic (eg. echinococcosis)
 - b. Lung abscess
 - c. Tracheobronchitis
 - d. Immunodeficiency
- b) Trauma
 - a. Aspiration of foreign body (major cause of hemoptysis for children younger than 4 years of age)
 - b. Contusion
 - c. Iatrogenic (eg. damage from bronchoscopy)
- c) Bronchiectasis
 - a. Cystic fibrosis
 - b. Ciliary dyskinesia
 - c. post-lower respiratory tract infection
- d) Vasculature
 - a. Pulmonary arteriovenous malformation
 - b. Alveolar hemorrhage syndromes (eg. associated with renal disease or rheumatologic disease)
 - c. Connective tissue disease (eg. Goodpasture syndrome, vasculitis)
 - d. Pulmonary thromboembolism
- e) Neoplasms (uncommon)
 - a. Bronchial adenoma
 - b. Metastatic cancer

5. Investigations

A) Laboratory tests

- CBC and differential (to assess infectious causes, hemoglobin level)
- ESR (may be elevated in infection and systemic disease)
- D-dimer (if pulmonary embolism is suggested)
- Coagulation studies (INR, PTT) (to rule out coagulation disorders)
- sputum sample sent in for C&S for bacteria, fungus, and mycobacteria

B) Diagnostic imaging

- Chest X-ray: In many cases of hemoptysis, a plain chest X-ray is insufficient to

identify the location of bleeding. As many as a third of children presenting with hemoptysis will have normal chest x-rays. An abnormal x-ray, however, can be useful in showing atelectasis, pneumothorax, alveolar infiltrates or some neoplastic tumours.

-Chest computed tomography: Should a chest X-ray be insufficient, a chest CT would be the next procedure of choice. A chest CT is useful for further visualization of the lung parenchyma and associated vasculature.

-MRI: An MRI may be helpful in evaluating the mediastinum and hilum structures, as well as finding arteriovenous malformations, but is not always readily available and **usually requires sedation** in the pediatric population.

-Bronchoscopy: If laboratory and imaging investigations are insufficient in determining the location and cause of hemoptysis, flexible fiberoptic bronchoscopy is indicated.

References

1. Neeraj Jain, Vibha Mangal, vibhu Kabatra. Approach in a Case of Hemoptysis. Pediatric Oncall [serial online] 2009 Vol 6. Available from: http://www.pediatriconcall.com/for-doctor/diseases-and-condition/PEDIATRIC_RESPIRATORY/hemoptysis.asp
2. Paul Painosi, Hammad Al-sadoon. Hemoptysis in Children. *Pediatr Rev* 17 (1996) 344-348
3. Scott A Schroeder. Hemoptysis. *AAP Textbook of Pediatric Care*. 2008