Flexible Bronchoscopy

Part 4B : Transbronchial Lung Biopsy VOLUME 2

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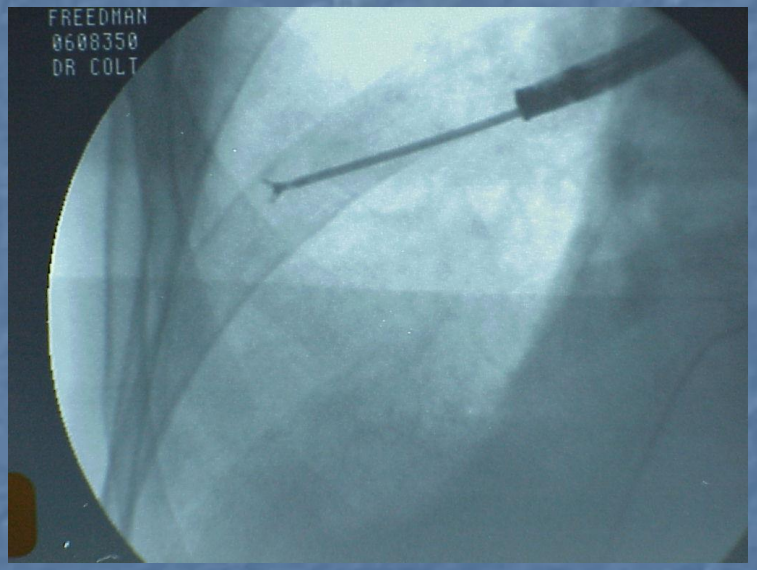
Transbronchial lung biopsy (TBLB) Volume 2

Response to procedure-related complications and adverse events



AIRWAY BLEEDING

And

PNEUMOTHORAX

Bronchoscopy International

Generally reported frequency of complications after Transbronchial lung biopsy

- **Bleeding > 50 ml 1-2 %**
- **Pneumothorax 1-4 %**
- **Death 0.04 - 0.12 %**

Bleeding after biopsy

- Increased risk in case of
  - Coagulopathy
  - Platelet dysfunction
  - Platelets < 50,000
  - Uremia
  - Immunocompromised host
  - Anticoagulation medication including certain antiplatelet medications such as Plavix
- Increased risk suspected but not documented in
  - Congestive heart failure
  - Pulmonary hypertension

Prevention

- Screening before airway procedures
  - History, examination, laboratory tests, explanation of risks to patient and or family members
- Careful procedure technique
  - Recognize hypervascularization, aberrant vessels, and submucosal arterioles
- Procedural planning
  - Supplemental oxygen, cardiac monitoring
  - Be sure sufficient space in procedure room to move around.
  - Availability of medication and hemodynamic resuscitation, including crash cart.
  - Airway resuscitation including endotracheal tubes, large bore suction catheter/Yankauer, oral airway and bite block.

Accepted precautions to prevent bleeding

- Platelet counts > 50,000/mm3
- Avoid uremia (serum creatinine < 2, BUN < 25 mg/dl)
- Avoid liver failure (alk phos < 110, SGOT < 25, Bilirubin < 1.5 ml/dl
- Avoid anticoagulated patients
- Check PT, aPTT in patients with history of bleeding or coagulopathy.
- Stop antiplatelet agents such as Plavix

Morbidity related to

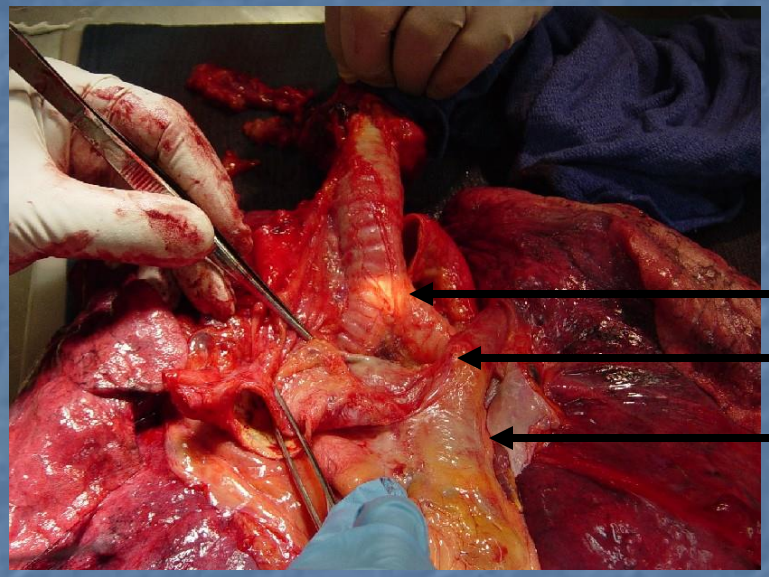
- Physiologic consequences of airway bleeding
  - Blood filling of dead-space
  - Airway obstruction and clot formation
  - Subsequent tachypnea and hypoxemia
  - Tachycardia, bradycardia, hypotension
  - Respiratory failure
  - Arrhythmia and cardiac arrest
- Underlying disease state
  - History of pneumonectomy
  - Critically illness
  - Significant comorbidities

Bronchial arterial anatomy

- Bronchial arterial blood (systemic arterial pressures)
  - Comes from the aorta (T 3-T 8)
  - Feeds the trachea and main bronchi
    - Drains into the bronchial veins and right heart
  - Feeds intrapulmonary tissues and airways
    - Drains through bronchopulmonary anastomoses into pulmonary veins and left heart

Collateral circulation and increased bronchial and pulmonary anastomoses are found in inflammatory diseases, cystic fibrosis, bronchiectasis, and TB.

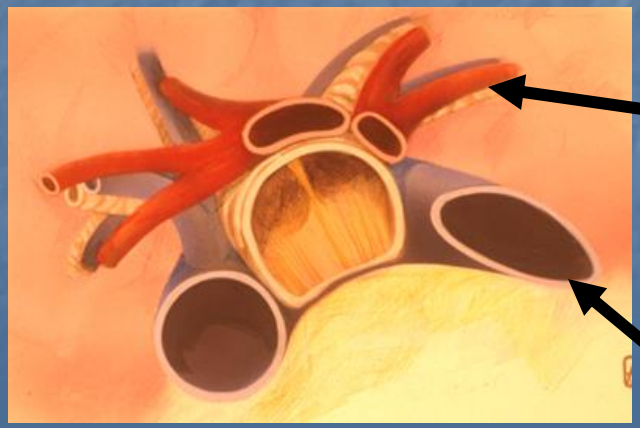
Vascular and airway anatomy



Carina

Left Pulmonary artery

Main pulmonary artery



Left upper lobe pulmonary veins

Left upper lobe pulmonary artery

Ventilatory dead space

A patient's left main bronchus, right main bronchus, and trachea can completely fill with only 150 ml of blood or saline, causing hypoxemia, and respiratory arrest.

Treating the bleeding airway

1) Establish and maintain an open airway
2) Stop the bleeding
3) Prevent or treat respiratory, cardiac, and hemodynamic complications

(1) Maintaining an open airway

- Bronchoscopic suction and large bore suction of the oral pharynx
- Lateral safety position
- Tilt the patient or the table 45 degrees towards the bleeding side
- Note the bleeding site and remember how to get back to it!
- Tamponade the bleeding bronchus using continuous bronchoscopic suction
- Unilateral intubation

The safety position (lateral decubitus)

- Bleeding side down
- Allows face to face contact with patient if operator working from the front or side of the patient
- Allows blood and secretions to flow from the larynx and out of the corner of the mouth
- Avoids collapse of the larynx and laryngeal obstruction by tongue or edematous upper airway.
- Oral pharynx easily suctioned

Safety position

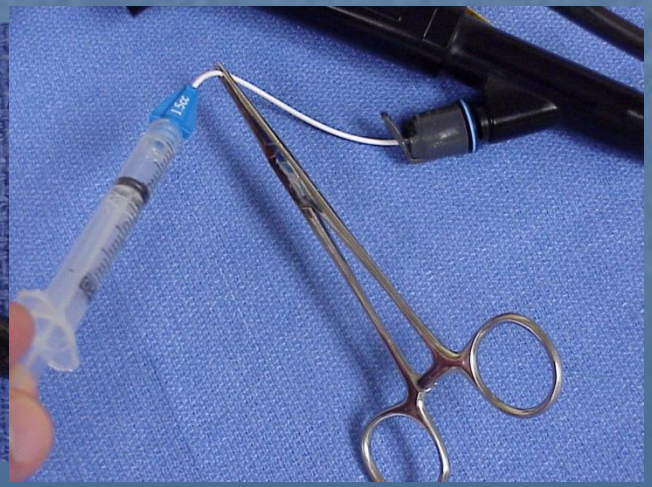
Turning the patient onto the “safety position” (bleeding side down) also protects the contra lateral airway

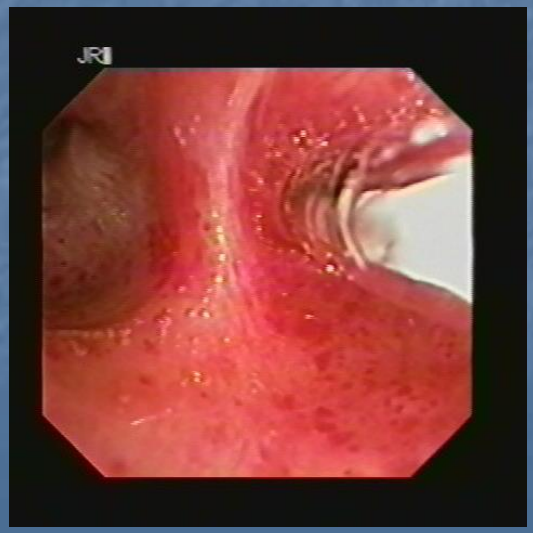
(2) Stop the bleeding

- Tamponade using
  - Bronchoscopic suction, Balloons, the rigid bronchoscope, cotton pledgets, tampons.
- Vasoconstriction using
  - Epinephrine, cold saline washes
  - Intravenous vasopressin (0.2 - 0.4 units / min) causes bronchial arterial vasoconstriction: danger if patient has coronary artery disease and hypertension.
- Enhance clot formation
  - Allow clot to form in the bleeding area
  - Lateral decubitus position

Tamponade balloons

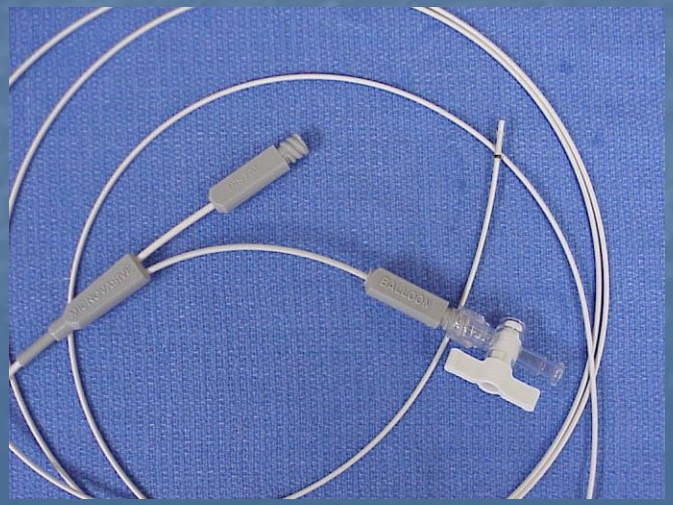
If a tamponade balloon or Fogarty catheter is inserted into a bleeding segmental bronchus, its position should be verified by flexible bronchoscopy and chest radiograph. The balloon can remain in place for several days if necessary.

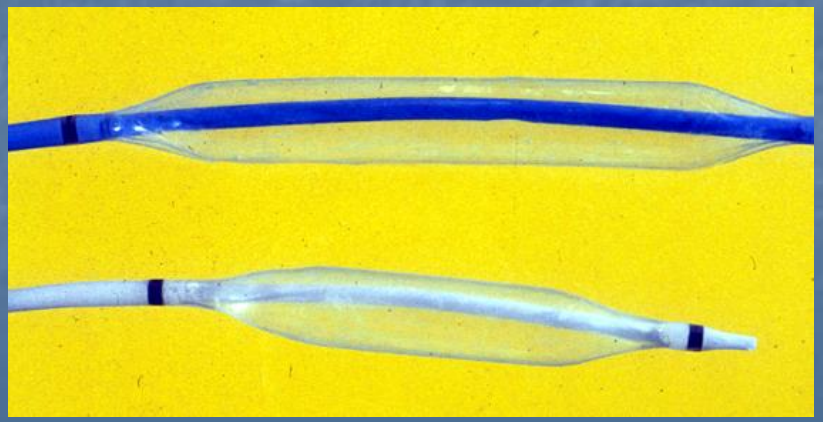




Dilating balloons

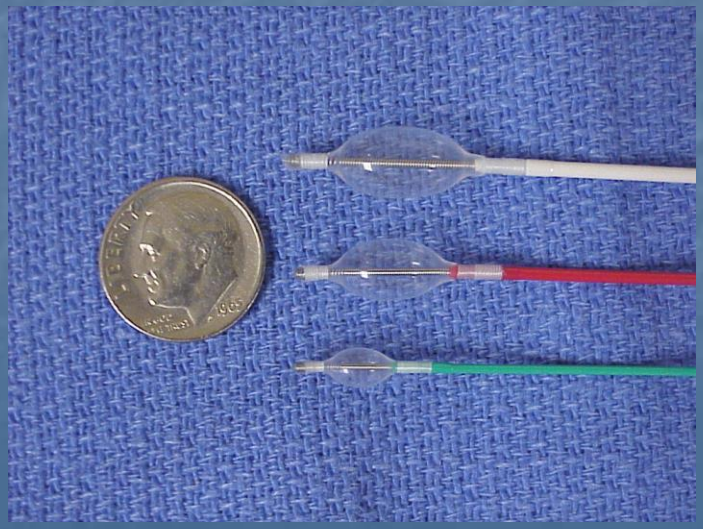
Tamponade balloons or, if necessary, dilating balloons are usually large enough to tamponade a bleeding segmental and subsegmental airway





Fogarty catheters

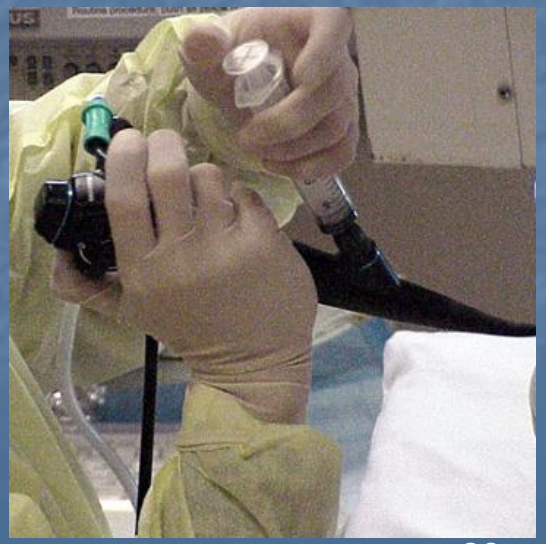
A Fogarty balloon catheter can be used but operators and their assistants should first verify that balloon diameter is sufficient to fill segmental bronchial airway AND that balloon catheter fits through working channel of the bronchoscope.



The Cook (Arndt) bronchial blocker, if necessary, should be inserted through a large endotracheal tube

Saline lavage

Immediate administration of large aliquots of iced saline using a wedged or partially wedged bronchoscope and continuous or intermittent suction and gravity dependent clot formation stops most bleeding.



Do not remove freshly formed clot

Once a clot forms, it is important to NOT remove it once bleeding has stopped. Inspection bronchoscopy (with or without clot removal can be performed the following day

Large blood clot causing a cast of the distal airway

Avoid adverse effects on respiration , cardiac, and hemodynamic status: Beware anxiolytics and narcotics on respiration

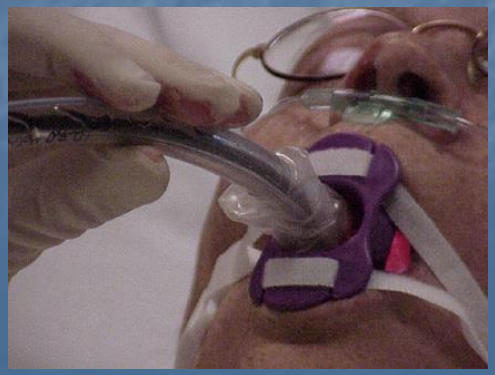
In case of bleeding, additional intravenous sedation can result in adverse events:

These include respiratory failure, hypoxemia, and hypercapnia, hypotension and aspiration pneumonia.

Reversing agents should be available. Additional sedation or anxiolysis might warrant intubation even after bleeding is controlled.

Avoid adverse effects on respiration , cardiac, and hemodynamic status: Consider intubation with a large endotracheal tube

If intubation is desired or warranted, a large single lumen endotracheal tube can usually be inserted over the bronchoscope. Selective unilateral bronchial intubation is only possible if the oral route is used. ALWAYS insert a bite block to prevent patients from biting down on the bronchoscope (regardless of level of sedation).



Pneumothorax after biopsy

- May be immediate
  - Detected by symptoms such as dyspnea, pleuritic chest pain, hemoptysis, tachycardia, tachypnea, or hypotension.
  - Detected on fluoroscopy
- May also be delayed
  - Justifies prolonged observation post-procedure
  - May be detected by symptoms, or chest radiograph (during exhalation)
  - May often be small and asymptomatic

Treatment alternatives

- Observation and repeat chest radiograph if small and asymptomatic.
- Observation and hospital admission.
- Small bore chest tube insertion and discharge.
- Small bore chest tube insertion and hospital admission.
- Large bore chest tube insertion and hospital admission.

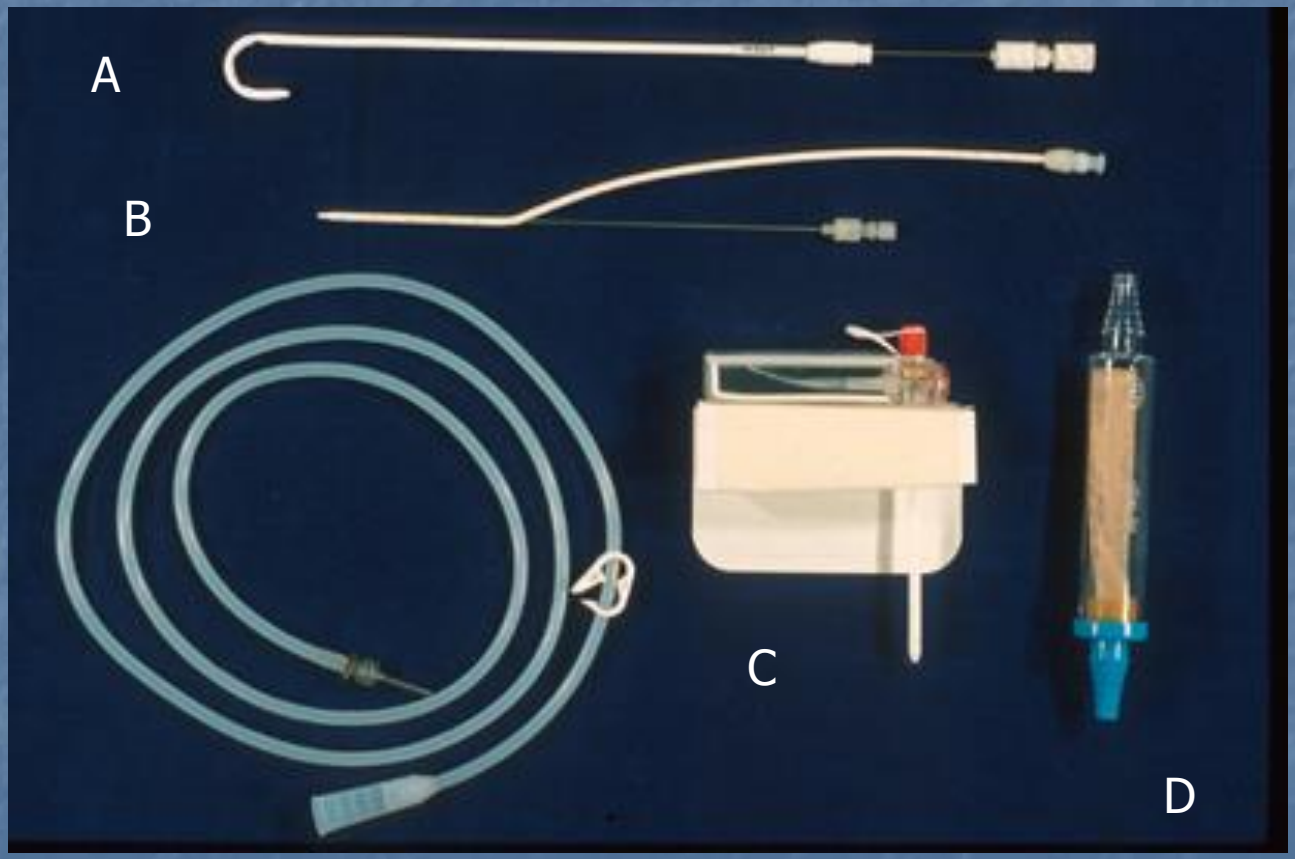
Examples of chest tubes

A Pigtail

B. Cook catheter

C. Tru-Close

D. One-way valve



This presentation is part of a comprehensive curriculum for Flexible Bronchoscopy. Our goals are to help health care workers become better at what they do, and to decrease the burden of procedure-related training on patients.

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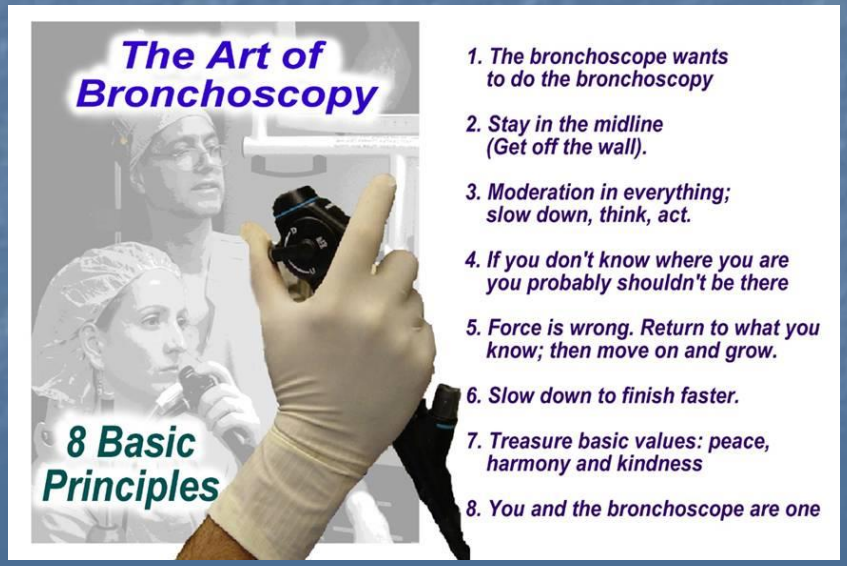

Thank you