

# Basic management of airway bleeding and hemoptysis

José De Cárdenas MD  
Associate Professor of Medicine and Surgery  
Director, Interventional Pulmonology Program

# Objectives

1. To understand and describe the basic principles of management of airway bleeding
  - Local hemostasis
  - Different basic techniques for selective airway endobronchial isolation.
  - Will not discuss advanced bronchoscopic therapy (cautery, sealing segmental bronchi or rigid bronchoscopy)

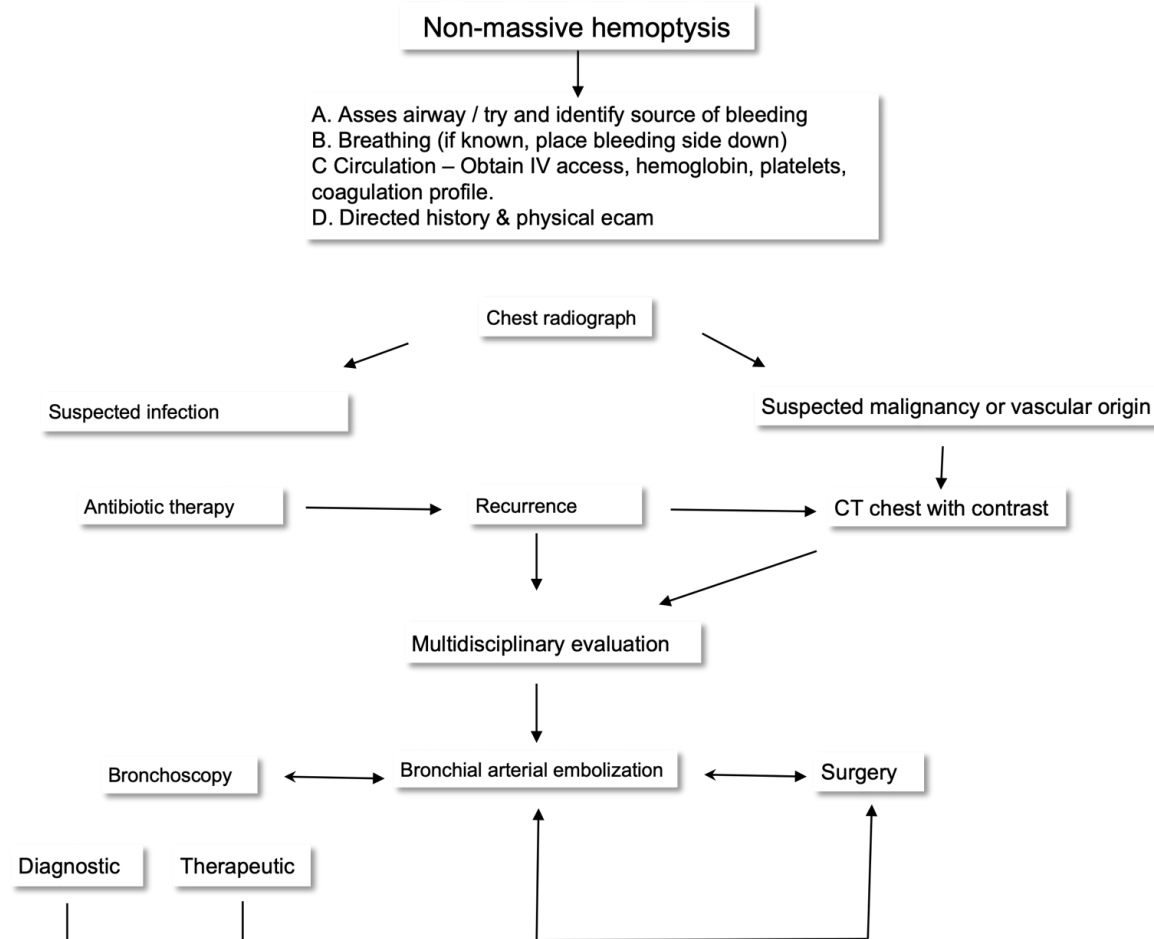
# Definition

- No clear consensus
- Massive hemoptysis Volume definition
  - 100-1000ml/24h
  - >200 ml/24h (major hemoptysis)
  - >150ml /12h (severe hemoptysis)
  - >400 ml /24h (exsanguinating hemoptysis)
- Magnitude of effect definition
  - Transfusion
  - Hospitalization
  - Intubation
  - Aspiration and airway obstruction
  - Hypoxemia ( $\text{PaO}_2 < 60$  mm Hg)
  - Death

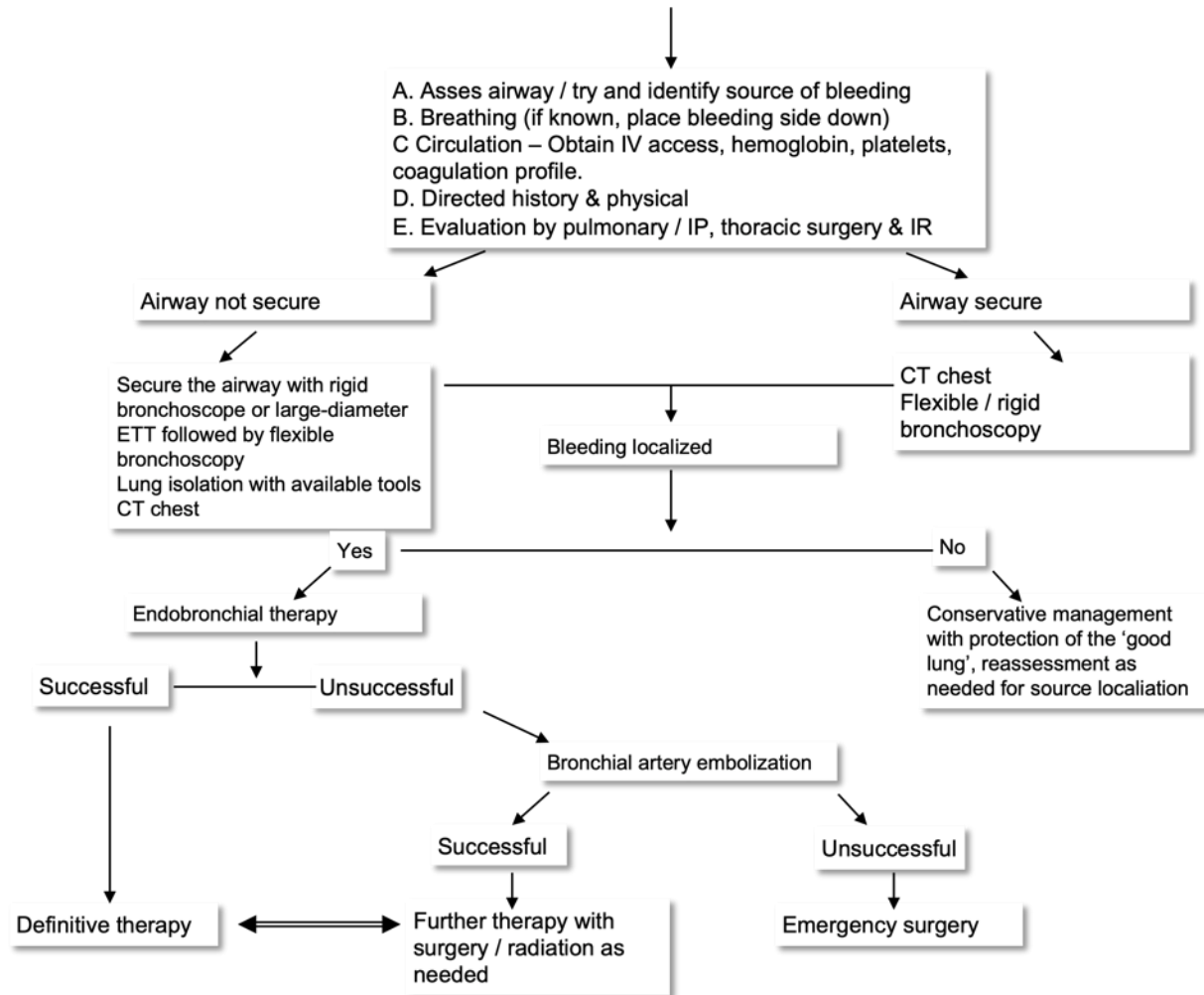


Am Rev Respir Dis 1968;97:187–192.  
Am J Med Sci 1987;294:301–309.  
Respir Med 2003;97:790– 795.  
BJR 2007;80:21–25.  
Clin Chest Med 1999; 20:89–105.  
Respiration 2010;80:38–58

# Management of non-massive hemoptysis



# Management of massive hemoptysis



# Classification of bleeding after transbronchial biopsies

Grade	Findings at Bronchoscopy	Rationale
1	Suctioning of blood required for less than 1 minute	Minimal bleeding of no clinical consequence to the patient or the provider.
2	Suctioning more than 1 minute required or repeat wedging of the bronchoscope for persistent bleeding or instillation of cold saline, diluted vasoactive substances or thrombin	Requirement of one or more tools to control or prevent further bleeding.
3	Selective intubation with ETT or balloon/bronchial blocker for less than 20 minutes. Or premature interruption of the procedure.	Meaningful but short-term change in the clinical status of the patient involving more invasive procedures and causing interruption of the planned procedure.
4	Persistent selective intubation > 20 minutes or new admission to the ICU or PRBC transfusion or need for bronchial artery embolization or resuscitation.	Change in level of care and requiring advanced ventilatory support and/or transfusion of PRBC.

CHEST 2020; 158(1):393-400

# Principles of endoscopic management

## Area of bleeding is endoscopically visible:

- Local hemostasis:
  - laser photocoagulation
  - argon plasma coagulation
  - electrocautery
- Any of tamponade methods.

and:

- Instill hemostatic agent:
  - cold saline
  - epinephrine
  - tranexamic acid
  - fibrinogen/ thrombin combination
- Seal the segment using:
  - silicone spigot
  - cyanoacrylate glue
  - oxidized regenerated cellulose

**Source of bleeding is peripheral,**  
then identify the segmental bronchus

# Local hemostatic drugs

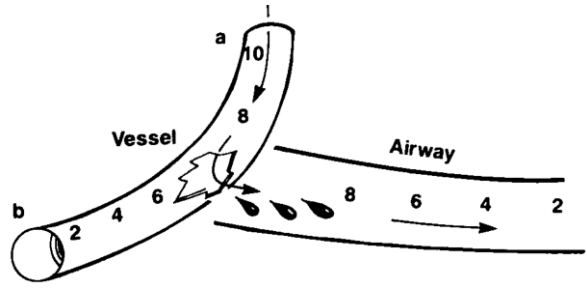
Treatment and strategy	Bleeding severity	Patients	Immediate control
<b>Cold Saline</b> Conlan 1980	>600 mL /24h	23	23/23 (100%)
<b>Topical vasoconstrictive agent</b> Tuller 2004	See note	110	110/110 (100%)
<b>Fibrinogen-thrombin</b> De Gracia 2003 Tsukamoto 1989 Bense1990	Severe hemoptysis (>150mL/12h) Massive hemoptysis Massive hemoptysis	11 9 3	11 (100%) 9/9 (100%) 3/3 (100%)
<b>Tranexamic acid</b> Solomonov 2009	750 and 600mL	2	2/2 (100%)

- NS 4°C in 50-ml aliquots (average volume of 500 ml). One patient: bradycardia. Use RB
- Vasoconstrictive agent, no useful for massive hemoptysis, since drug is diluted and washed away. Epinephrine: hypertension and tachyarrhythmias -> ornipressin fewer side effects.

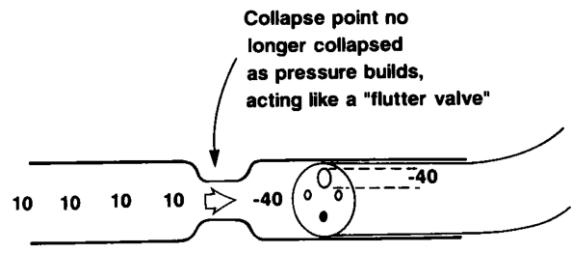
Respiration 2010; 80:38-58



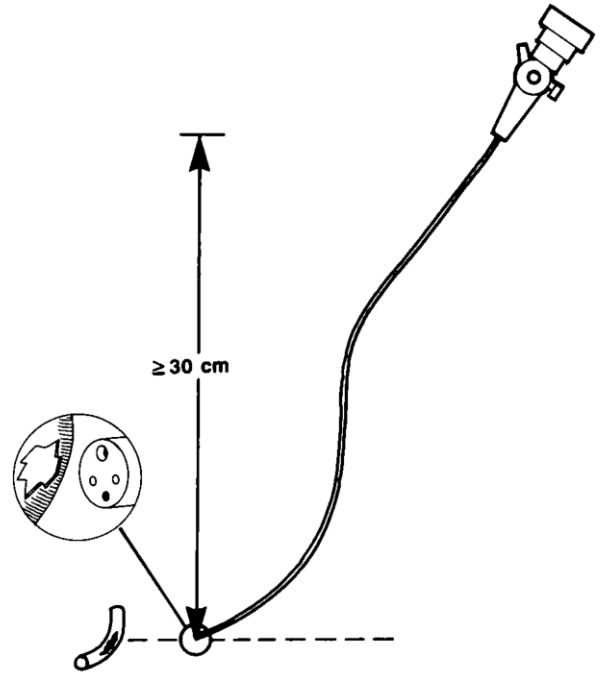
# Direct tamponade with the bronchoscope



A driving pressure is needed for blood to flow from A to B along the vessel. If a defect is created after the biopsy, the same driving pressure will cause blood to flow into the AW



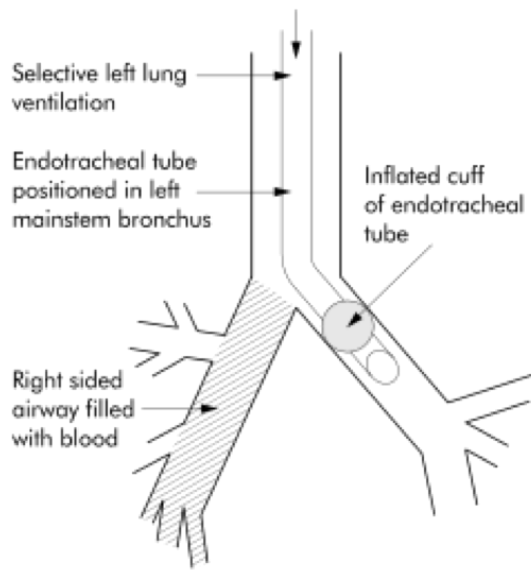
The "collapse point" will not remain a barrier to stop the flow of blood, because the driving pressure from the vessel will rise, creating a "flutter valve: at the former collapse point.



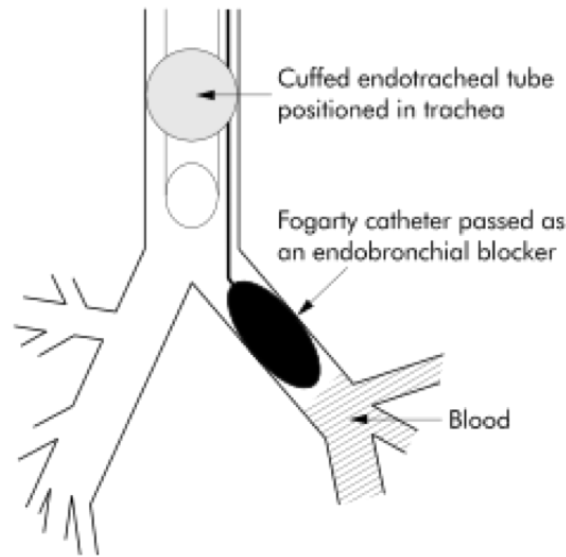
If suctioning is not done, the height of the FB above the defect will serve as a potential fluid column to exert back pressure. Natural clotting mechanism will occur allowing the operator to pull the FB back from the wedged position without recurrence of blood flow.

JOBIP 1994;21:4

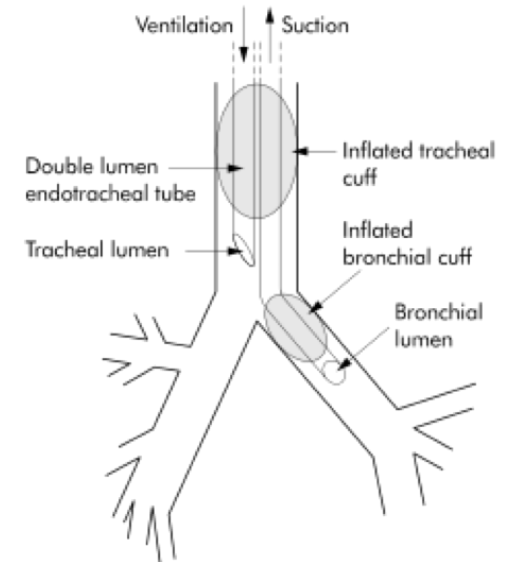
# Selective intubation and airway blocking



Source of bleeding : RIGHT bronchial tree



Source of bleeding : LEFT bronchial tree

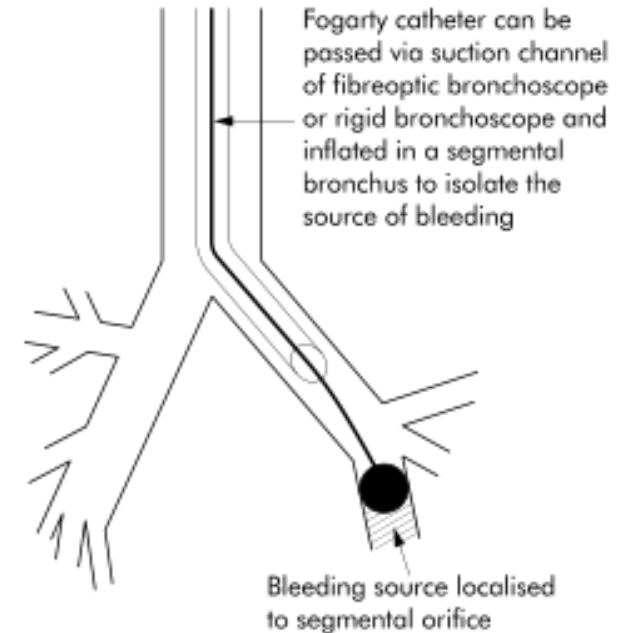


Double lumen tube: Not recommended

Thorax 2003;58:814-819

# Tamponade method: Segmental isolation

- Only a temporary measure
- Isolation of bleeding segment with balloon catheter may prevent aspiration into large airways
- A size 4-7 Fr balloon catheter is passed through the working channel of the FB and the balloon is inflated.
- Balloon is left in place for 24-48 hours, and deflated under controlled conditions and direct FB visualization



Placement of a Fogarty catheter guided by FB to control massive bleeding from a segmental bronchus

Eur Respir J 1994;7:2033-7.

# Materials for deployment of blockers:

What you should have in your ICU and/or bronchoscopy suite

- Bronch cart with small bronchoscope (XP-190 or P-190), in addition to your therapeutic scope.
- Preferable ETT 8.0 or 9.0 and an airway cart
- Blockers:
  - Arndt Endobronchial blocker 7 and 9 French
  - Fogarty balloon #4 or 6, plus a three-way stop cock, and a 3cc syringe luer lock
- Bronchoscopic forceps or snare
- Silicone spray can
- Saline NaCl 0.9% 500 ml bottle with bowls
- Epinephrine 1:100 000, 20 mL loaded in 10 cc syringes (2 cc epinephrine plus 8 cc of air)

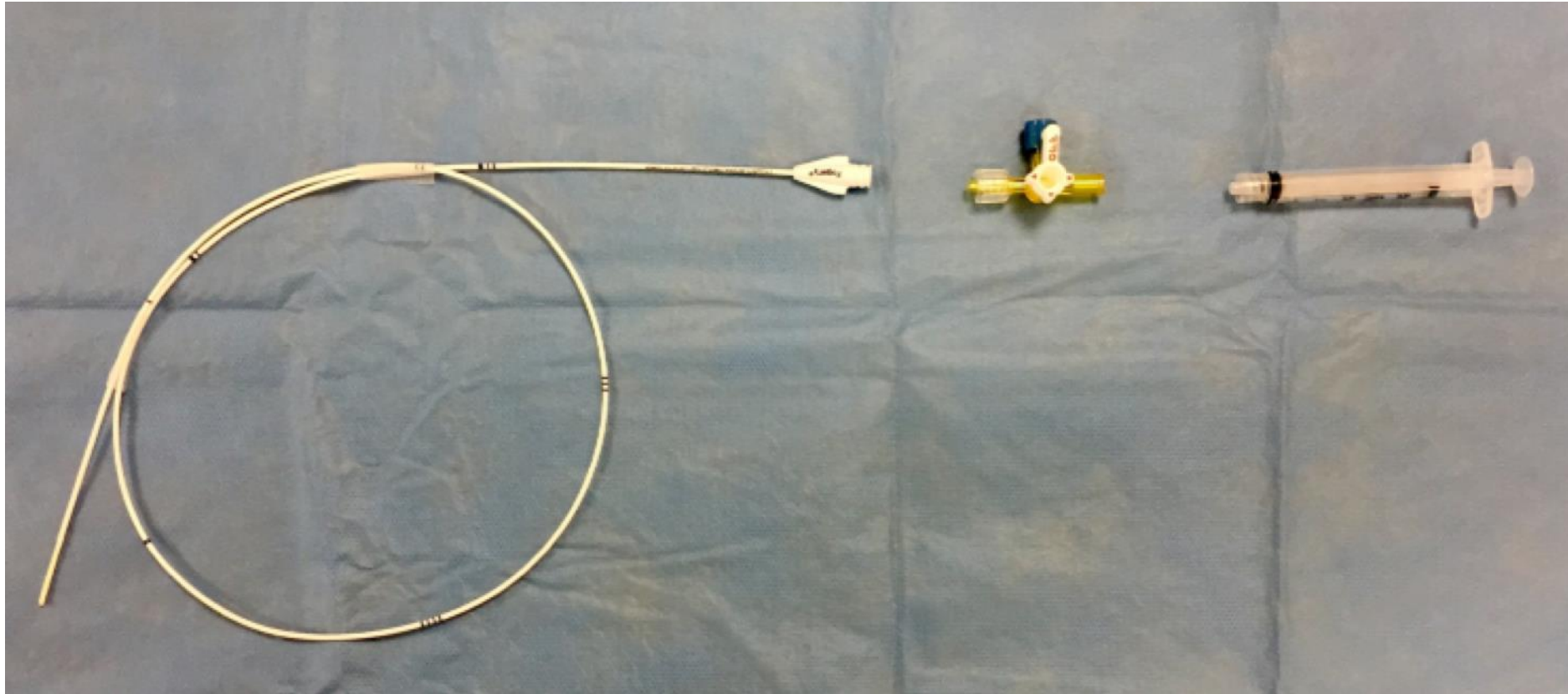
# Know your bronchoscopes

Bronch scope	Outer diameter	Working channel	Procedures
BF XP190	2.8mm	1.2mm	Stenosis, distal inspection
BF MP190	3.7mm	1.7mm	Stenosis, distal inspection
BF P190	4.2mm	2.0mm	BAL, possible biopsies
BF-Q190	4.9mm	2.0mm	BAL, possible biopsies
BF TH190	6.2mm	2.8mm	Therapeutic cases
BF XT190	6.3mm	3.2mm	Therapeutic cases
BF UC180 (EBUS)	6.9mm	2.2mm	EBUS

# Method 1. Fogarty balloon advanced directly through the bronchoscope

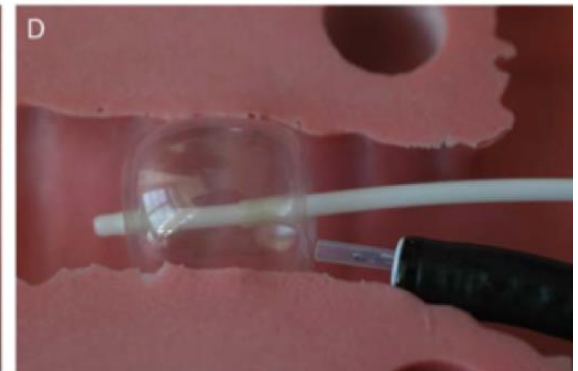
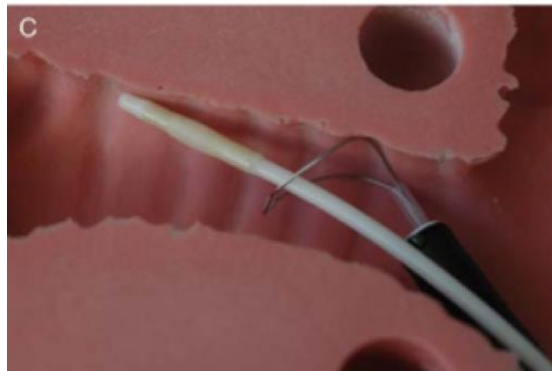
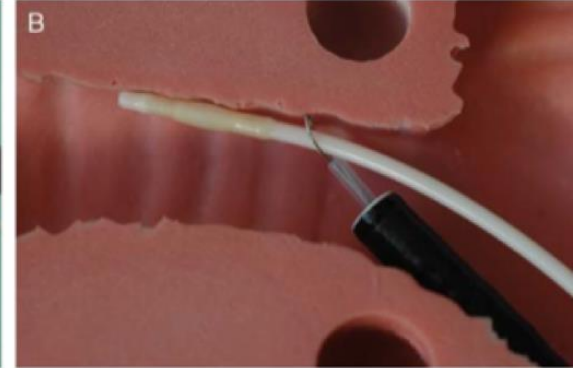


# Fogarty Balloon set up









# Method 2. Fogarty balloon advanced outside the scope



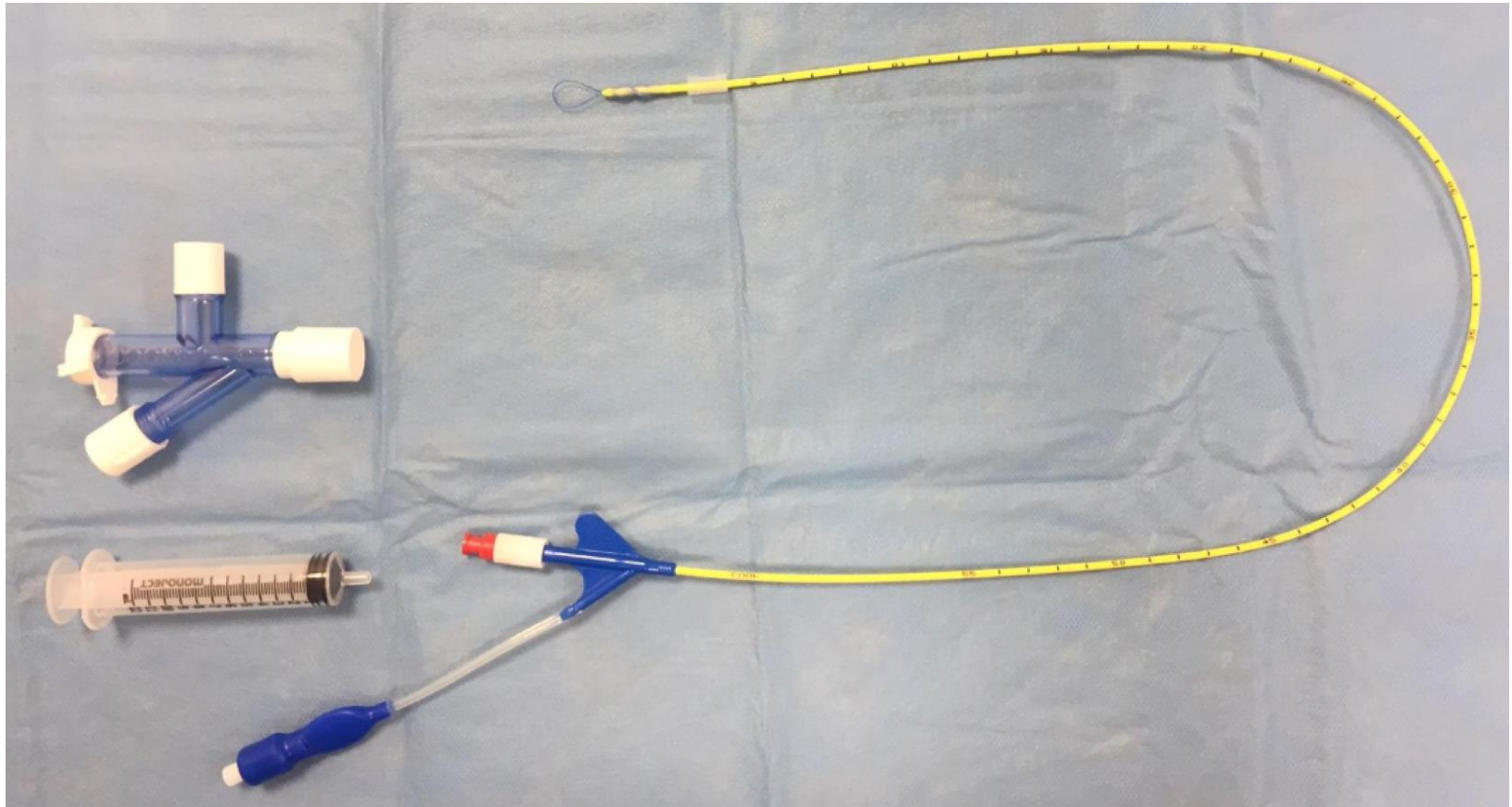
*(J Bronchol Intervent Pulmonol 2014;21:361-365)*



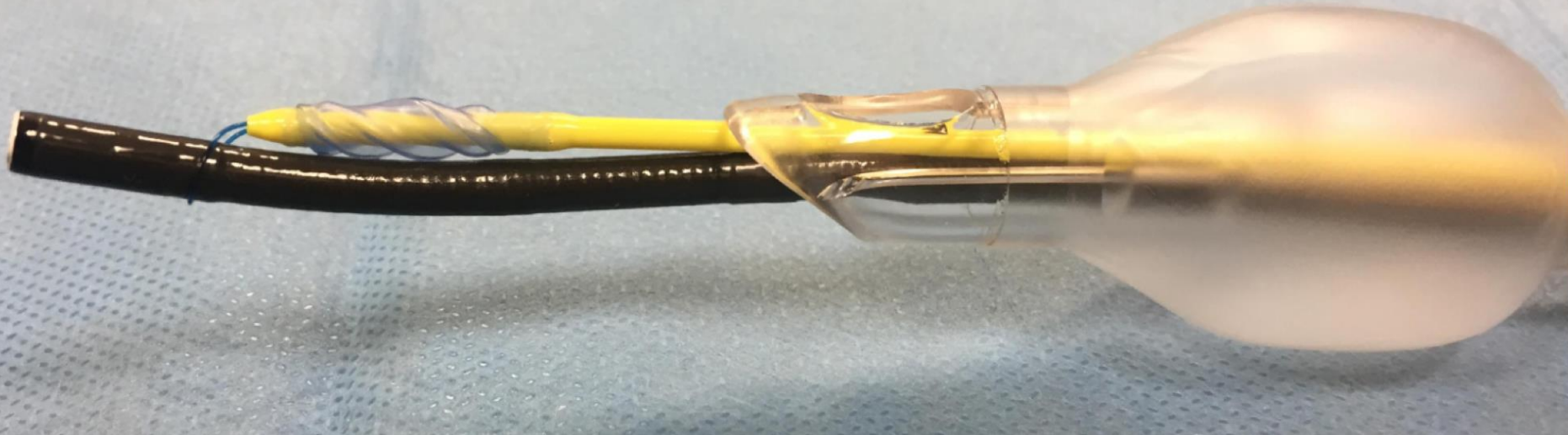
# Method 3. Using an endobronchial blocker

	Arndt Endobronchial blocker	Cohen Flextip endobronchial blocker	Rush EZ-Blocker	Fuji Uniblocker
<b>Appearance</b>				
<b>Size (Fr)</b>	5, 7 and 9	9	7	5 and 9
<b>Guidance mechanism</b>	<i>Nylon wire loop coupled with the fiberoptic bronchoscope</i>	<i>Wheel device to deflect the tip, guidance arrow at the tip for direction</i>	<i>Y-shape at the distal endo to straddle the carina</i>	<i>Pre-shaped tip to be directed into the desired airway</i>
<b>Recommended endotracheal tube for use (mm)</b>	<i>Greater than 5.0 (5Fr) Greater than 7.5 (7Fr) Greater than 8.0 (9Fr)</i>	<i>Greater than 8.0</i>	<i>Greater than 7.5</i>	<i>Greater than 5 (5Fr) Greater than 8.0 (9Fr)</i>
<b>Maximum inflation volume (mL)</b>	<i>2 (5Fr) 6 (7Fr) 8 (9Fr)</i>	<i>9</i>	<i>12</i>	<i>3 (5Fr) 8 (9Fr)</i>
<b>Center channel (i.e. internal diameter, mm)</b>	<i>1.4</i>	<i>1.6</i>	<i>1.4</i>	<i>1.4</i>

# Arndt endobronchial blocker setup.



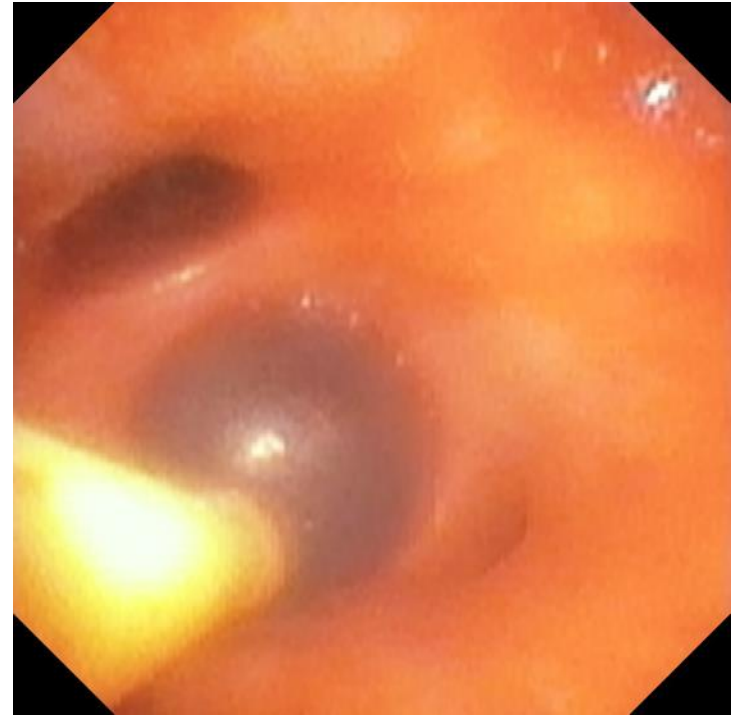
# Bronchoscopic guidance of Arndt endobronchial blocker through an endotracheal tube.



# Arndt Endobronchial blocker and Fogarty examples



Fogarty balloon occluding LUL take off

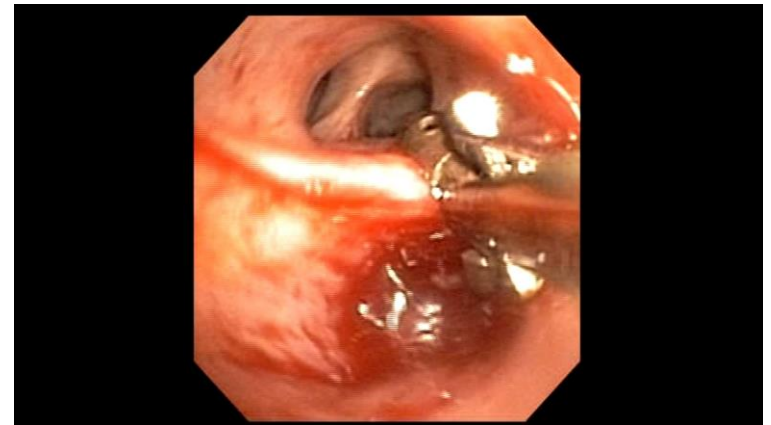


Arndt EBB occluding the RLL take off



# A word of wisdom to every bronchoscopist

- Be prepared and anticipate
  - Epinephrine, review in detail vascular anatomy
- Know your team:
  - Define roles
  - Decubiti lateral
  - IR, anesthesia, thoracic surgery
- Know your tools:
  - Fogarty, forceps, Surgicel, cryoprobe, therapeutic scope and rigid
- Know your room, patient, and environment
  - Do the right *procedure* on the right *patient*, in the right *place* at the right *time*
- If you find an endobronchial lesion that you suspect will bleed a lot, needle first.



# Take home messages

- Do not forget the basics:
  - Protect your good lung at all cost
  - Tamponade with scope
  - Bleeding side should be down
  - Suction only when needed
- Effective communication: calm, specific orders to team
- Know your scopes, tools and resources
- Lubricate well when deploying your blocker
- Practice with your team