Diagnostic Imaging Pathways - Haemoptysis

Population Covered By The Guidance

This pathway provides a diagnostic imaging algorithm for adult patients with confirmed haemoptysis.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points. Clicking on the PINK text box will bring up the full text. The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

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<th>SYMBOL</th>
<th>RRL</th>
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<td>None</td>
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<td>![Symbol]</td>
<td>Minimal</td>
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Pathway Diagram
Image Gallery

Note: These images open in a new page

1 Post-Primary Pulmonary Tuberculosis

Image 1 (Plain Radiograph): Pulmonary tuberculosis is an important cause
of haemoptysis. This chest radiograph demonstrates patchy bilateral opacification of the upper lung lobes with cavitation most marked on the left (arrow) consistent with post-primary tuberculosis.

### Pulmonary Haemorrhage

Image 2 (Plain Radiograph): There is widespread airspace opacification of both lungs with air brochograms. This patient had bilateral pulmonary haemorrhage due to Goodpasture's (Anti-GBM) syndrome.

### Pulmonary Haemorrhage

Image 3a (Plain Radiograph) and 3b (Bronchial Angiogram): Image 3a demonstrates right apical consolidation with cavitation due to mycetoma formation on a background of tuberculosis (arrow). The bronchial artery was embolised with gel foam and coils due to recurrent haemoptysis (Image 3b).

### Teaching Points

- A chest radiograph (CXR) may reveal a cause of haemoptysis. Abnormalities may require further evaluation on CT
  - If CXR and/or clinical picture are consistent with infection, consider treating for infection first and then pursuing further imaging if haemoptysis is persistent
- CT of the chest is indicated in patients with persistent/recurrent haemoptysis, moderate volume haemoptysis more than 30mL or in patients with risk factors for lung malignancy such as more than 30 pack-year smoking history or age over 40
- Further investigations are dictated by CT findings. This may include a bronchoscopy if a neoplastic lesion is seen
- If no cause is identified after bronchoscopy and CT, the risk of malignancy is low. There are no recommendations for what imaging or bronchoscopy surveillance should be undertaken in this time, if at all
- Massive haemoptysis refers to when the volume of blood is life threatening by virtue of airway obstruction, hypotension or blood loss and is a medical emergency. There is no universally accepted definition and volume thresholds range from 100mL to more than 1000mL of haemoptysis in 24h
  - Depending on whether the patient is haemodynamically stable, diagnostic tests (e.g. CT scan) may be undertaken
  - If the airway is not secure, bronchoscopy is preferred initially, as it affords therapeutic intervention at the same time and can allow the airway to be secured. When the patient is sufficiently stable, CTA can be undertaken to plan for embolisation or to localise the source if not already identified
Chest Radiography (CXR)

- Frequently recommended as the initial imaging modality to investigate haemoptysis 1
- May detect a cause of haemoptysis in 40-50% of cases 2,3
- If CXR and/or clinical picture are consistent with infection, consider treating for infection first and then pursuing further imaging if haemoptysis is persistent 4
- In patients with a normal CXR, the incidence of malignancy is 3-10% 1
  - Patients with negative CXR and two or more risk factors for malignancy (>40 years old, >30 pack year smoking history) should proceed to CT 1
- Moderate volume haemoptysis >30mL or persistent or recurrent haemoptysis also warrants further imaging 1
- CT is also indicated to further evaluate abnormalities detected on CXR such as a mass or parenchymal disease 4

CT Angiography (CTA)

- Contrast enhanced CT with opacification of the pulmonary and systemic vessels is recommended to evaluate for the source of haemorrhage and can also be used for work up for intervention, such as embolisation. CTPA shows only opacification of the pulmonary vessels and may miss haemoptysis caused by systemic vessels
- CTA of the chest is indicated in patients with: 1
  - Persistent/recurrent haemoptysis
  - Moderate volume haemoptysis more than 30mL
  - Risk factors for lung malignancy such as more than 30 pack-year smoking history or age over 40
- Localises the site of bleeding in 77-92.5% of cases of non-massive haemoptysis 5-7
- Intravenous contrast helps to characterise masses and vascular lesions; bronchiectasis and parenchymal disease can be evaluated with non-contrast images
- Patients with a normal CT are unlikely to have abnormal findings on bronchoscopy, 8,9 suggesting that CT may be sufficient
- No cause is identified after bronchoscopy and CT in 10-20% of cases. 10,11 These patients have a low risk of malignancy and may be followed up for 3 years, although there are no recommendations for what imaging or bronchoscopy surveillance should be undertaken in this time, if at all 1

Bronchoscopy

Non-Massive Haemoptysis

- In non-massive haemoptysis, typically reserved for patients with recurrent bronchiectasis, or to further investigate abnormalities on CT 1,4,8
- With improvements in CT, bronchoscopy rarely reveals aetiologies not already diagnosed by CT, including malignancy 8,9
- No cause is identified after bronchoscopy and CT in 10-20% of cases. 10,11 These patients have a low risk of malignancy and may be followed up for 3 years, although there are no recommendations for what imaging or bronchoscopy surveillance should be undertaken in this time, if at all 1
- Bronchoscopy allows biopsies to be taken for histology or brushings and washings for cytology and microbiology 2
Massive Haemoptysis

- Massive haemoptysis refers to when the volume of blood is life threatening by virtue of airway obstruction, hypotension or blood loss and is a medical emergency. There is no universally accepted definition and volume thresholds range from 100mL to more than 1000mL of haemoptysis in 24h.
- In unstable patients with massive haemoptysis, flexible bronchoscopy may be the first-line diagnostic test.
  - Flexible bronchoscopy can be performed at the bedside in the setting of true massive haemoptysis where patients are too unstable to be transferred for radiological studies.
  - Allows therapeutic intervention
  - Allows airway to be secured
- Identifies the site of bleeding in of massive haemoptysis in 73-93%, similar to CTA (70-88.5%) and bronchoscopy (73-93%).
- CTA is more useful than bronchoscopy for identifying the underlying cause. CTA reveals the underlying cause in 60-77% compared to 2.5-8% with bronchoscopy.
- In non-massive haemoptysis, bronchoscopy has a much lower yield, especially in younger patients.
- Disadvantages:
  - Invasive procedure with a risk of complications
  - Failure to visualise peripheral lesions

CT Angiography (CTA)

- Rapid, non-invasive investigation that can localise the site and cause of haemoptysis.
- Contrast enhanced CT with opacification of the pulmonary and systemic vessels is recommended to evaluate for the source of haemorrhage. CTPA shows only opacification of the pulmonary vessels and may miss haemoptysis caused by systemic vessels.
- Provides useful information to improve the success of bronchial artery embolisation.
- Identifies the site of bleeding in 70-88.5% of massive haemoptysis, similar to bronchoscopy (73-93%).
- More useful than bronchoscopy for identifying the underlying cause. CTA reveals the underlying cause in 60-77% compared to 2.5-8% with bronchoscopy.
- In the setting of true massive and life-threatening haemoptysis, flexible bronchoscopy is the first-line management so that the airway can be secured, as well as providing useful information about the site of bleeding.
  - Once airway stabilisation and site localisation is accomplished, CTA can add additional information, particularly about the underlying aetiology and vascular anatomy if there is a view to embolisation.

Bronchial Angiography

- Invasive diagnostic test that is indicated when bronchial artery embolisation is intended.
- Angiographic signs of pulmonary haemorrhage include extravasation of contrast media, hypervascularisation, abnormal arborisation of bronchial arteries, systemic-pulmonary shunts and bronchial artery aneurysms.

References
References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document


8. Bonlokke S, Guldbbrandt LM, Rasmussen TR. **Bronchoscopy in patients with haemoptysis and normal computed tomography of the chest is unlikely to result in significant findings.** Danish medical journal. 2015;62(8):A5123. (Level II-III evidence). [View the reference](#)


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