Jacobs School of Medicine and Biomedical Sciences
University at Buffalo

Interventional Pulmonology

SANDIP SAHA MD

- Who am I?
- What is interventional pulmonology?
- History of Bronchoscopy
- Patient cases
- What procedures can I offer?
- When to refer?
- What program we are creating at BGH?

- Canadian, raised in the suburbs of Toronto
- Went to York University for undergrad

- Medical school in St. Maarten at the American University of the Caribbean
- Moved to the UK for my first year of core rotations
- Then moved to the USA for the final year.

- Moved to Detroit for residency
- Wayne State for Internal Medicine
- Michigan State for Pulmonary Critical Care fellowship

- Moved to New Haven, CT
- Yale University for Interventional Pulmonology

- Moved back to Canada last fall

So what is interventional pulmonology?

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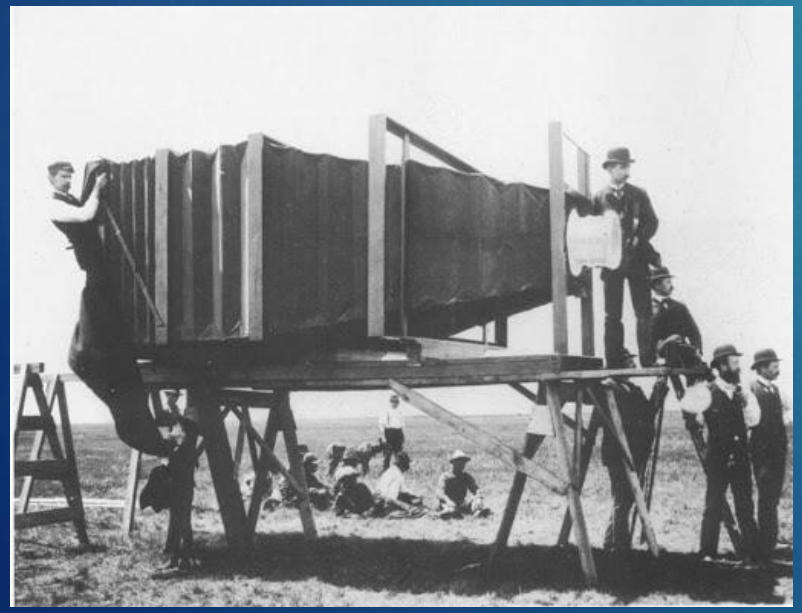
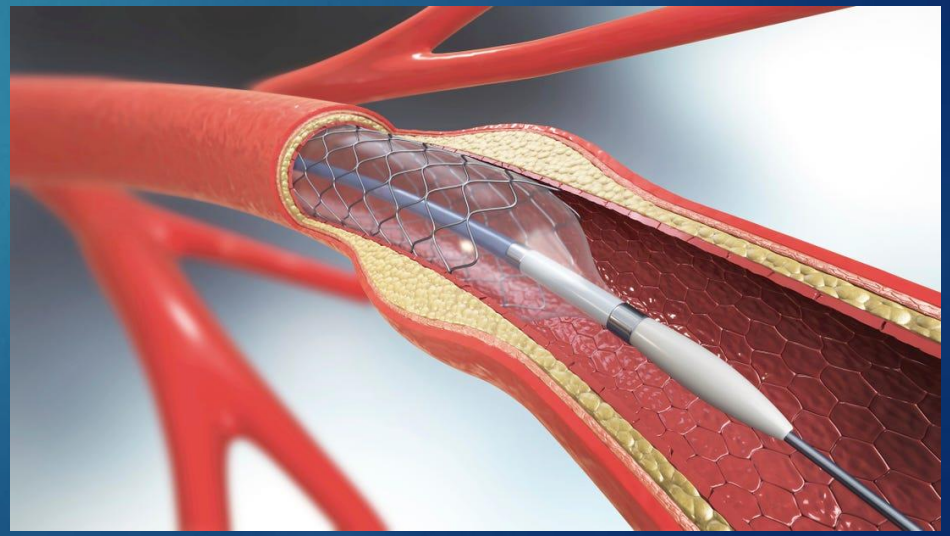
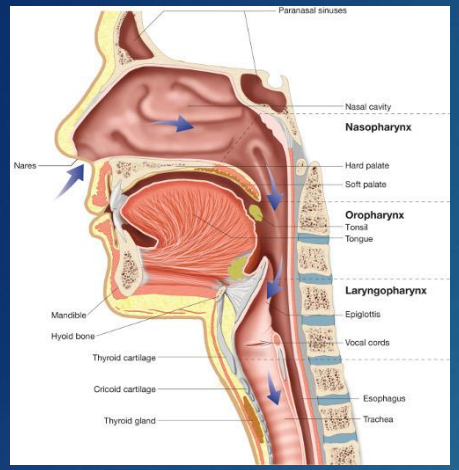
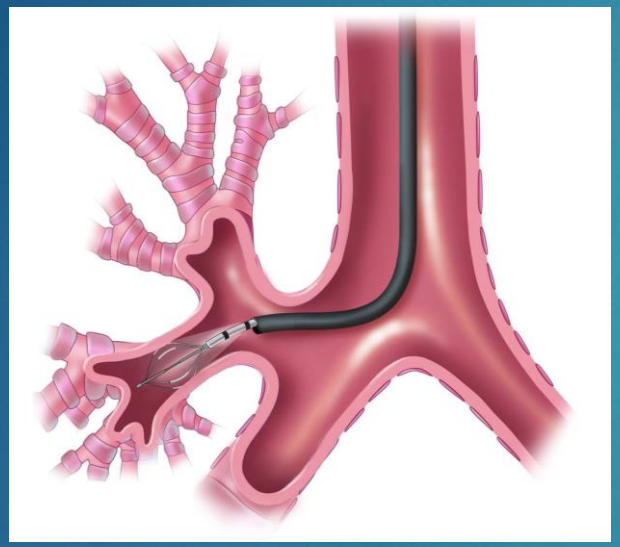
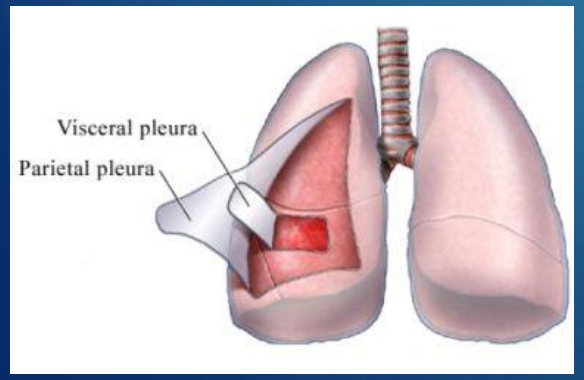










- Interventional pulmonology is a sub-specialty of pulmonary medicine
- Minimally invasive endoscopic and percutaneous procedures for the diagnosis and treatment of neoplastic and non-neoplastic disease of the:
  - Airways
  - Lungs
  - Pleura

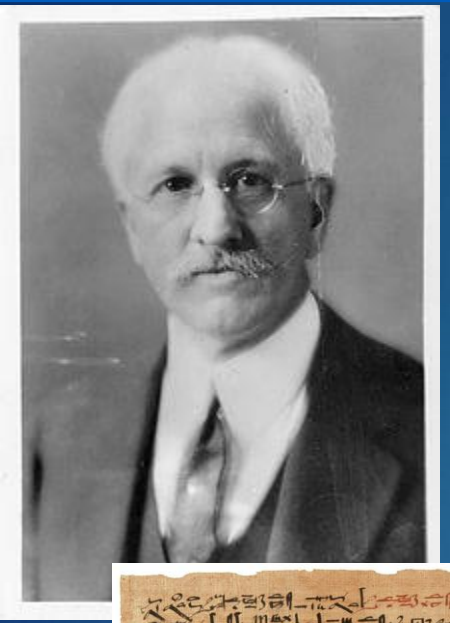
- The first interventional pulmonology program became available in the early 2000s
- Lahey Clinic, Boston, MA
- Currently there are 45 programs in N.America
- But when did it really start?

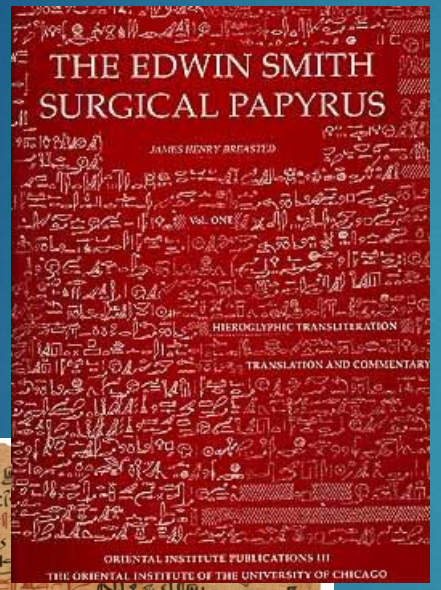
- Two ancient Egyptian tablets from 3600 BC depict a lancet pointed into the neck of a seated person.
- First depicted tracheostomy

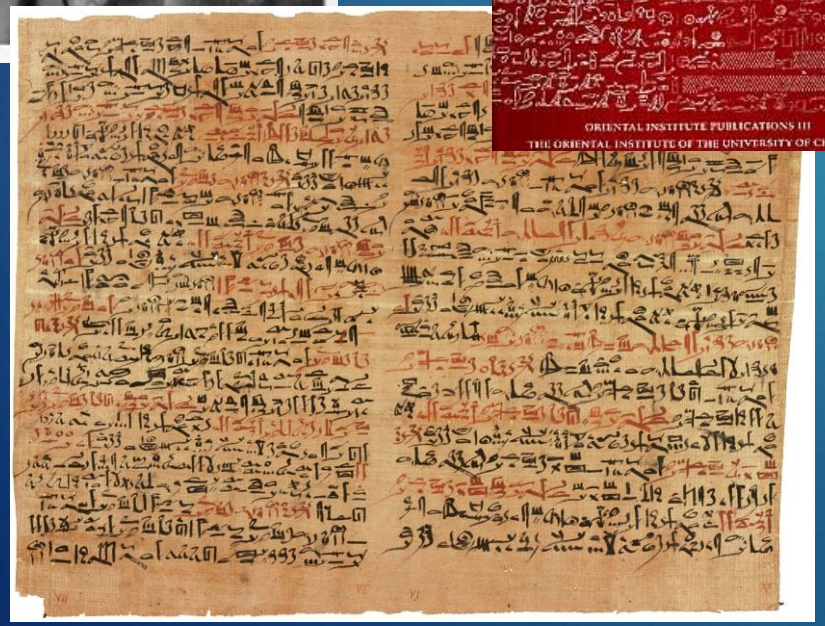
FIG. 1

Tracheostomy in ancient Egypt. Patric C Blomstedt. (2014)

- 3000 BC
- Architect Imhotep (later known as a physician)
- Described pleural infections





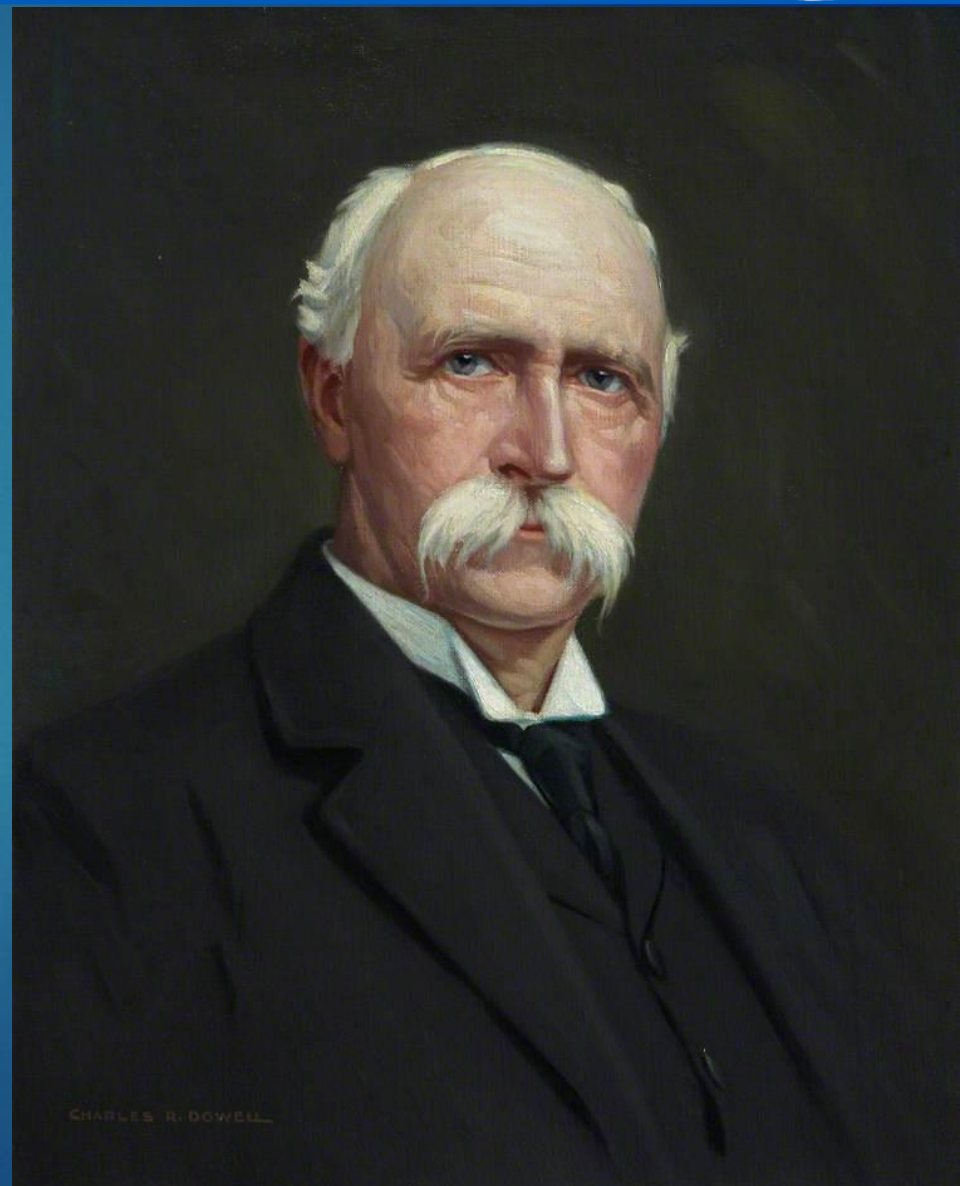


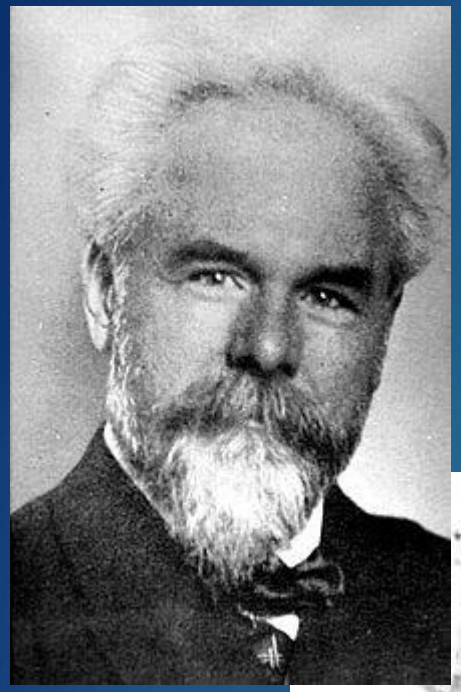
- Author of the Edwin Smith Papyrus
- Collection of 48 cases, translated by Egyptologist, Dr. James Henry Breasted (1930)
- Mentions case of infected chest wall abscess
- describes cooling applications for drawing out the infection, astringent applications for drying up the wound, and poultices for bandaging up the wound.

- October 16, 1846
- Boston dentist William T.G. Morton and John Warren, used sulfuric ether to anesthetize a man who needed surgery to remove a vascular tumor from his neck.

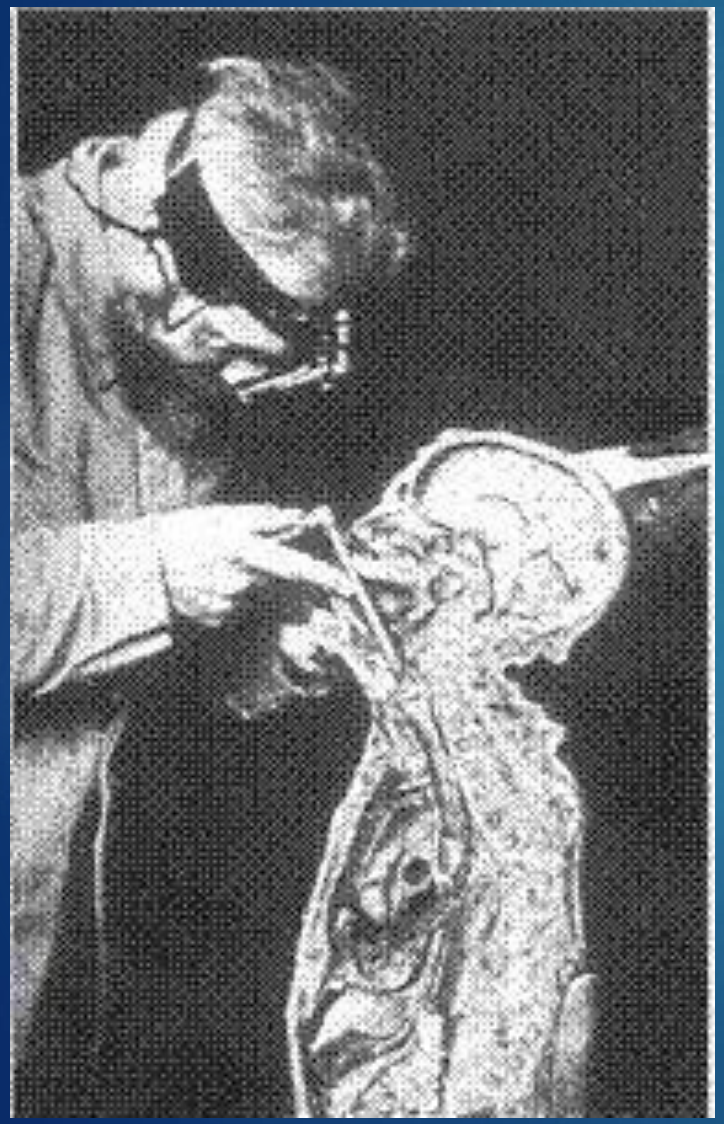
"First Operation Under Ether" painting by Robert C. Hinckley. Courtesy of the Boston Medical Library in the Francis A. Countway Library of Medicine

- 1870
- Scottish Neurosurgeon, Sir William Macewen
- began work on intubation of the larynx, instead of tracheotomy, in diphtheria





- 1897
- First rigid bronchoscopy performed by Gustav Killian
- Removal of an aspirated pork bone from the right main bronchus
- Cocaine was used for topical anesthesia



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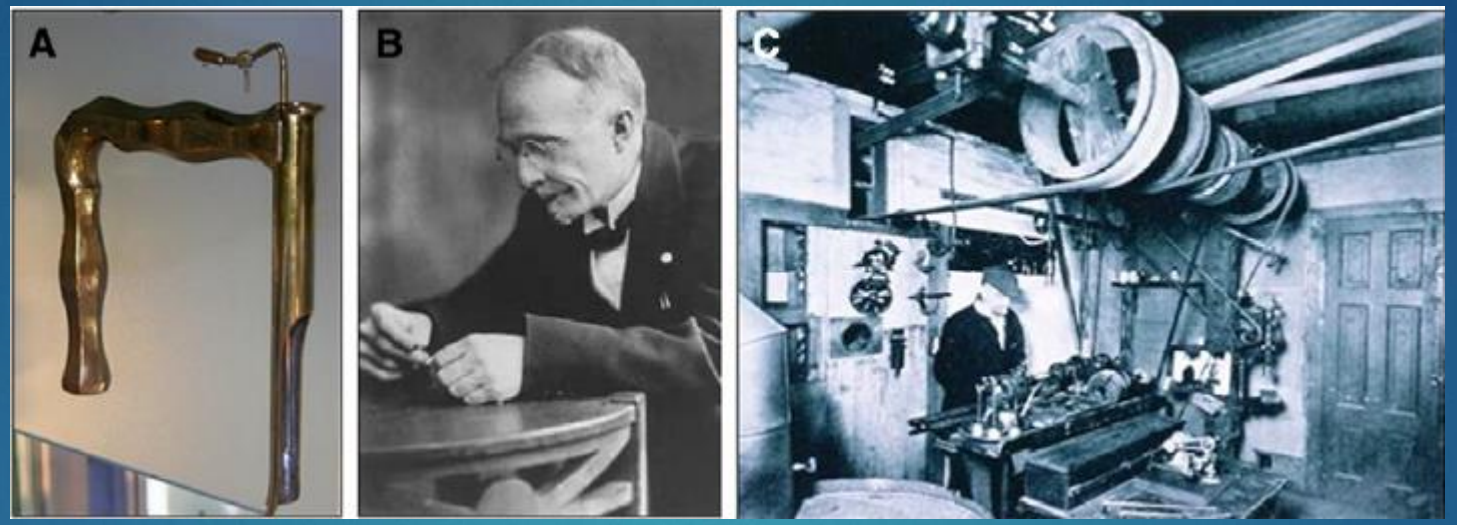
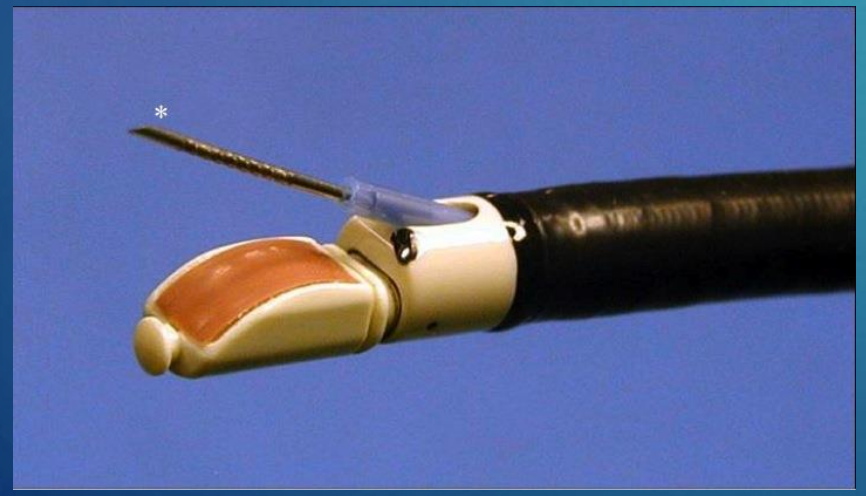


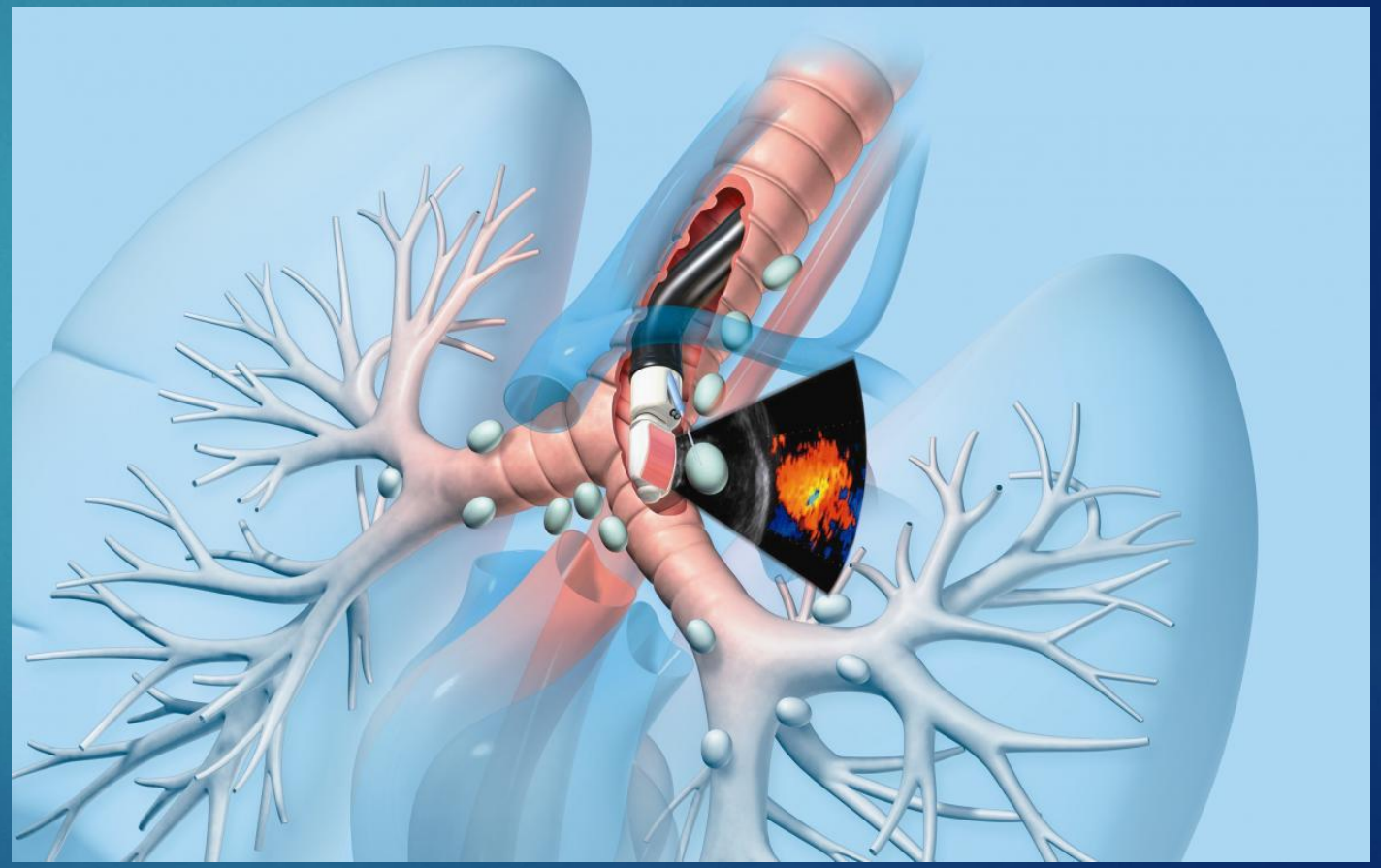
- 1920
- Chevalier Jackson, laryngologist
- Refined the rigid scope, to use illuminated tubes
- Considered the father of American Bronchology

- 1967
- Shigeto Ikeda
- Thoracic surgeon at the National Lung Cancer Center, in Japan
- Developed the first flexible bronchoscope
- Prototype developed in 1964, consisted of over 15,000 glass fibers

- 2004
- Kazuhiro Yasufuku
- Thoracic surgeon at the University of Toronto
- Developed the convex ultrasound probe with Olympus to create the EBUS bronchoscope.

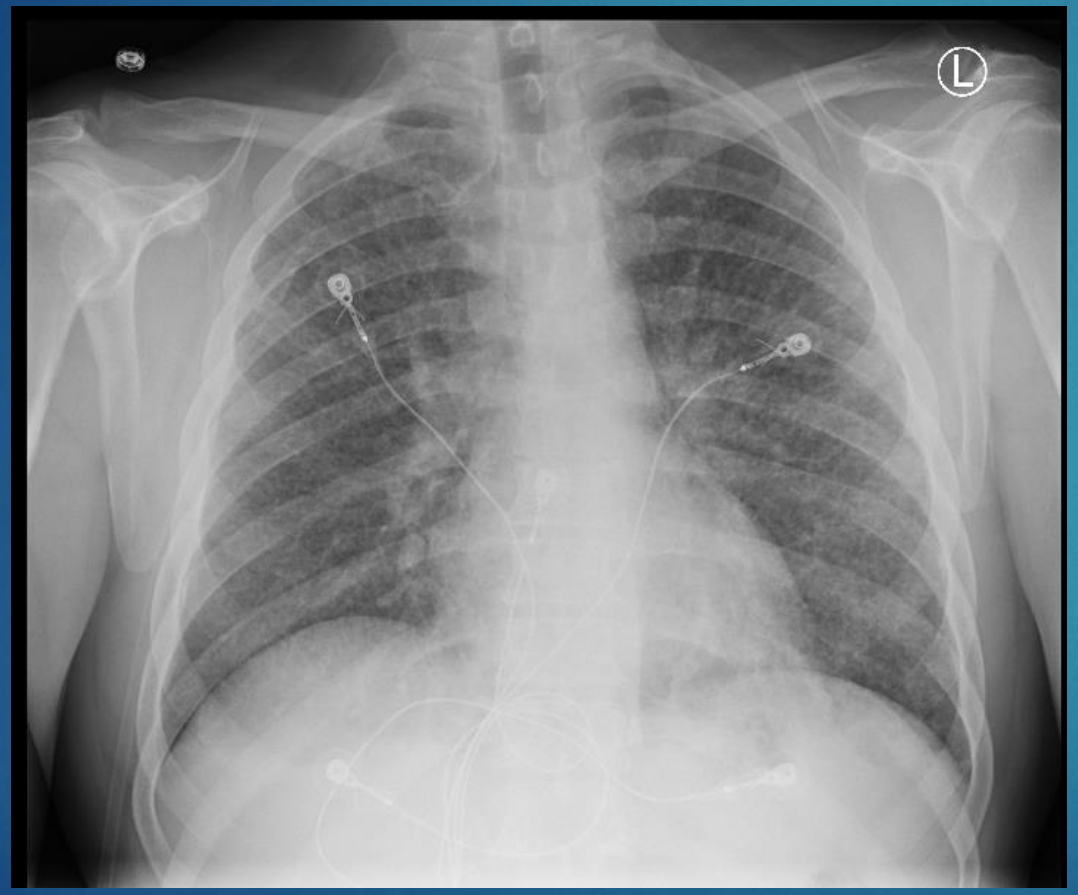
- EBUS (endobronchial ultrasound)
- Noninvasive mode of sampling the mediastinal lymph nodes, to stage potential lung cancer





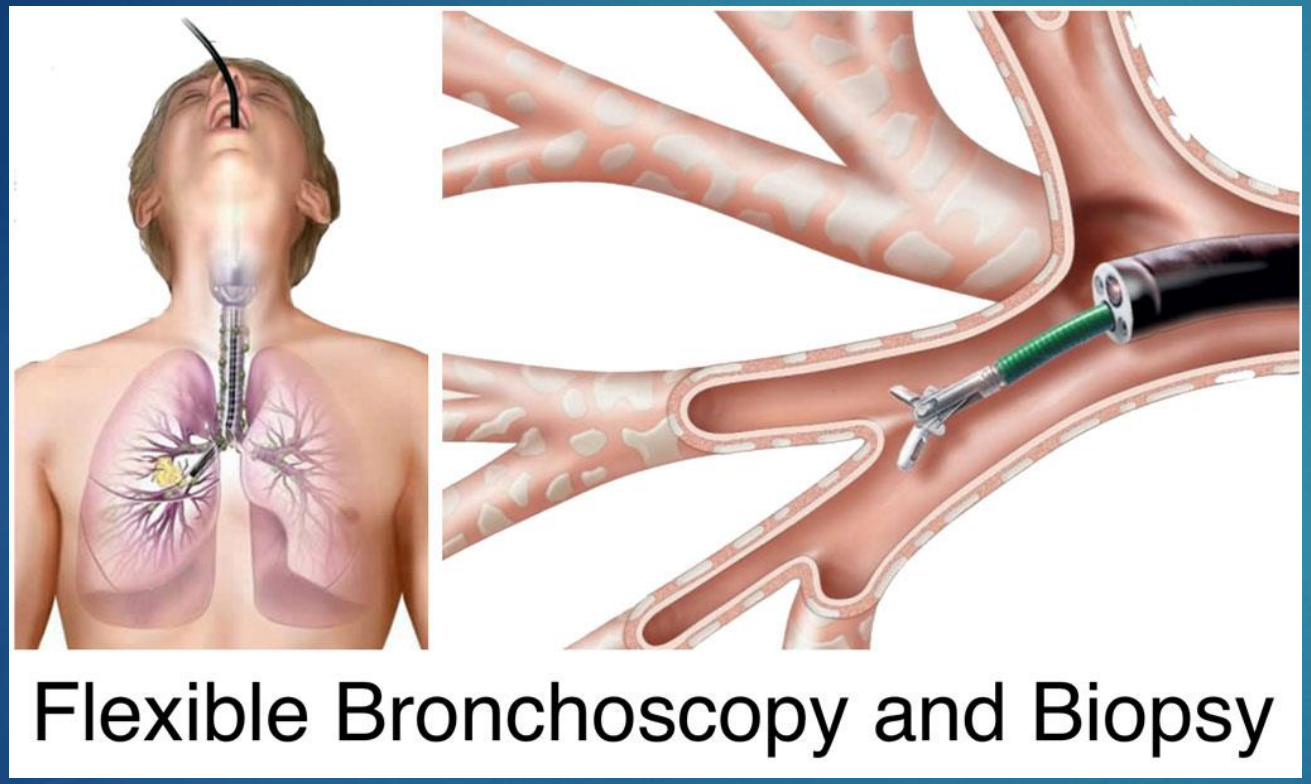
So how can an interventional pulmonologist help a patient?

1. LUNGS

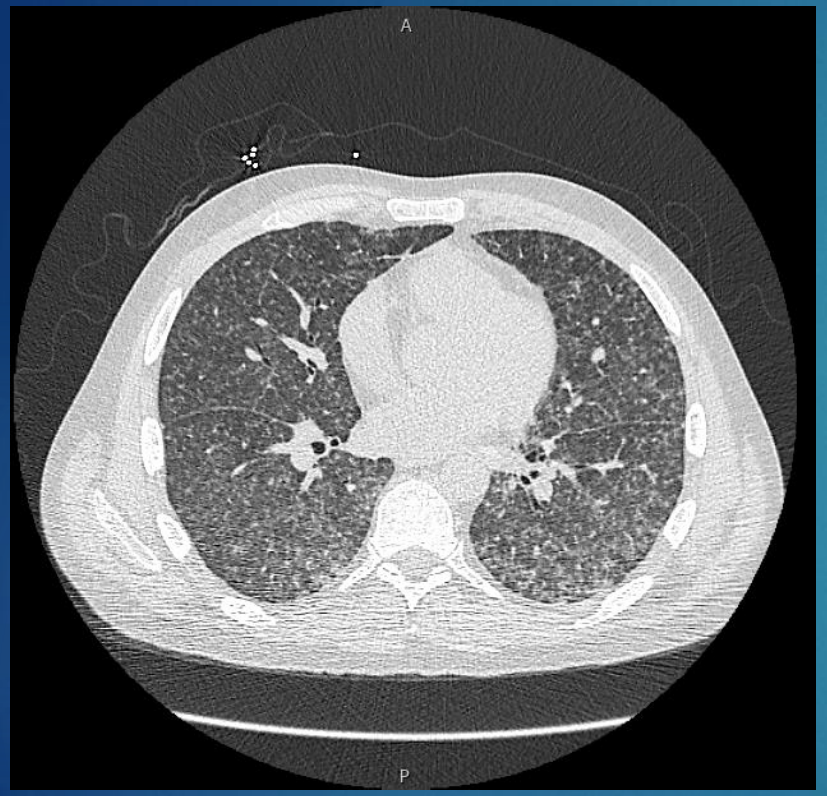


- 40yr M
- Immunocompromised, on therapy for UC and Neurosarcoid
- Presented with fevers, chills, reticulonodular pattern on CXR
- Was in a salt water pool, some family members had URI

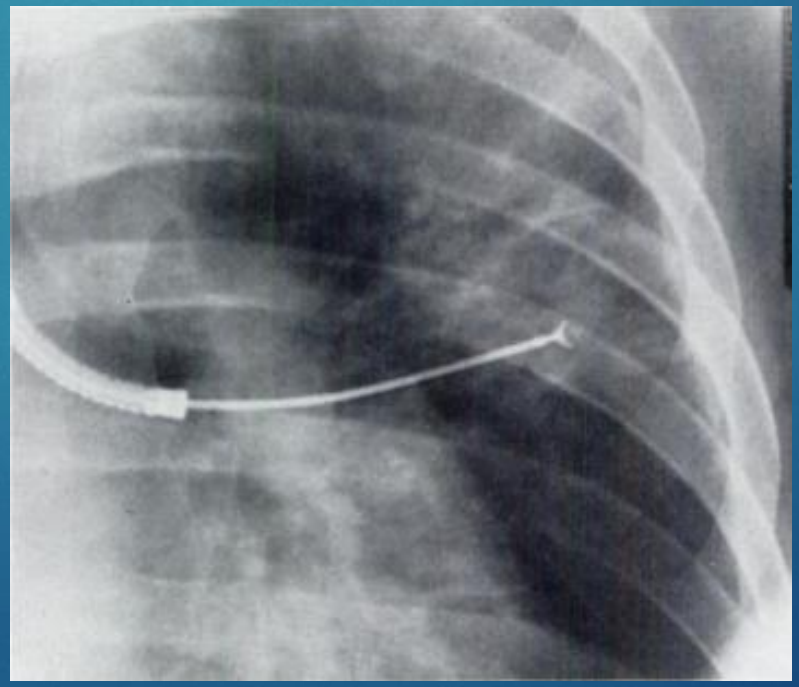
- Performed bronchoscopy for worsening hypoxia, persistent fevers, and abnormal CT Chest



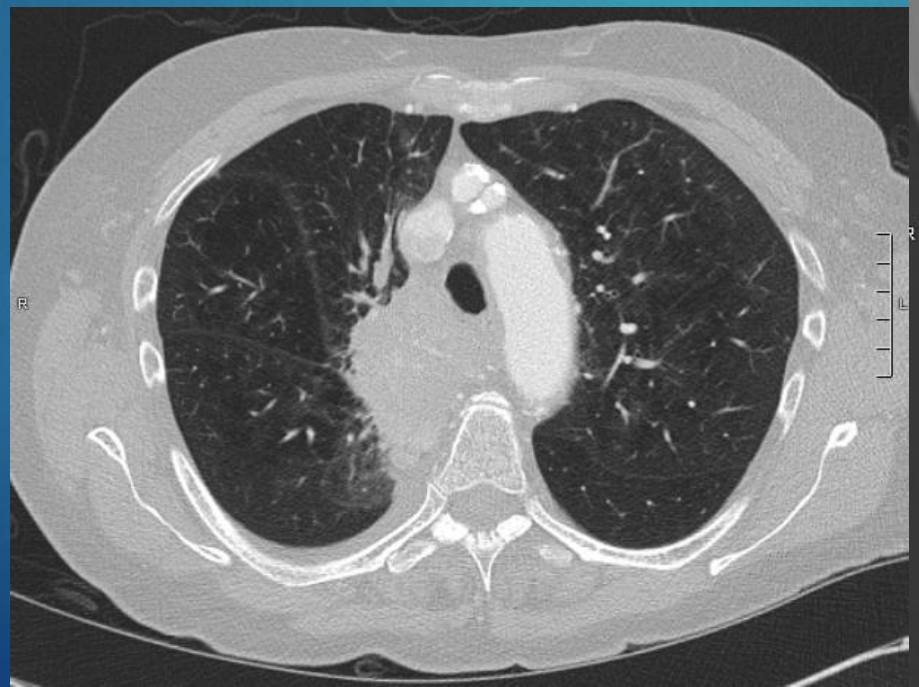
- Performed bronchoscopy for worsening hypoxia, persistent fevers, and abnormal CT Chest
- Transbronchial biopsies were performed



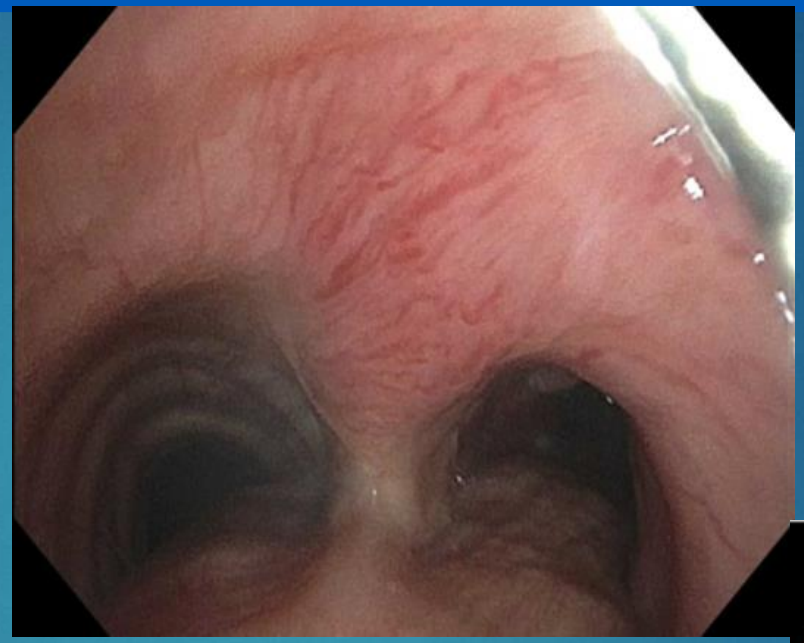
- Transbronchial biopsies revealed histoplasmosis

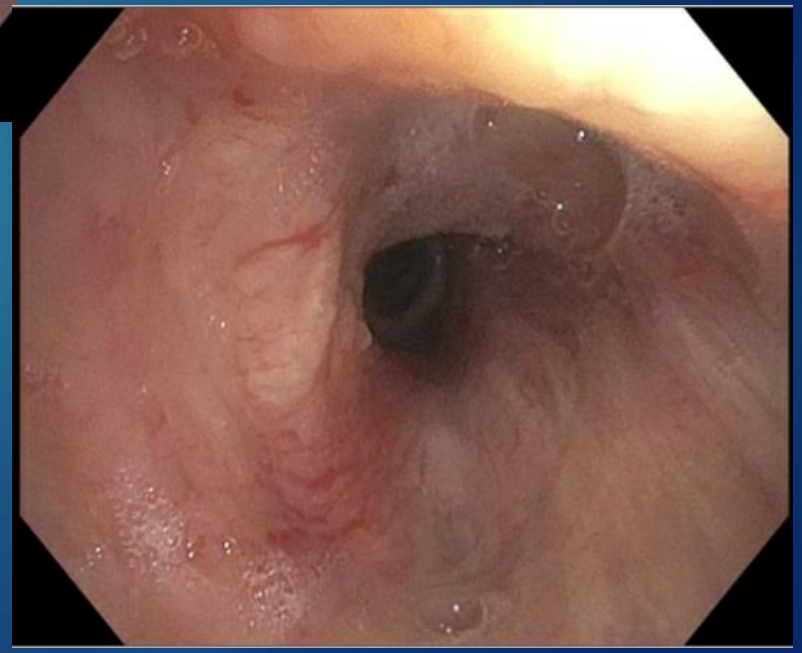


- 80F
- Dyspnea, cough, weight loss
- CT Chest revealed RUL mass

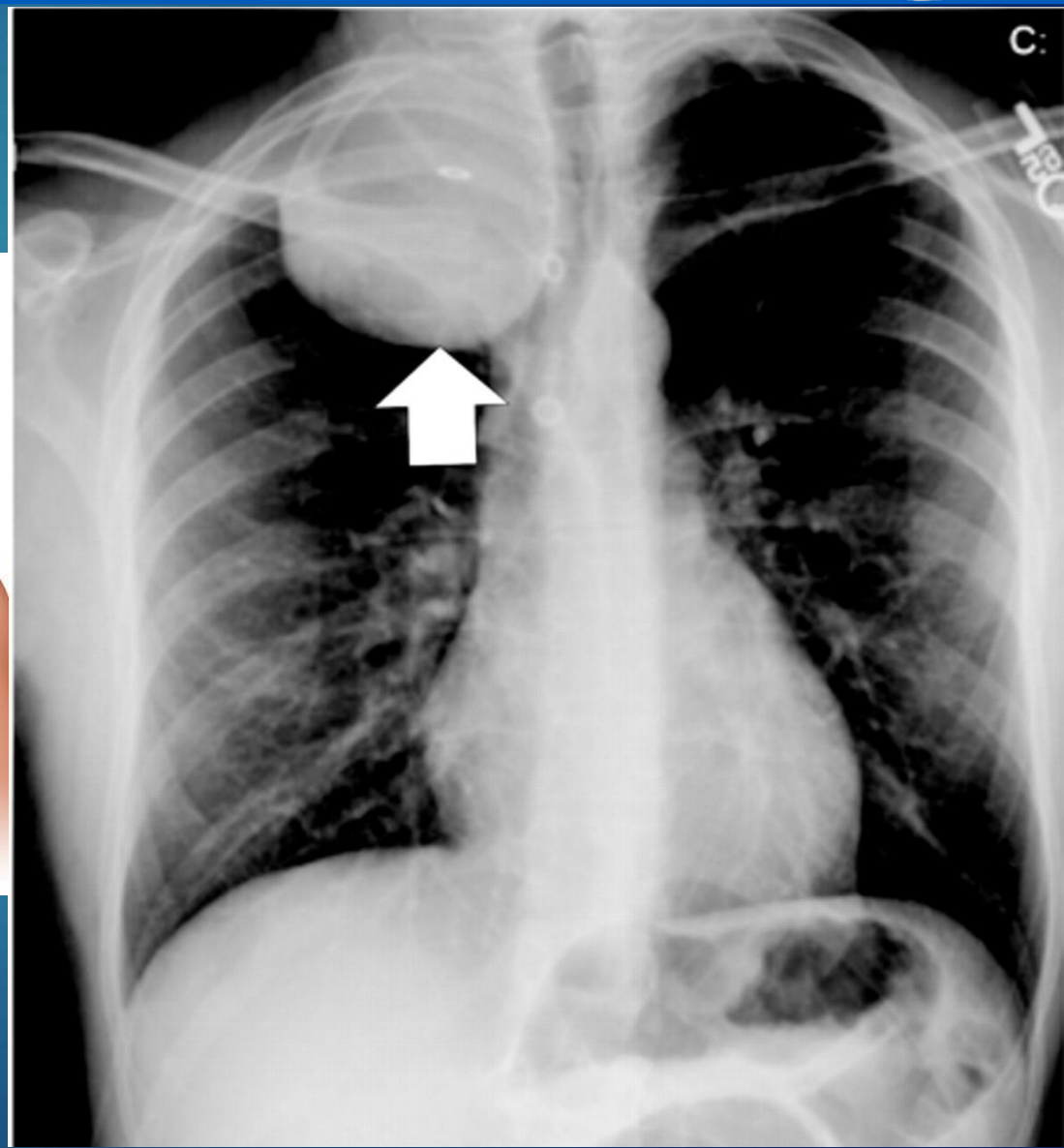


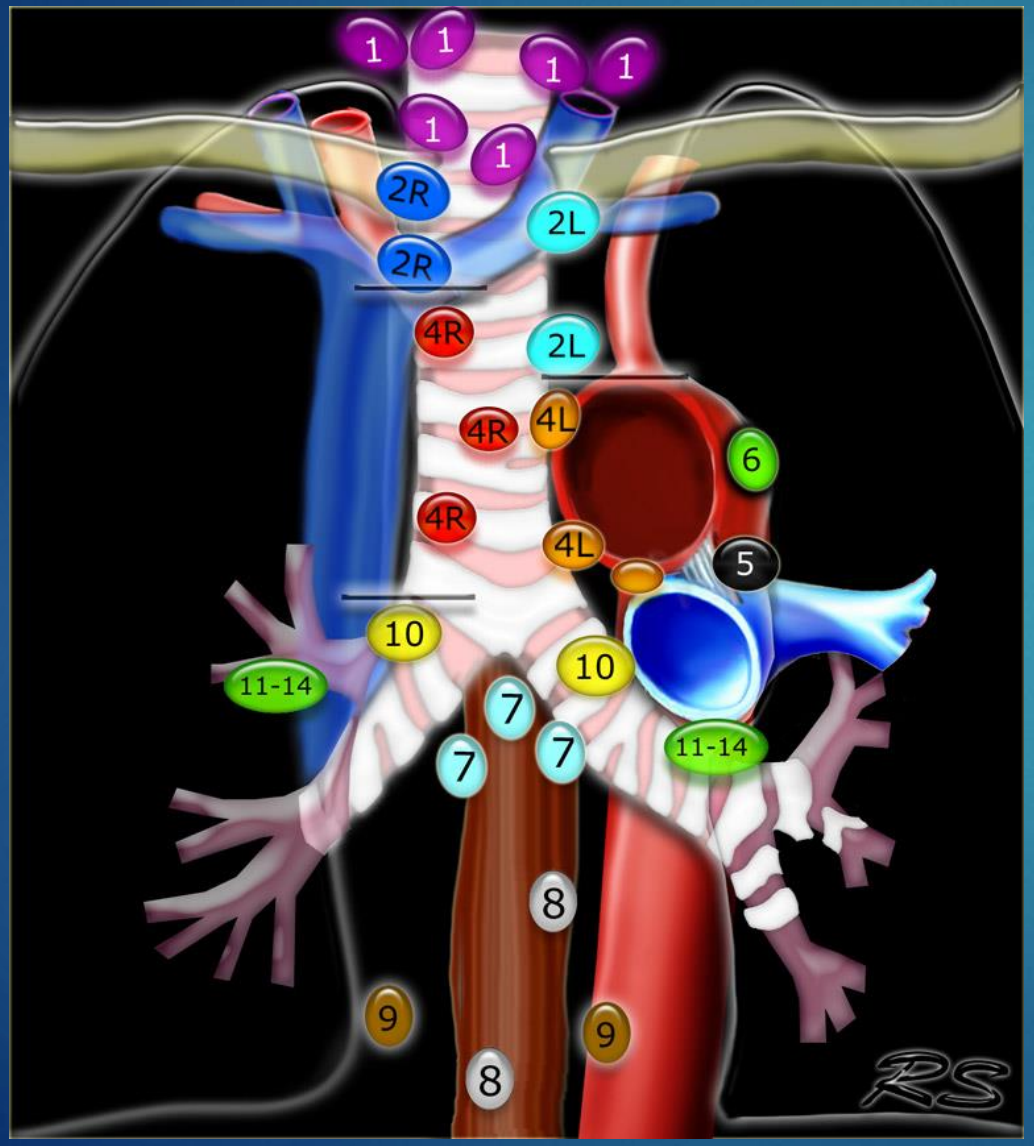
- Performed bronchoscopy and noted involvement at the main carina and RML
- Also performed EBUS for staging purposes
- Path and cyto positive for adeno carcinoma



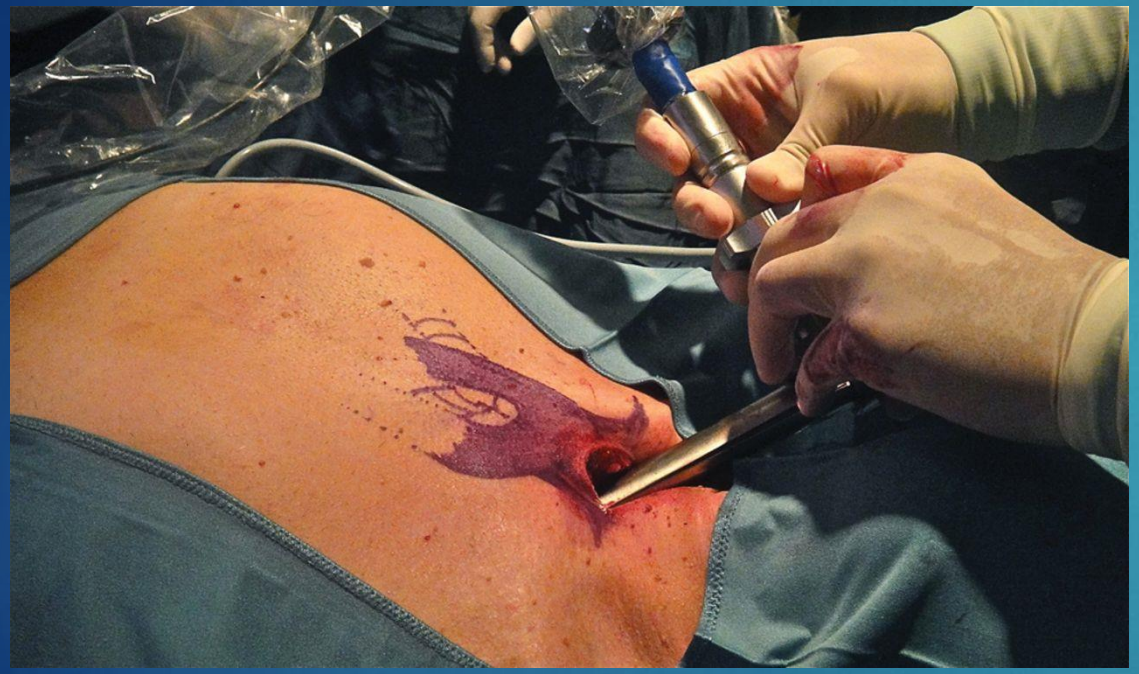


- If the mass is adjacent to the airway, I can use the EBUS scope and perform a transbronchial biopsy, for additional diagnosis





- Thoracic stations typically sampled using EBUS are 2, 4, 7, 10, 11
- Stations 5,6,8,9 accessed by mediastinoscopy



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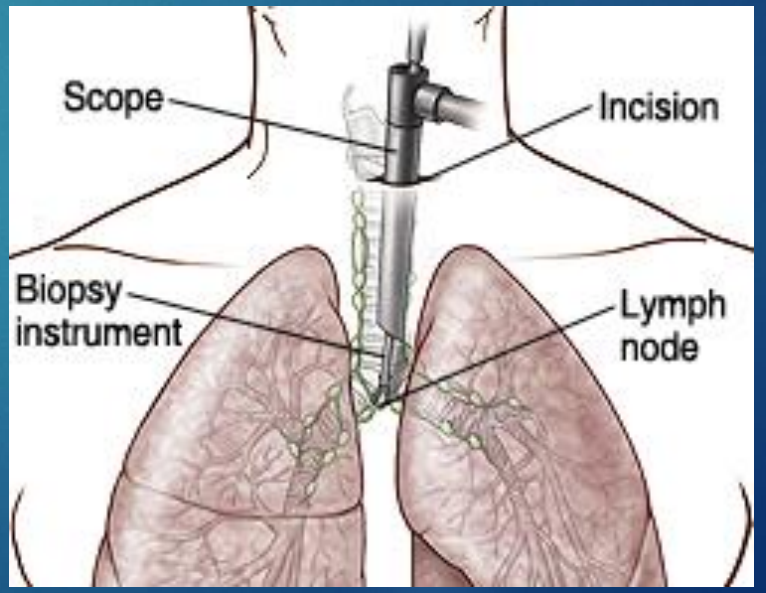

THORACIC: FEATURE EXPERT OPINION: LUNG CANCER

The eighth edition TNM stage classification for lung cancer: What does it mean on main street?

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From the Division of Thoracic Surgery, Yale University, New Haven, Conn.
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J Thorac Cardiovasc Surg 2018;155:356-9
0022-5223/$36.00

https://doi.org/10.1016/j.jtcvs.2017.08.138

***Feature Editor's Note**—The eighth edition of the American Joint Commission on Cancer TNM staging system for non–small cell lung cancer was introduced in January 2017 and*

T/II	Subcategory	N0	N1	N2	N3
T1	T1a	IA1	IIB	IIIA	IIIB
	T1b	IA2	IIB	IIIA	IIIB
	T1c	IA3	IIB	IIIA	IIIB
T2	T2a	IB	IIB	IIIA	IIIB
	T2b	IIA	IIB	IIIA	IIIB
T3	T3	IIB	IIIA	IIIB	IIIC
T4	T4	IIIA	IIIA	IIIB	IIIC
M1	M1a	IVA	IVA	IVA	IVA
	M1b	IVA	IVA	IVA	IVA
	M1c	IVB	IVB	IVB	IVB

Lung cancer stage groups.

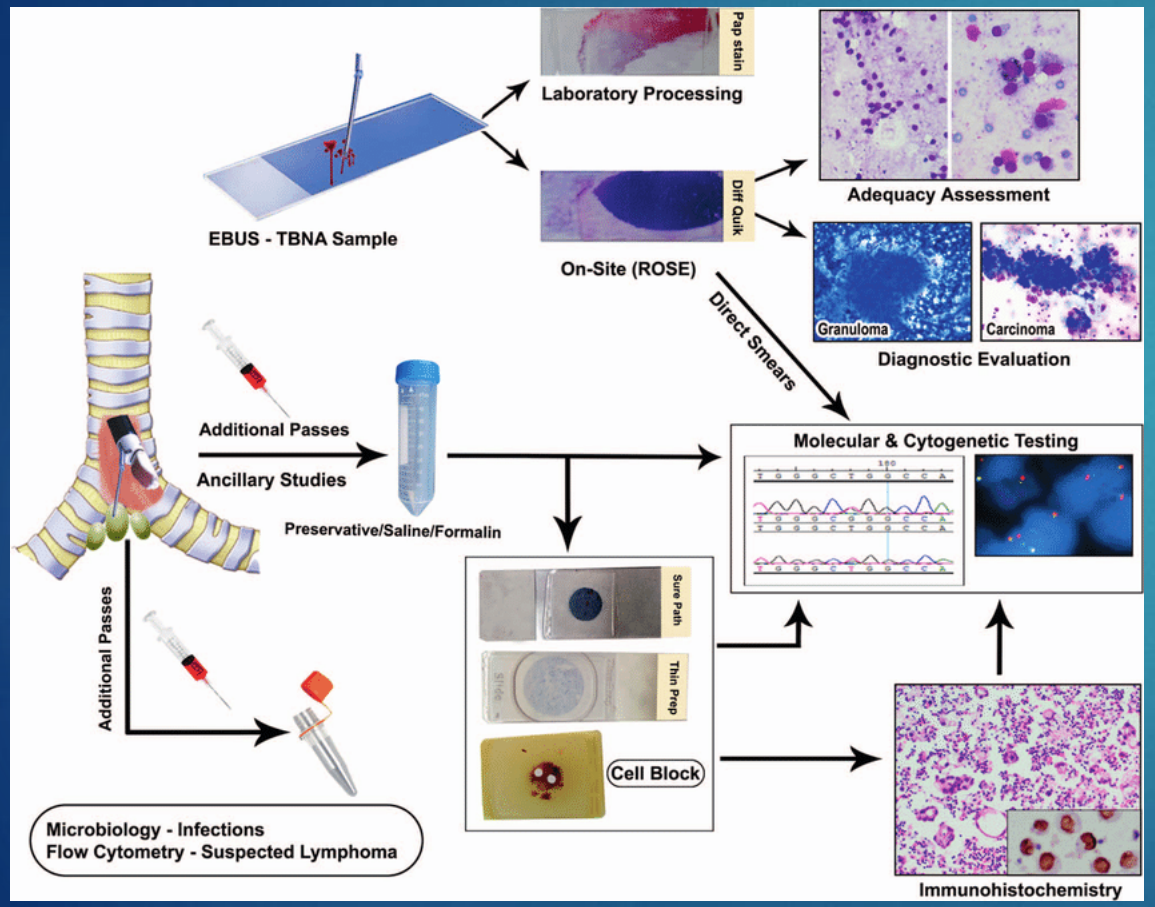
- Primary reason for a patient to undergo an EBUS bronchoscopy is to stage their lung cancer
- Obtaining tissue from the nodes, in a noninvasive modality, allows us to stage the patient.
- Allows for prognostication

TABLE 7] 5-Year Survival (%)

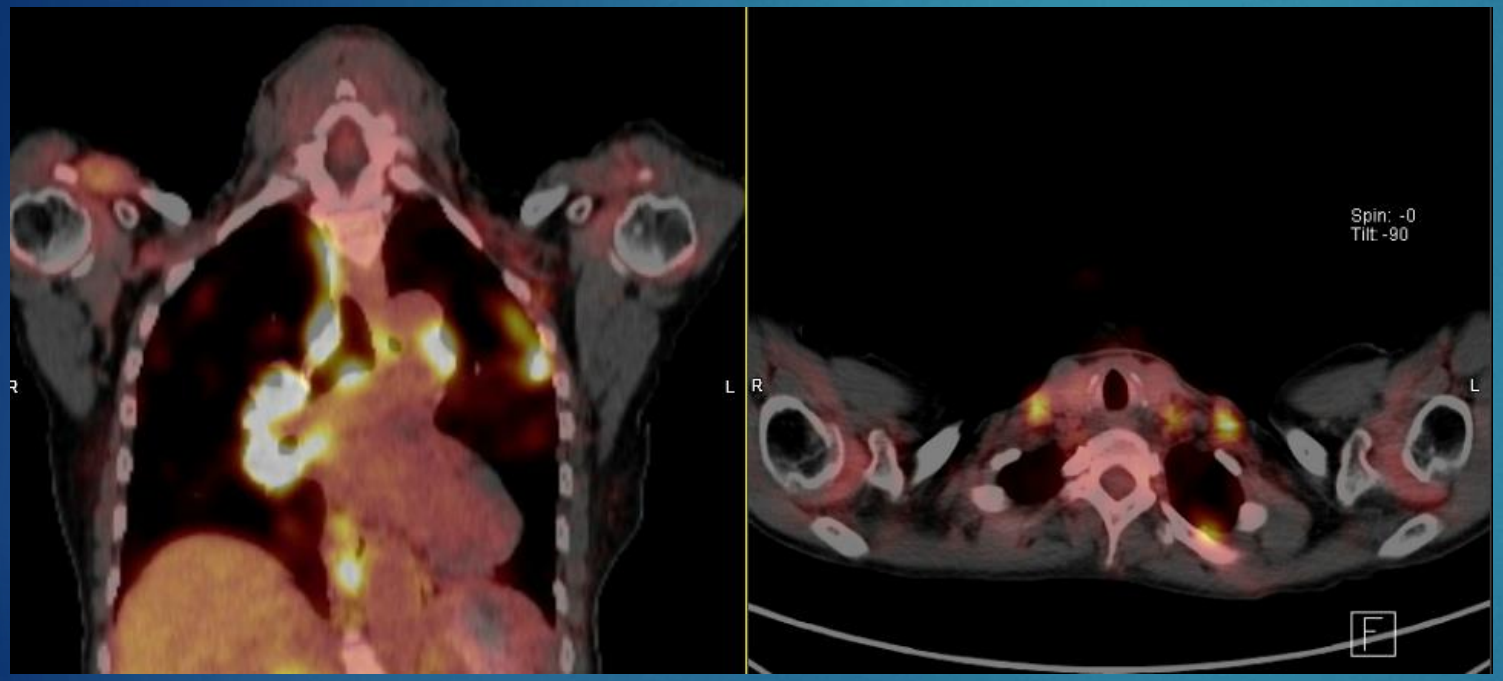
Type	IA1	IA2	IA3	IB	IIA	IIB	IIIA	IIIB	IIIC	IVA	IVB
Clinical	92	83	77	68	60	53	36	26	13	10	0
Pathologic	90	85	80	73	65	56	41	24	12	-	-

Average overall survival in the International Association for the Study of Lung Cancer global database of patients receiving a diagnosis between 1999 and 2010. Data from Goldstraw et al.[21]

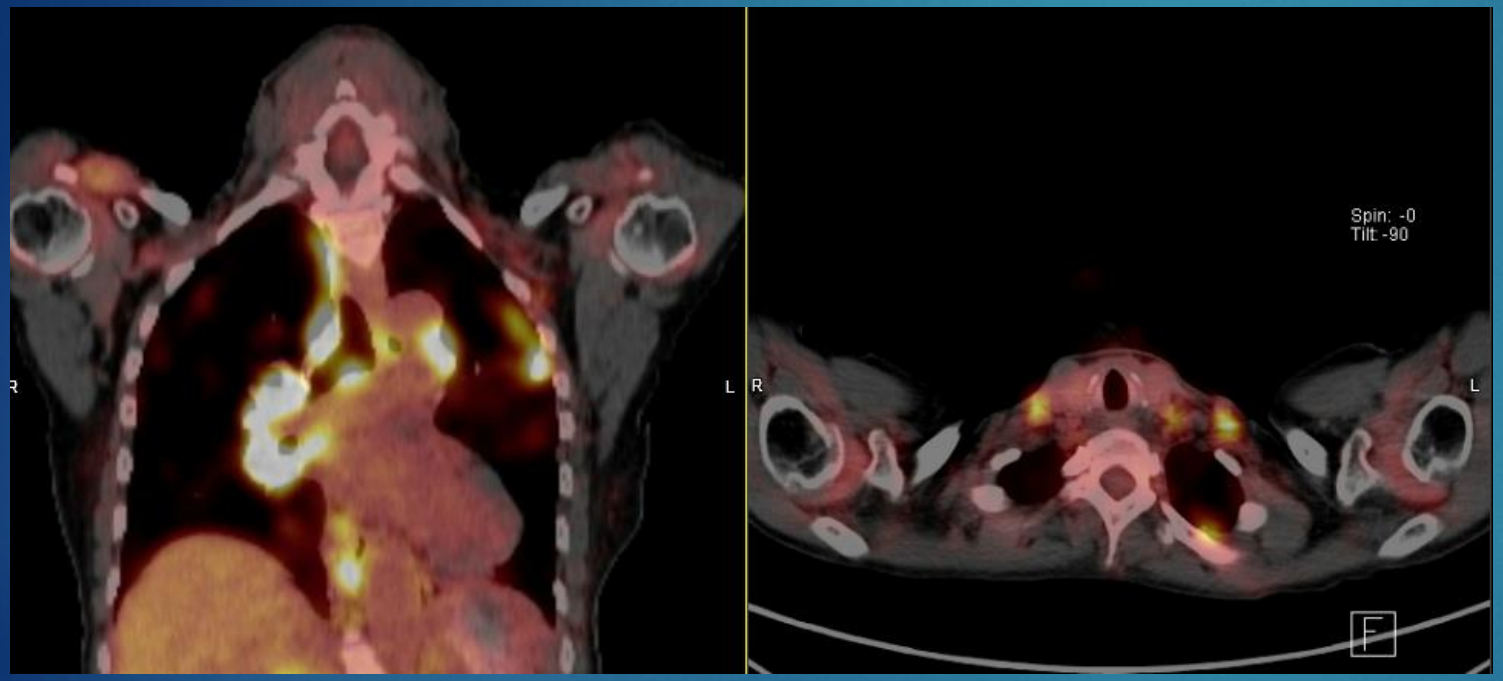
https://www.jtcvs.org/article/S0022-5223(17)32136-0/pdf



- Tissue is the issue!
- We send samples for analysis of molecular abnormalities in tumor specimens, including:
  - Gene mutations (EGFR, KRAS, BRAF, DDR2, p53, RET)
  - Gene amplifications (MET, FGFR1)
  - Fusions (EML4-ALK)
  - PDL1 testing

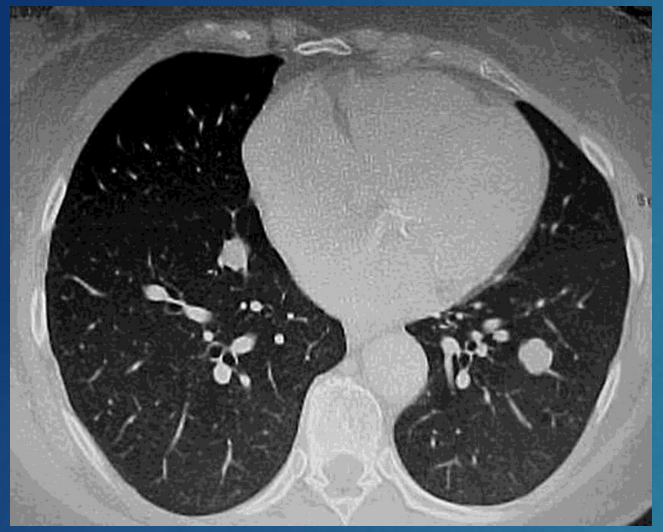


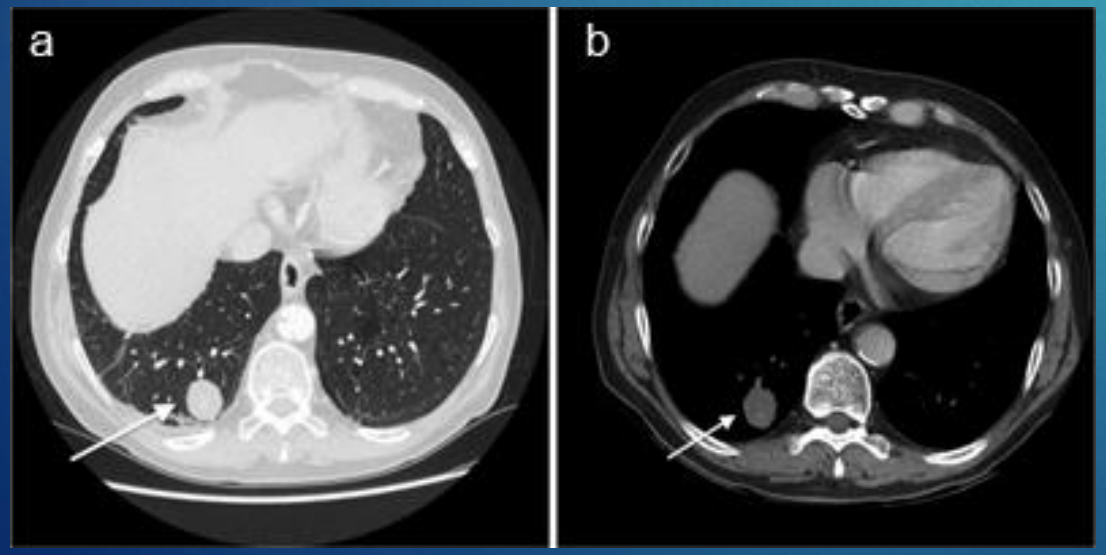
- 70 F referred for mediastinal adenopathy
- Needed tissue diagnosis
- Patient had been experiencing weight loss



- PET scan revealed mediastinal avidity
- Supraclavicular nodes were PET avid
- Physical exam revealed enlarged lymph nodes
- Referred for excisional biopsy instead

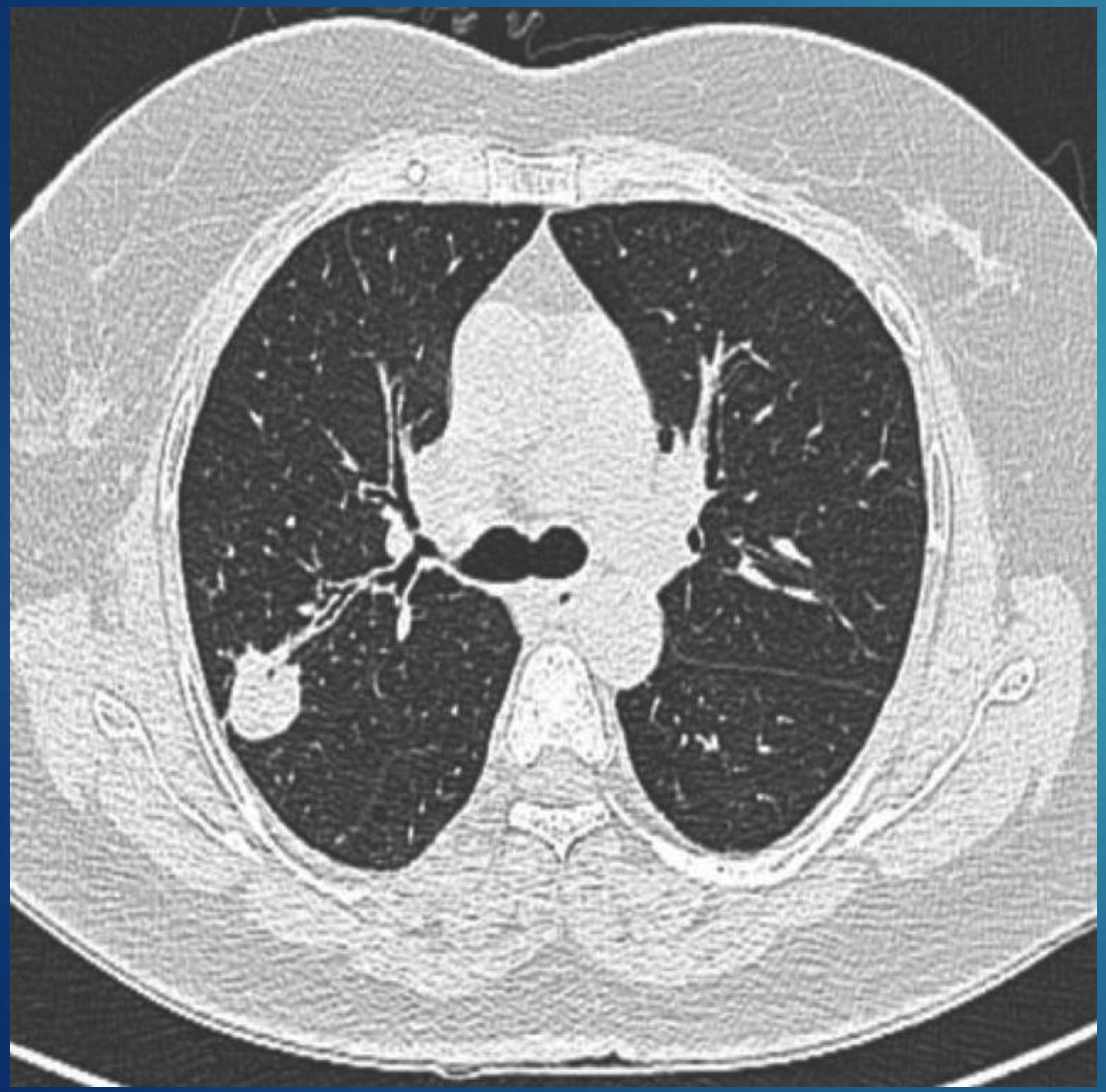
- Lung nodules, lung masses, mediastinal adenopathy
- You need a diagnosis? You need staging?





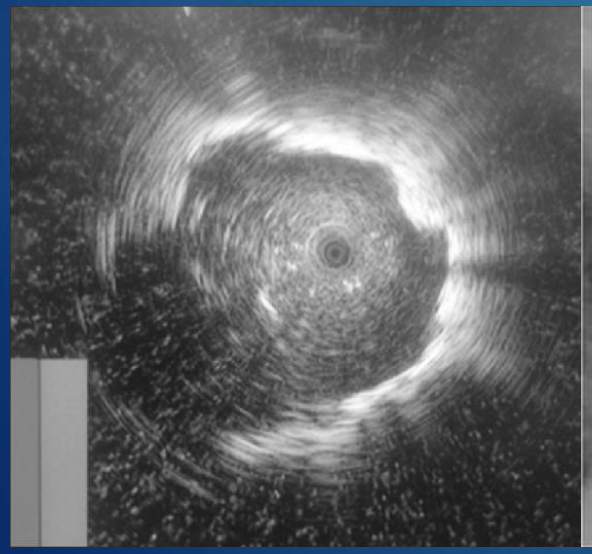
- CT guided biopsy vs bronchoscopic transbronchial biopsy?
- CT guided biopsies are excellent if the lesion is <2cm from the chest wall
- Incidence of pneumothorax increases when the lesion is >2cm, within the fissure, site other than RUL
- Overall complication rate 25% with percutaneous approach, incidence of pneumothorax 24%, with 7% of patients requiring a chest tube.

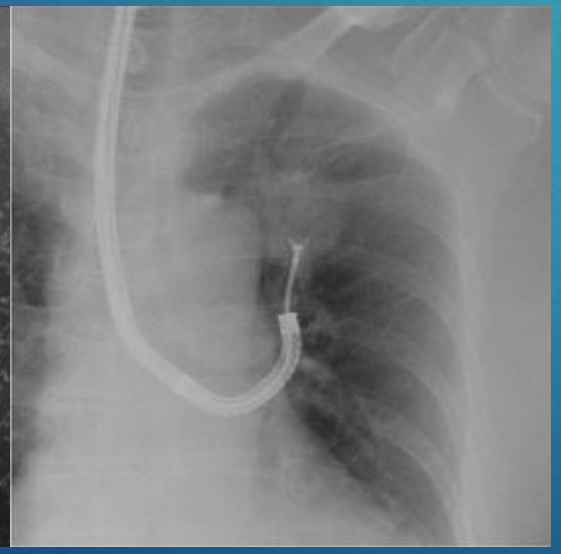
Kalanjeri et al. Clinics Chest Medicine 2018



- Bronchus sign is key
- Increases yield in tissue diagnosis when using forceps from 67% to 88%
- Location confirmed with the radial EBUS and fluoroscopy
- Risk of pneumothorax with EBUS alone is 0.2% or 1 in 500
- Risk of pneumothorax when combined with TBBX is 2.7%, or 1 in 37.

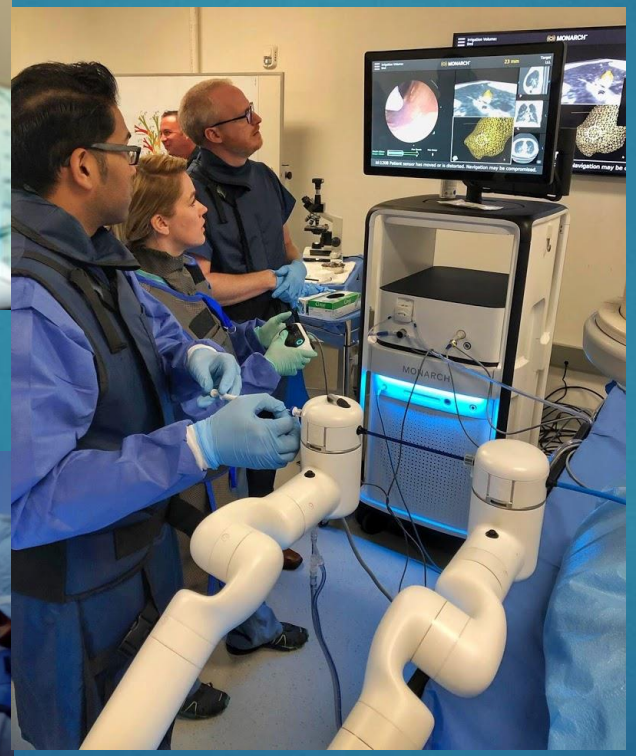
Kalanjeri et al. Clinics Chest Medicine 2018





- Radial EBUS
- Probe that is inserted through the bronchoscope
- Ultrasound is turned one to allow visualization of close proximity to the lesion
- Use fluoroscopy to perform transbronchial biopsies
- Confirming biopsy in 3 planes

- Trained to perform navigation bronchoscopy
- Obtain biopsies of the peripheral lesions

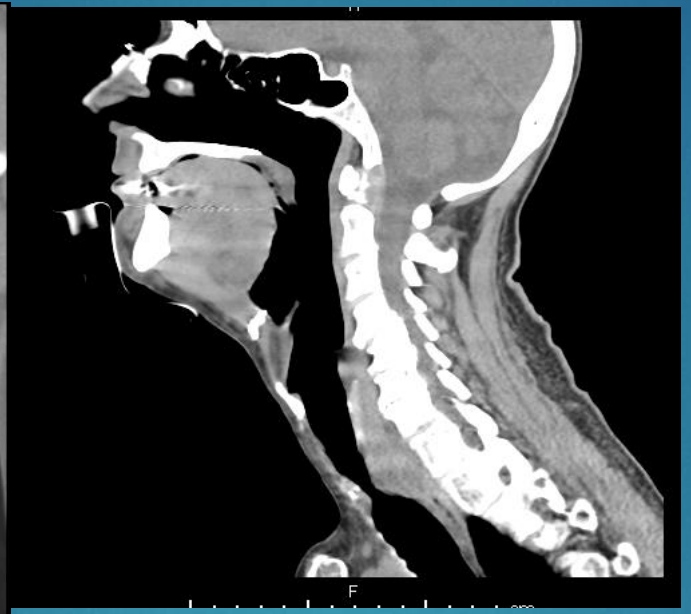


- Awaiting to secure a robotic bronch for Buffalo General Hospital soon.

2. AIRWAYS

- benign disease
- malignant disease

- 56M
- Homeless, smoker, COPD (not on supplemental O2 or inhalers)
- Presents to BGH with dyspnea, wheezing, secretions, chronic cough
- Was intubated a month prior to presenting to BGH following his initial trauma of being assaulted at the shelter



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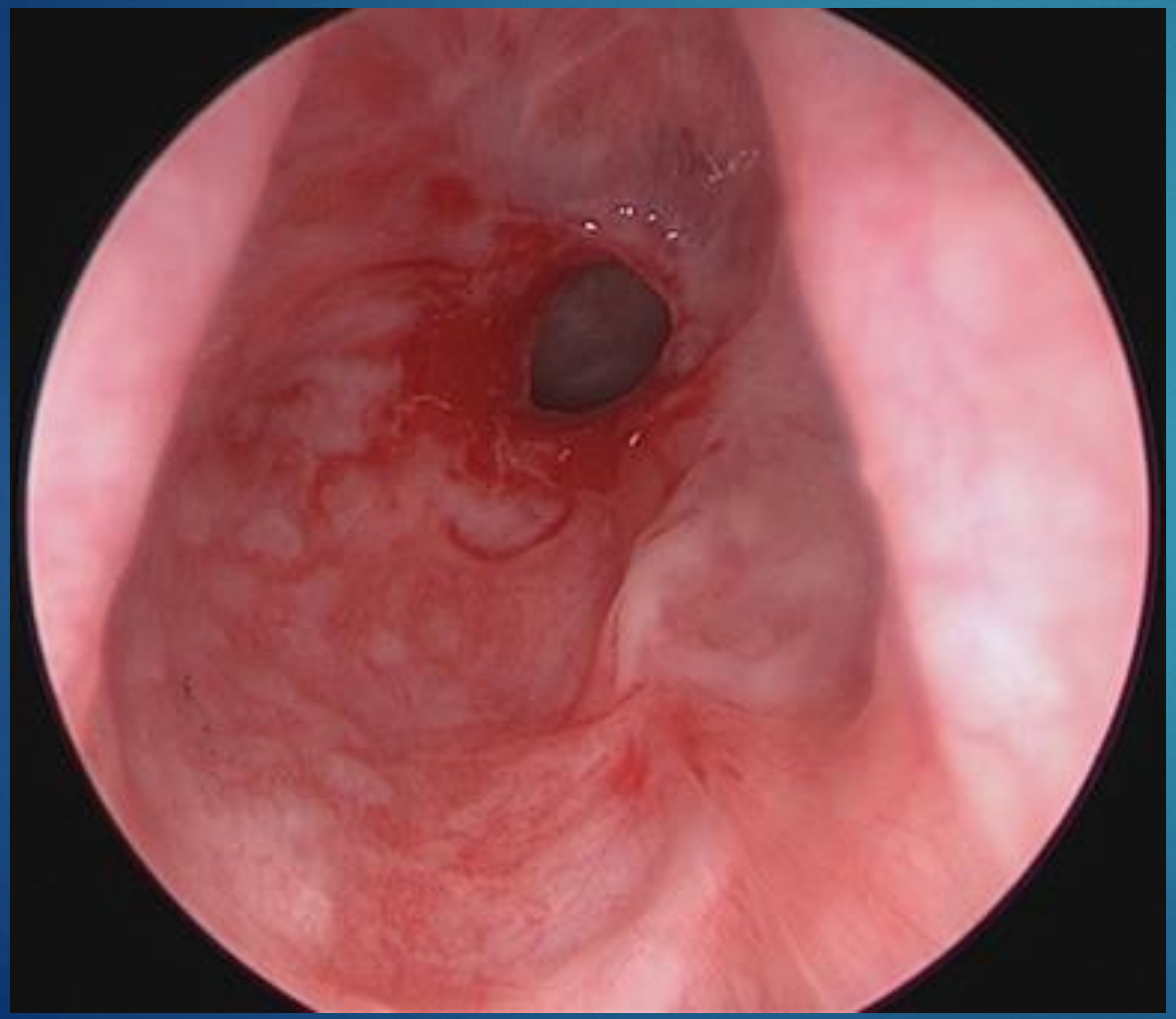
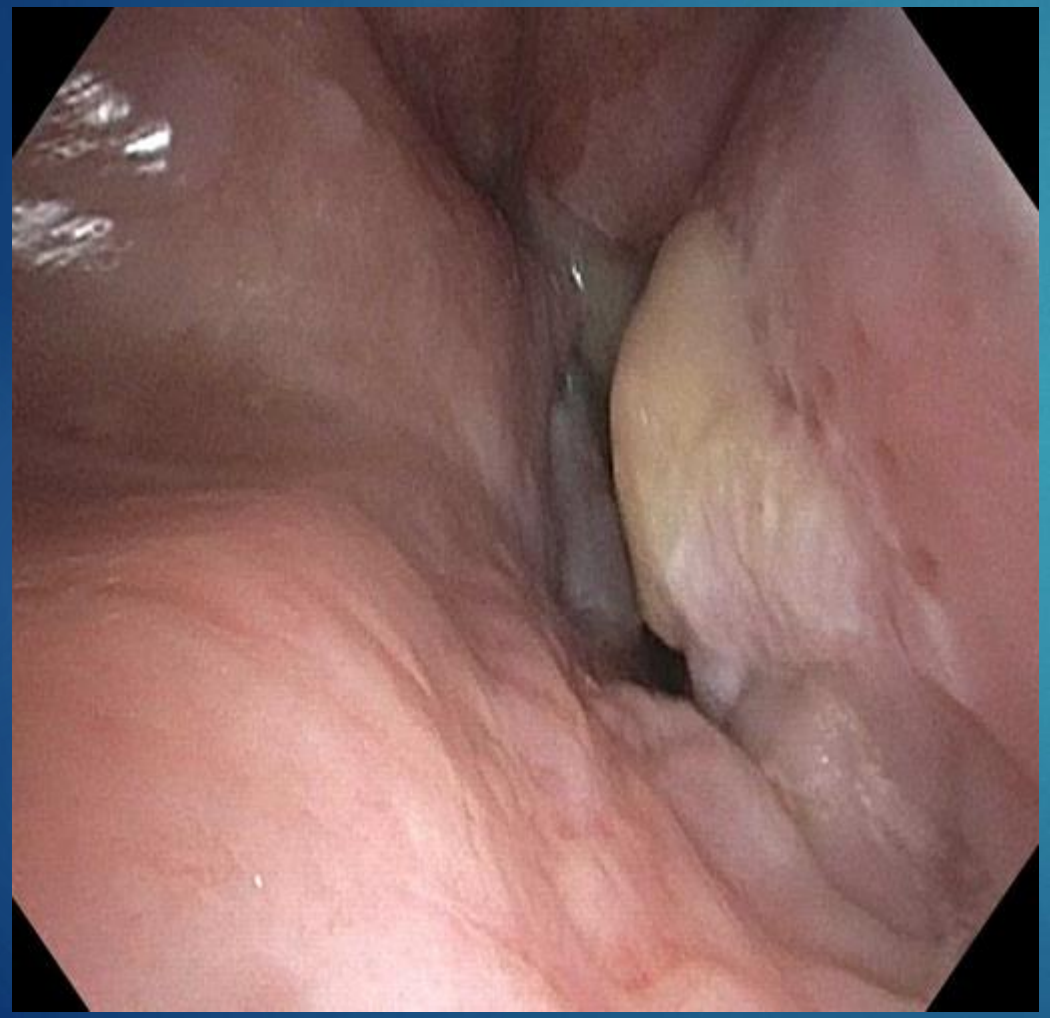
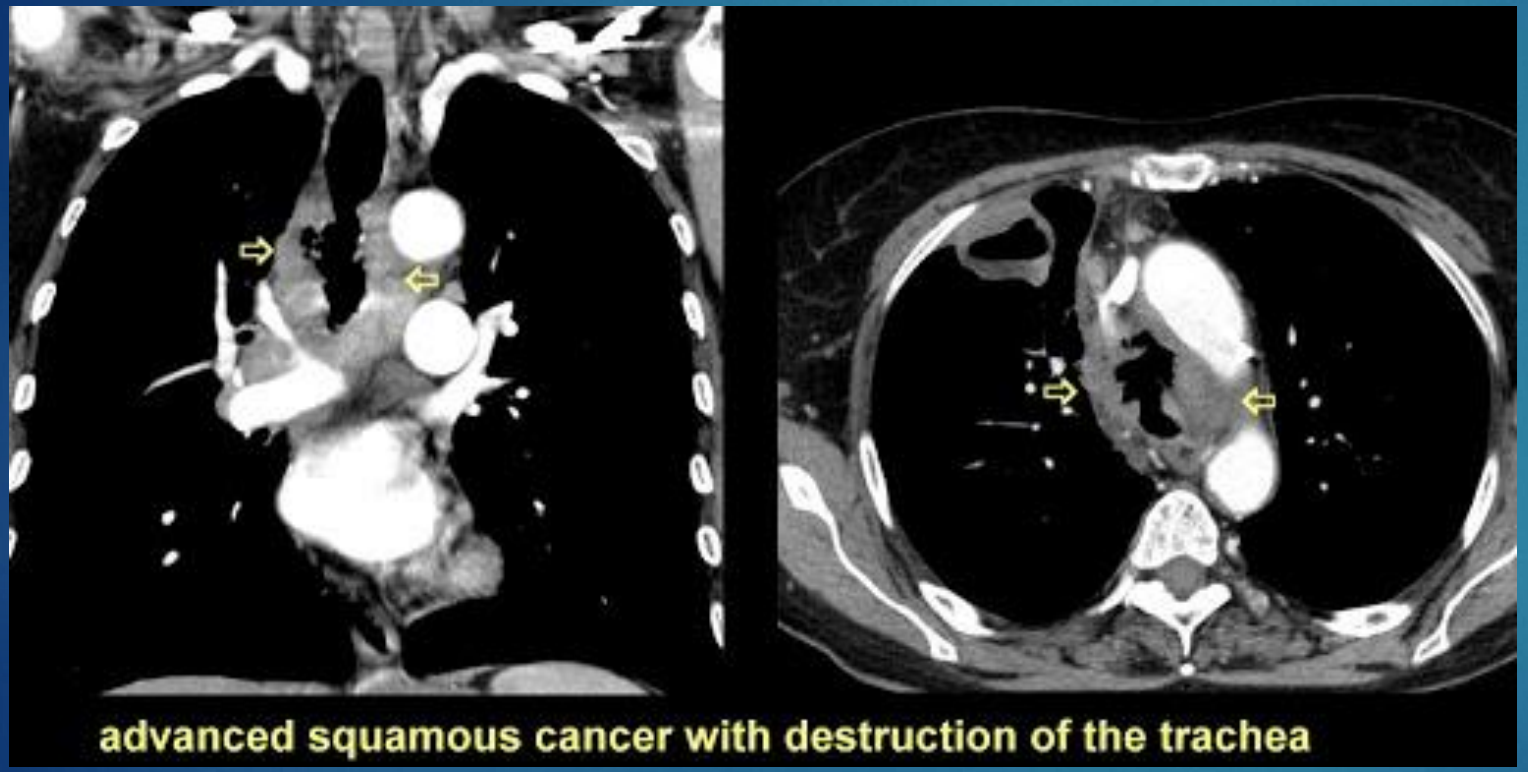


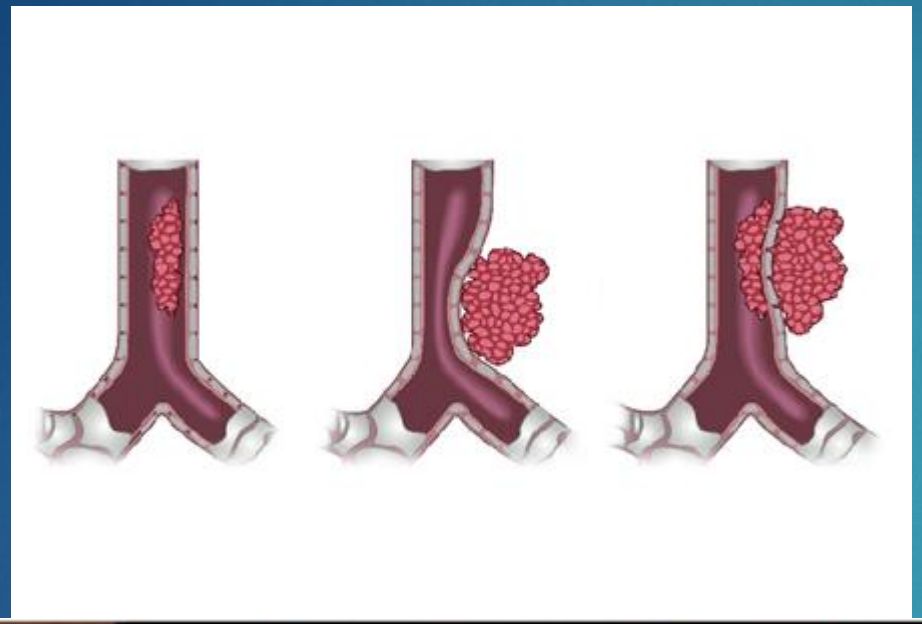
- Obstruction below the vocal cords
- Subglottic stenosis in 40yr F, post extubation



- Tumors over the vocal cords
- 50yr M with squamous cell ca of the head and neck



- Central airway tumors



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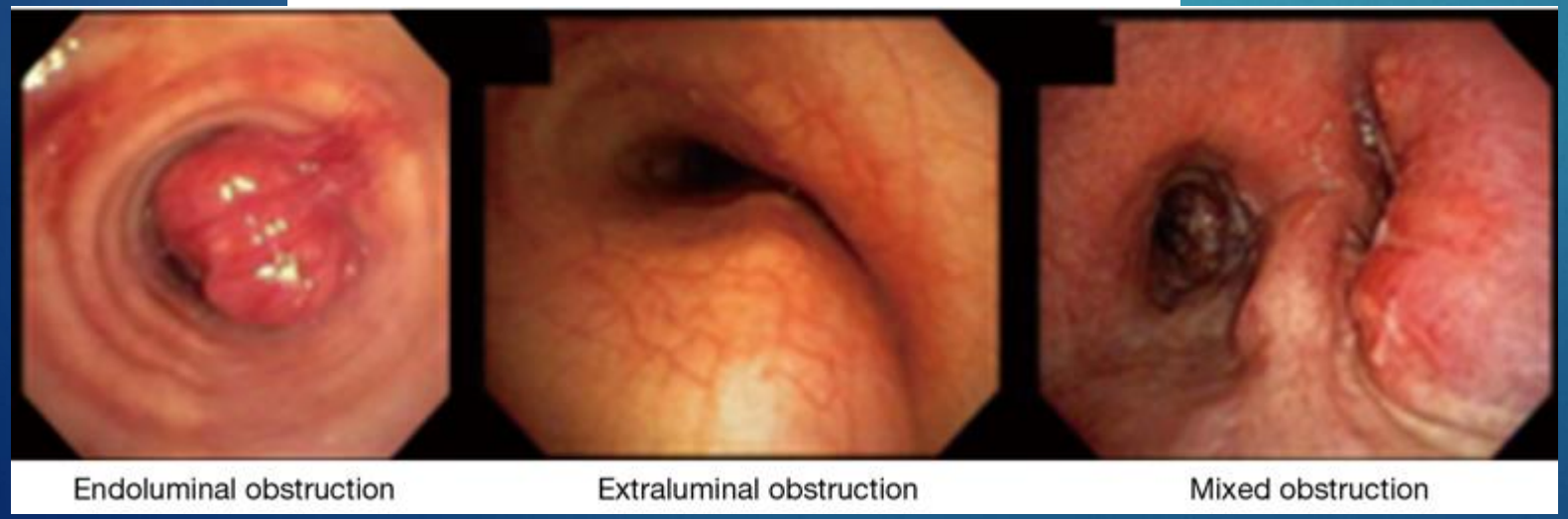
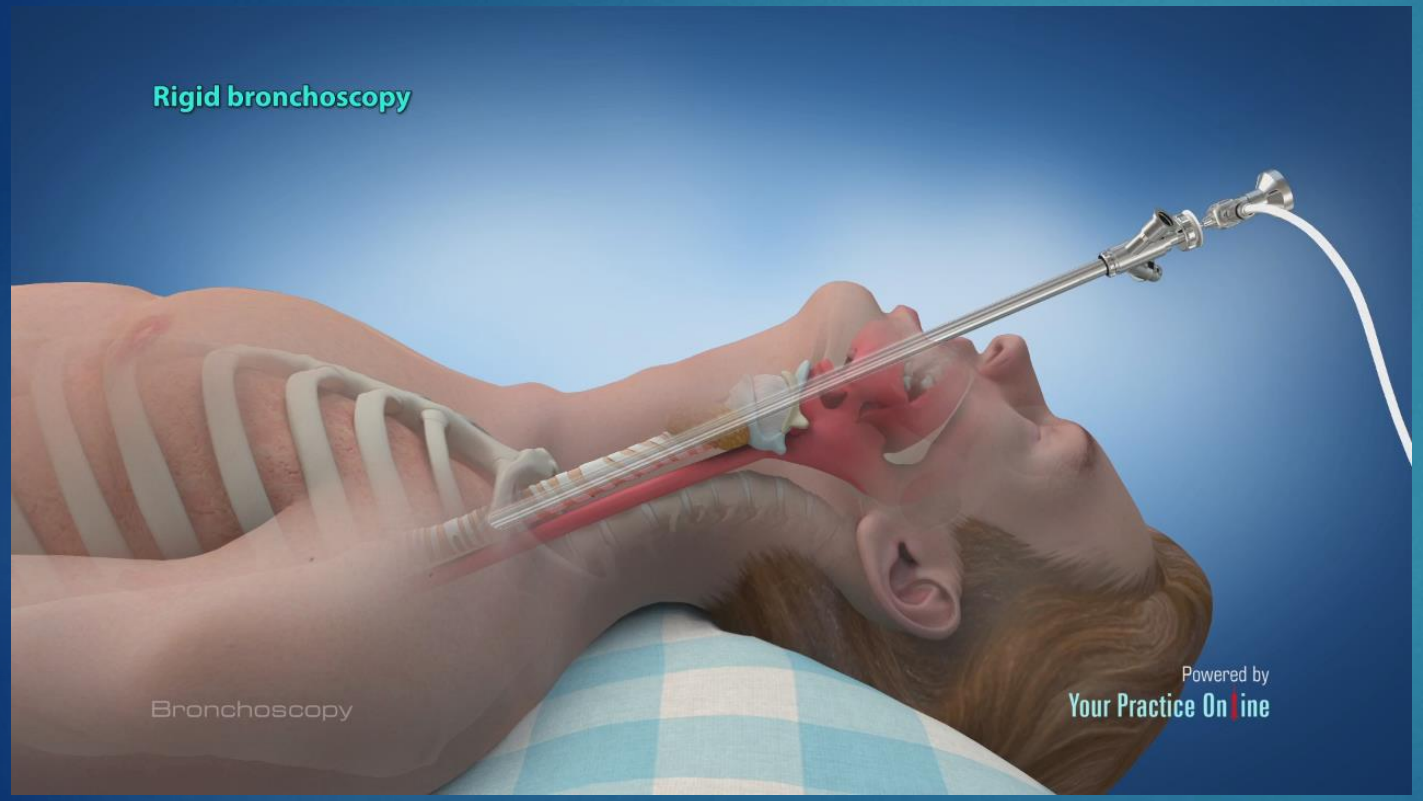
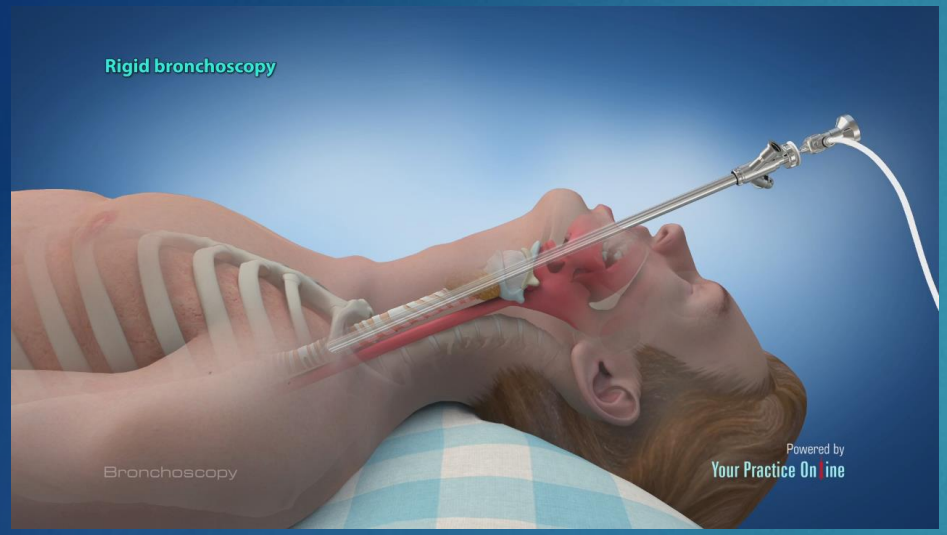




- Rigid bronchoscopy, to core out/ablate



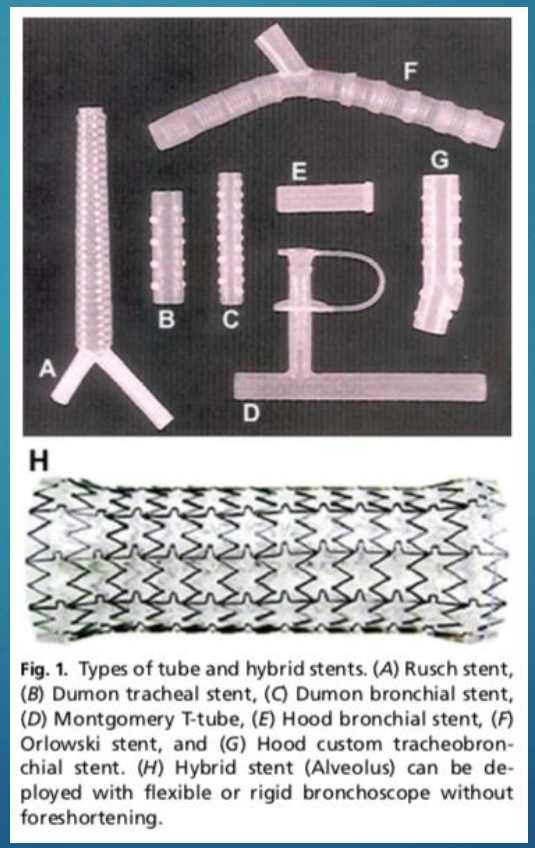
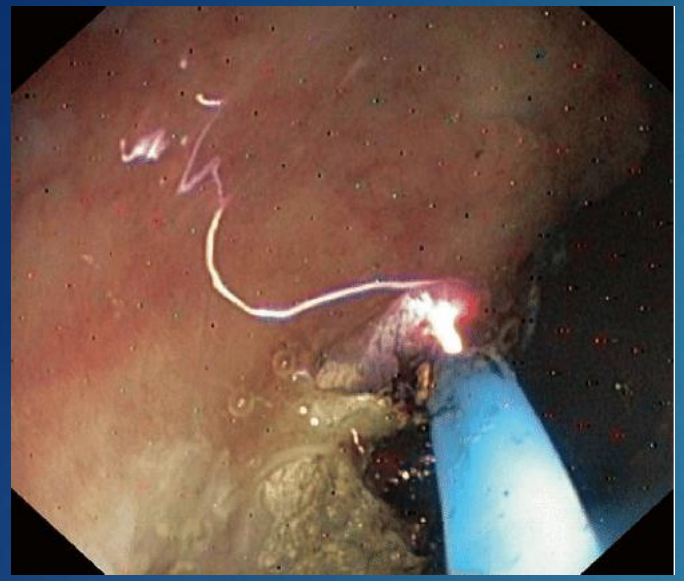
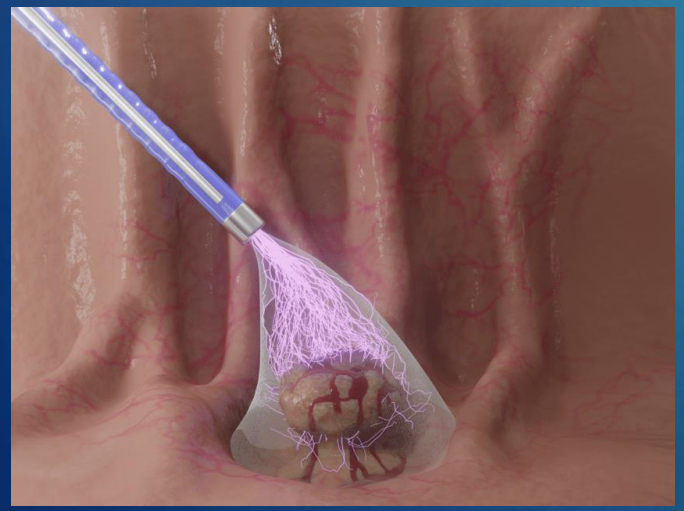
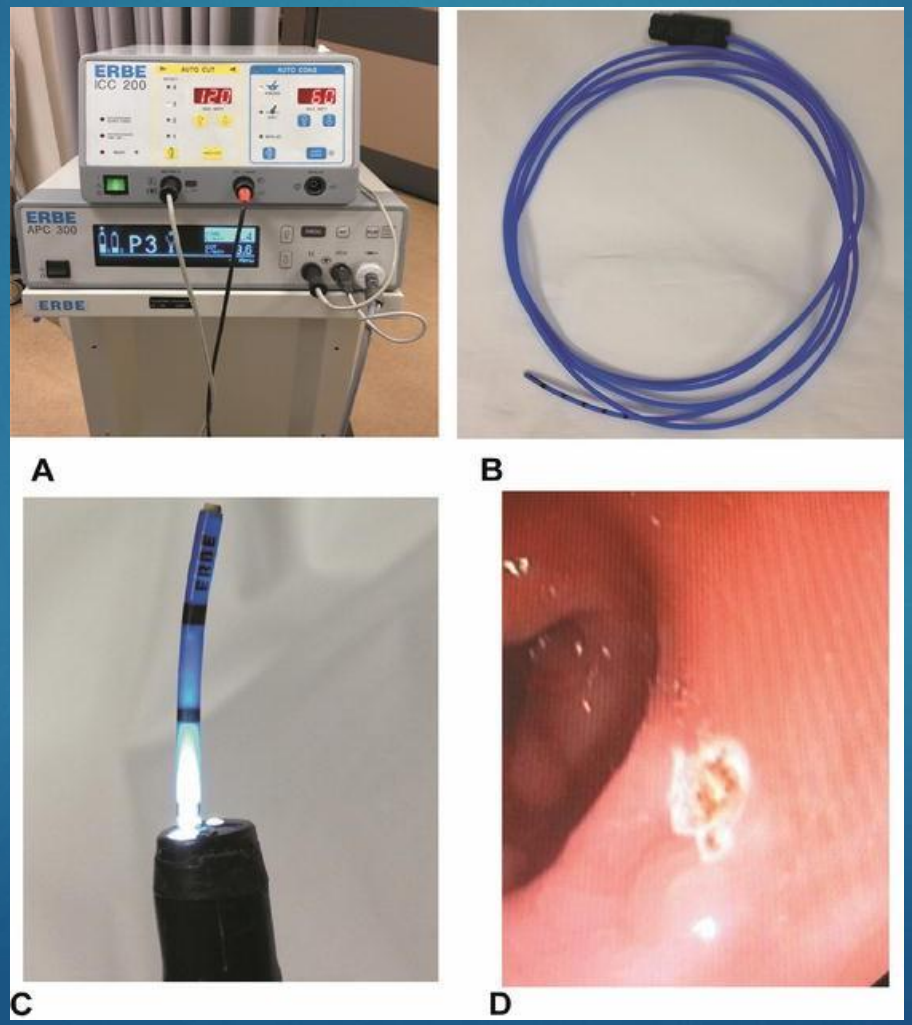


Fig. 1. Types of tube and hybrid stents. (*A*) Rusch stent, (*B*) Dumon tracheal stent, (*C*) Dumon bronchial stent, (*D*) Montgomery T-tube, (*E*) Hood bronchial stent, (*F*) Orlowski stent, and (*G*) Hood custom tracheobronchial stent. (*H*) Hybrid stent (Alveolus) can be deployed with flexible or rigid bronchoscope without foreshortening.

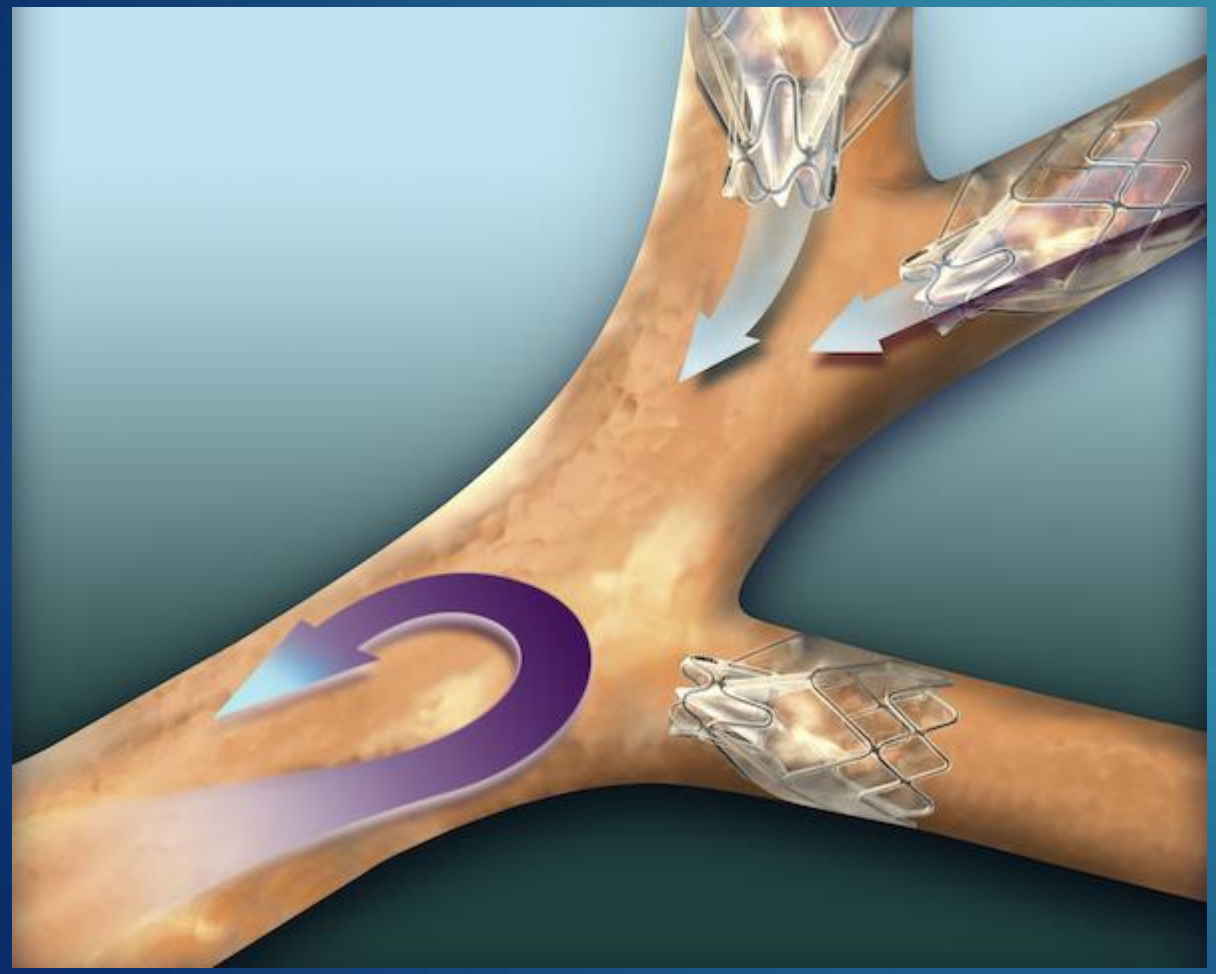
- Rigid bronchoscopy, to core out/ablate and place silicone or hybrid stents



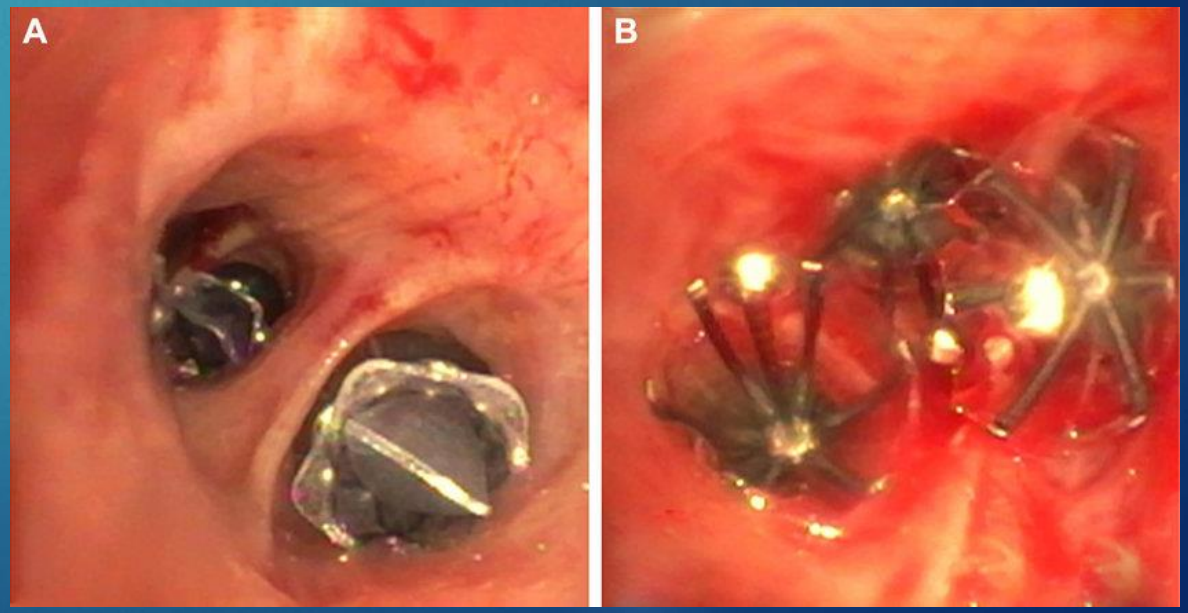




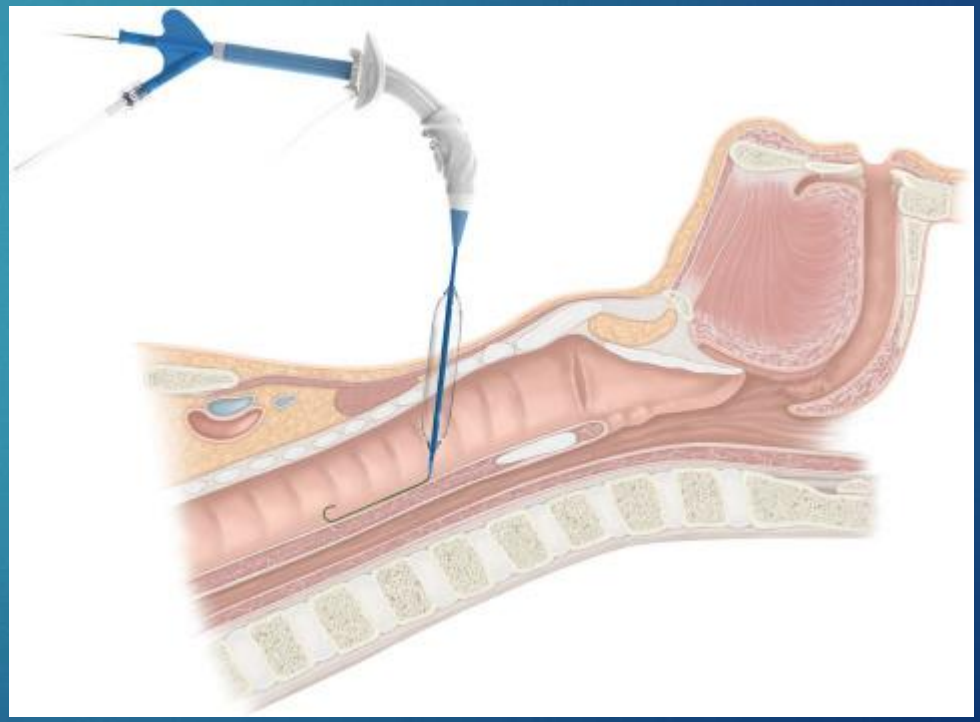
- APC: Argon plasma coagulation
- Non-contact sport
- Ionized gas that electricity is conducted through
- Depth of penetration is ~3mm



- Placement of endobronchial valves
  - Persistent air leaks from a bronchopleural fistula
  - Bronchoscopic lung volume reduction



What about those vented patients?



Percutaneous Dilational Tracheostomy

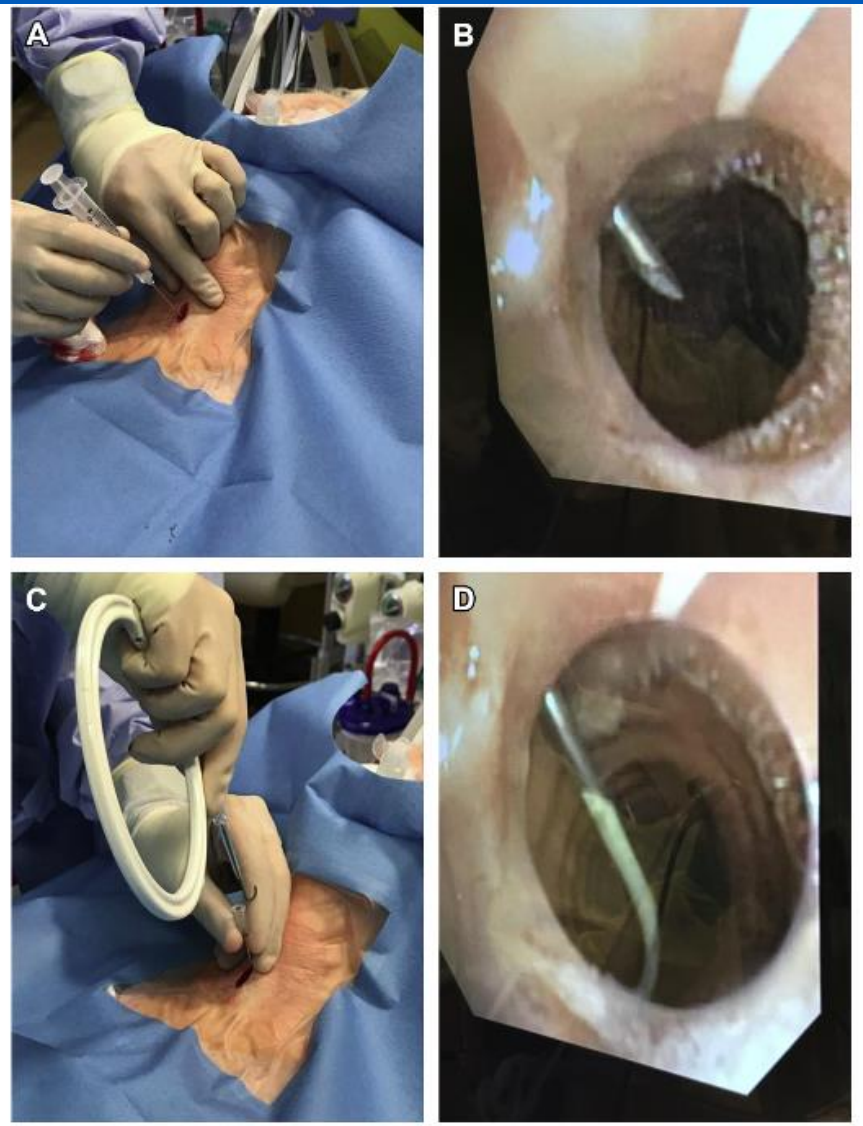


Fig. 6. Performance of PDT, part 2. (*A*) Insertion of introducer needle with (*B*) endoscopic view. (*C*) Insertion of guidewire with (*D*) endoscopic view.

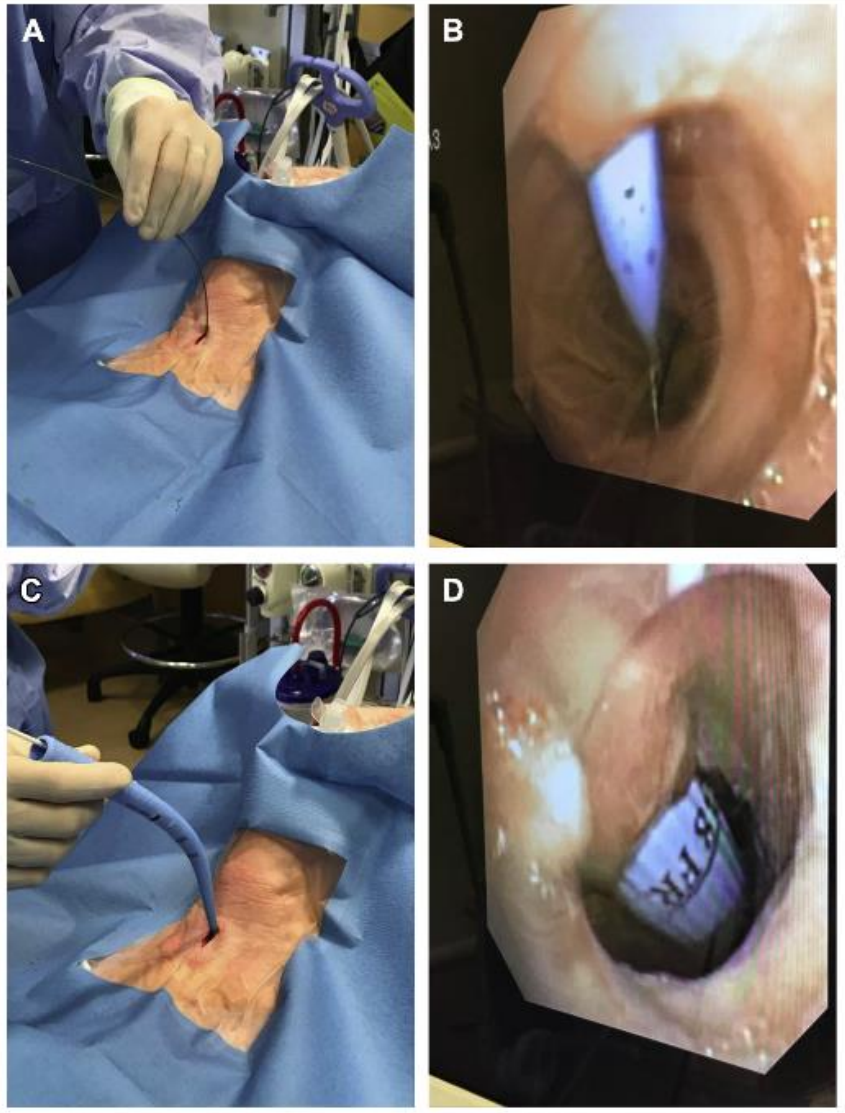
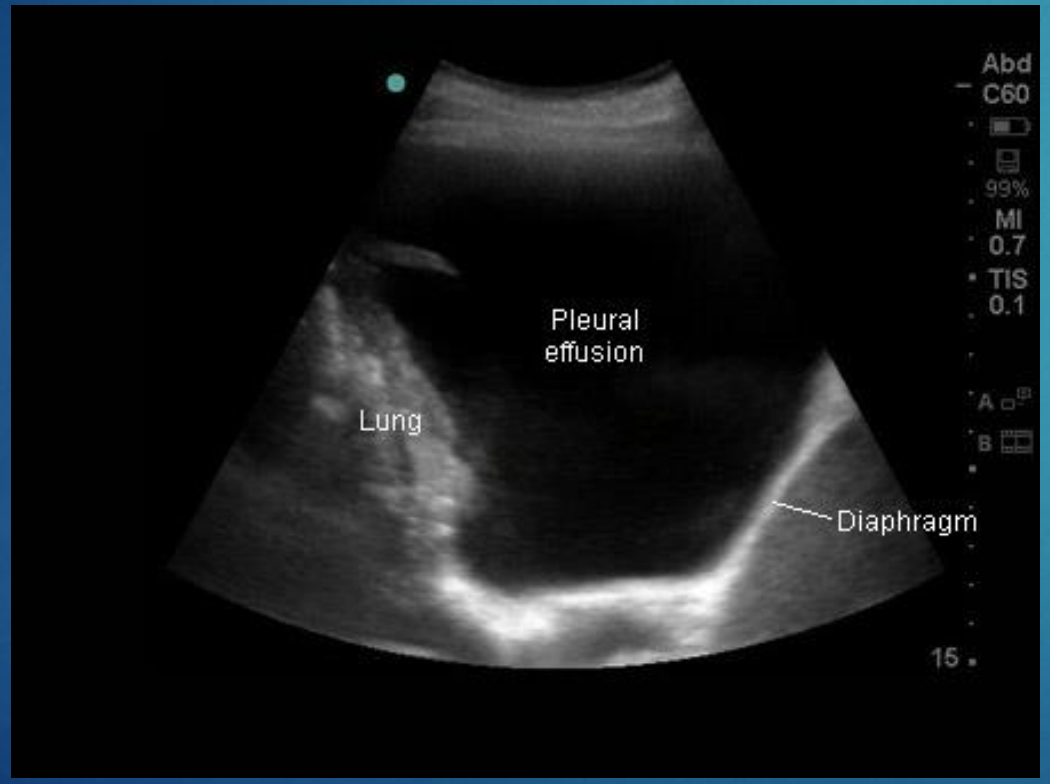
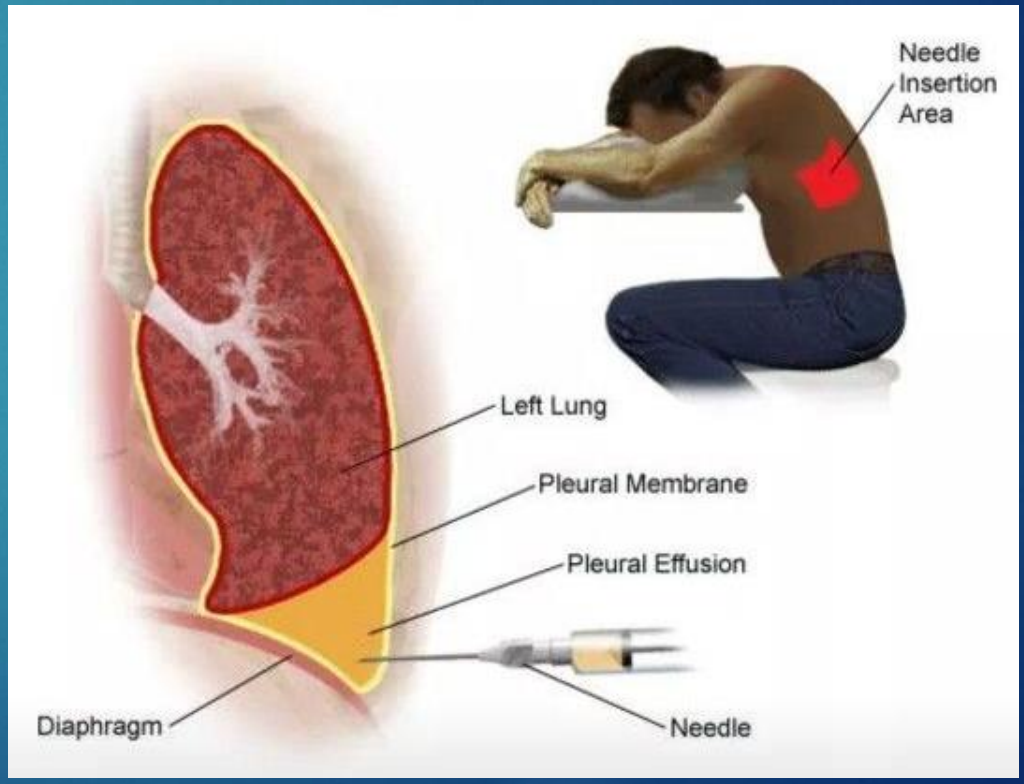


Fig. 7. Performance of PDT, part 3. (*A*) Insertion of a 14F dilator over wire and (*B*) endoscopic view. (*C*) Insertion of dilator and (*D*) endoscopic view.

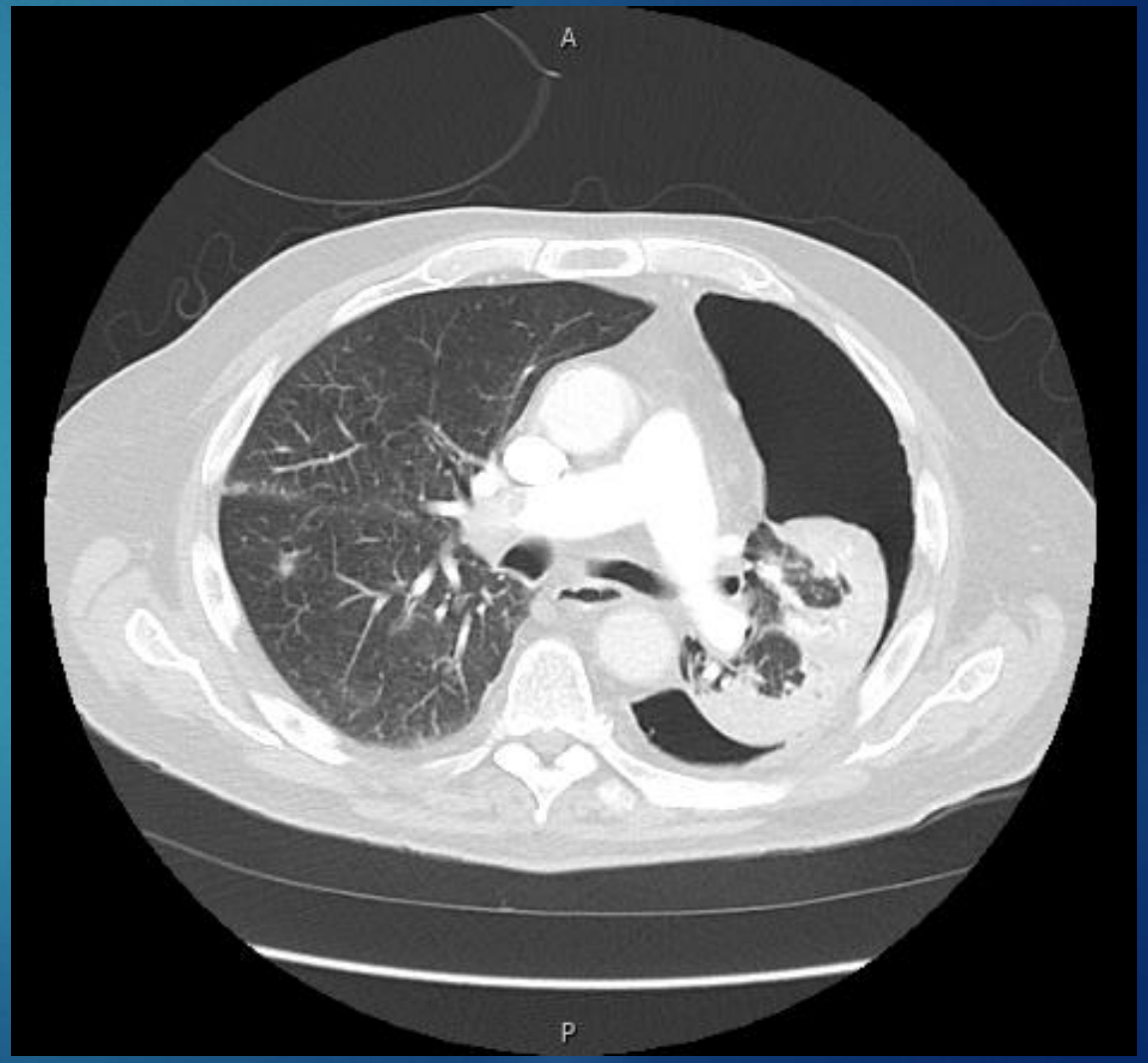
3. PLEURAL SPACE

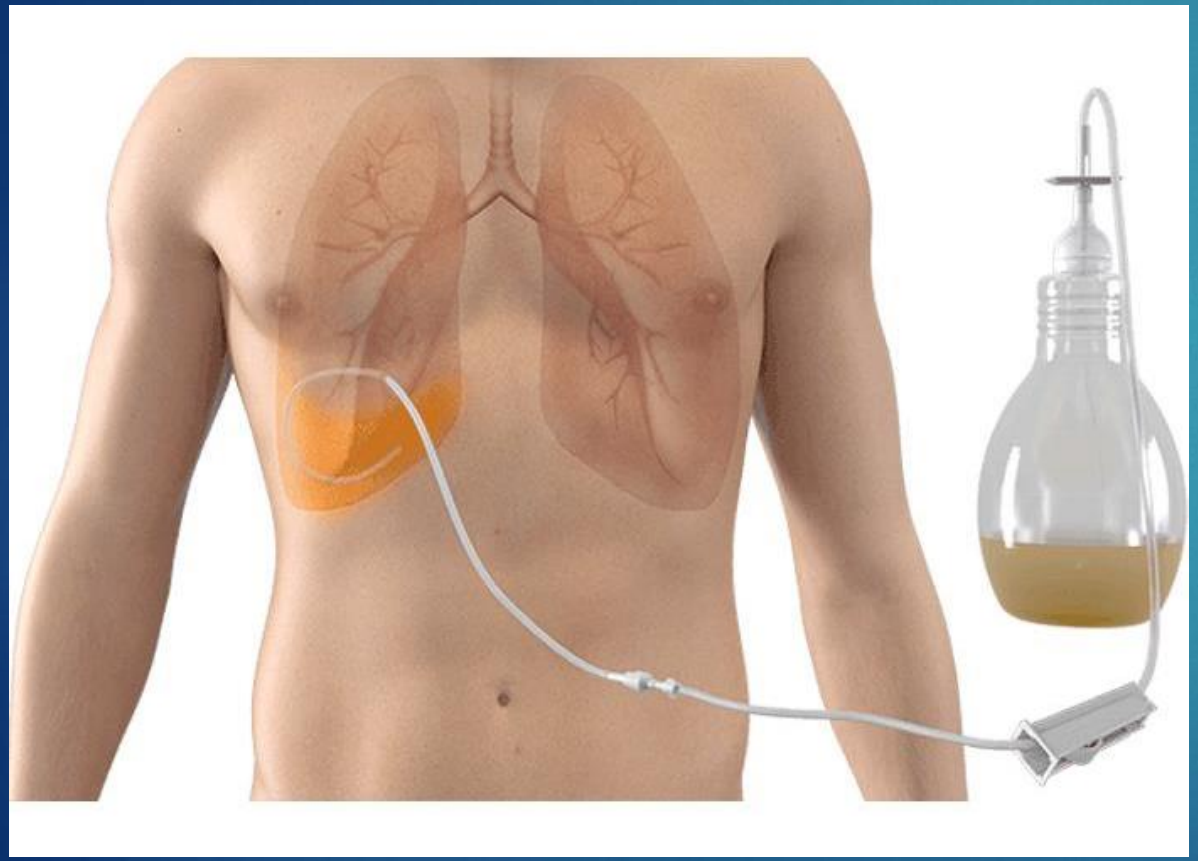
- 83 M, smoker
- Dyspnea and cough
- Thoracentesis for the simple effusion





- Left thoracentesis yielded 2L exudative effusion
- Repeat CT revealed a trapped lung
- Cytology from pleural fluid positive for adeno ca, lung primary





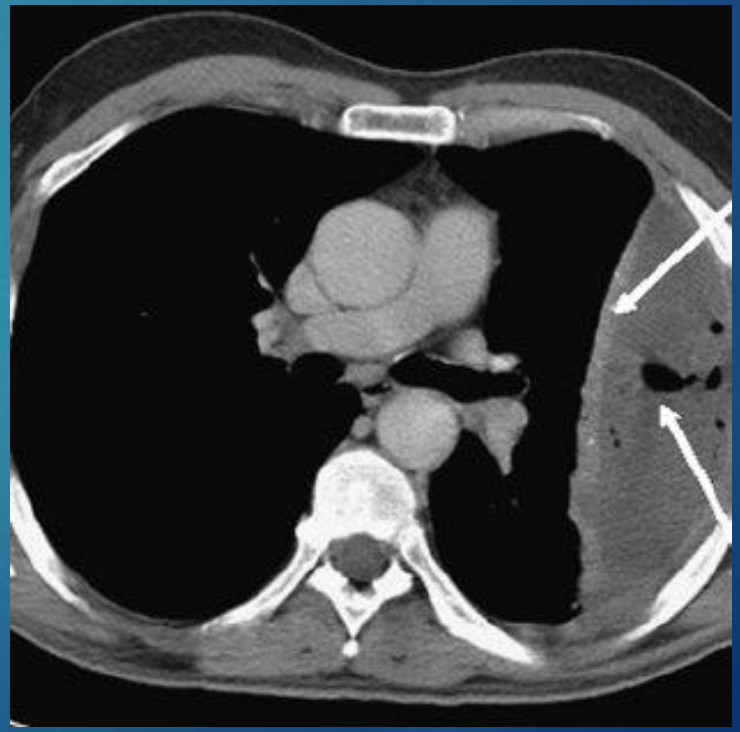
- Tunneled pleural catheters for:
  - Symptomatic, malignant recurrent effusions
  - Effusions secondary to CHF refractory to diuretics

- Options for pleurodesis with:
  - Talc slurry (risk of ARDS, pneumonitis with respiratory failure <1%)
  - Doxycycline (painful)

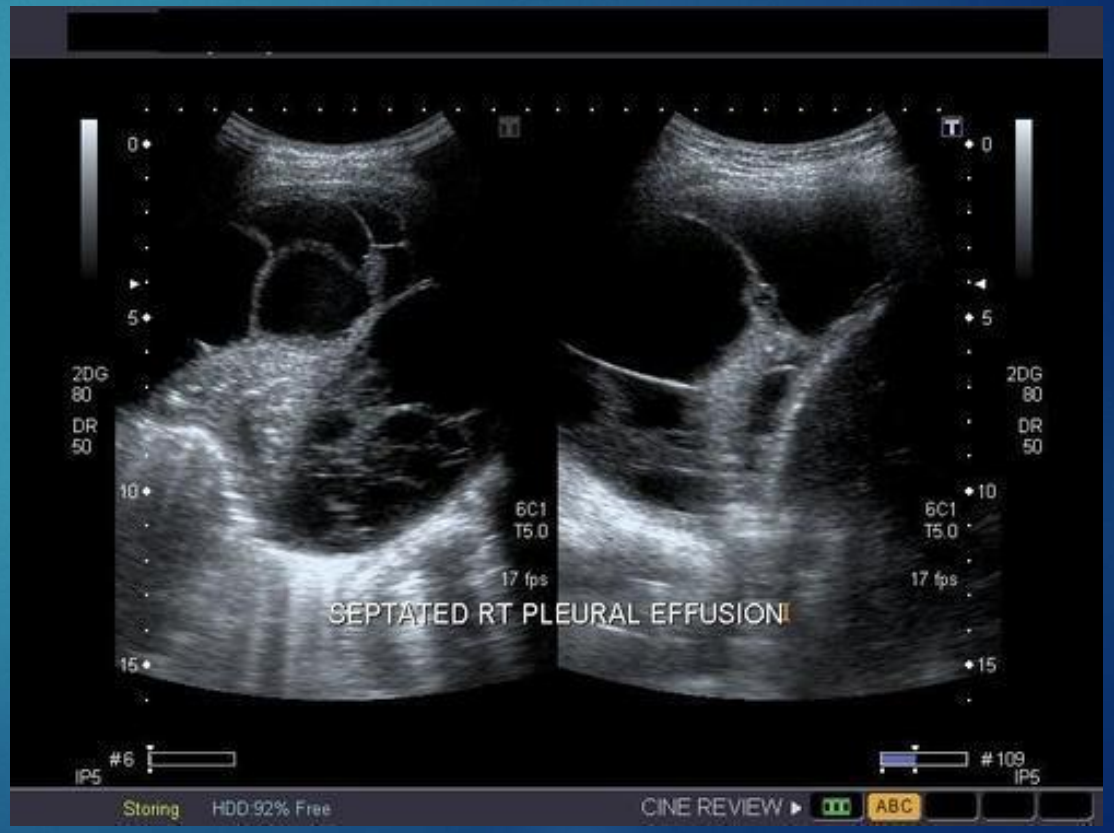
Talc controls effusion in >90% of cases if lung entrapment not present

Fishman's Pulmonary Diseases, 5th edition

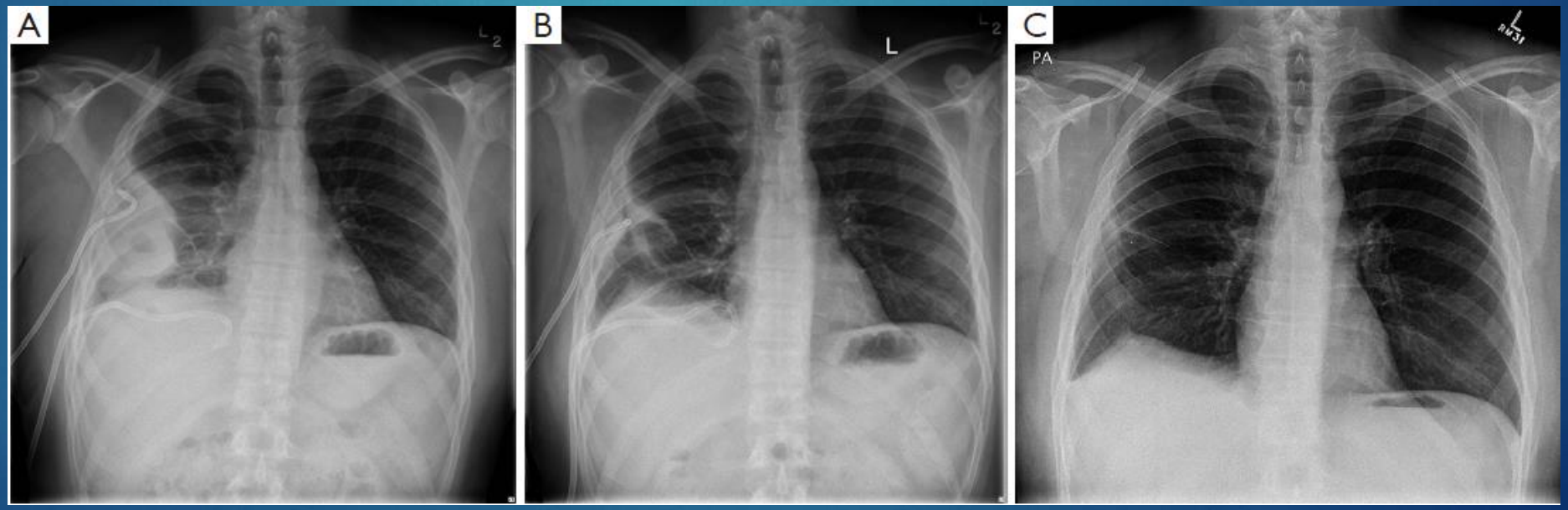
- 30yr M
- Fevers, chills, productive cough



- Complex effusions, indicated by adhesions on ultrasound
- Requires chest tube placement
- Requires lytic therapy

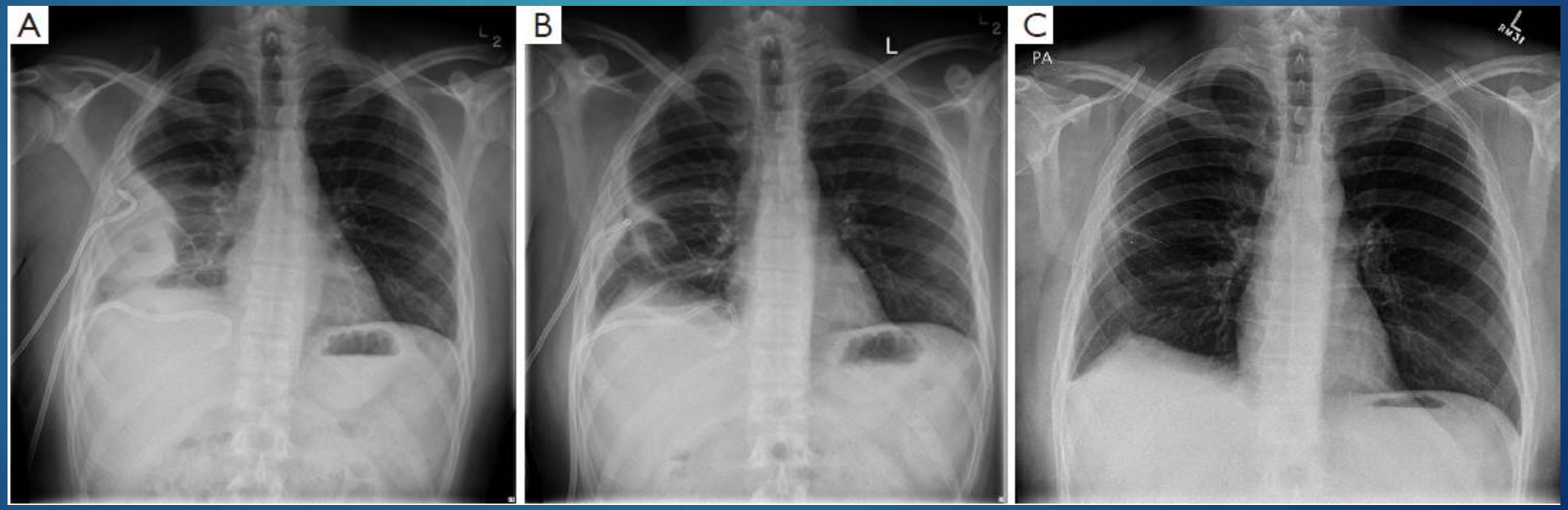


- MIST-2 Trial
- BID dosing of DNAse + recombinant tPA, injected via the chest tube, for 3 days
- Both agents work synergistically: tPA breaks down fibrinous septations to release the pockets of infected pleural fluid; DNAse decreases the viscosity



Rahman et al. NEJM 2011

- Contraindications to lytics:
  - Coagulopathy
  - allergy or hypersensitivity to tPA
  - presence of bronchopleural fistulas

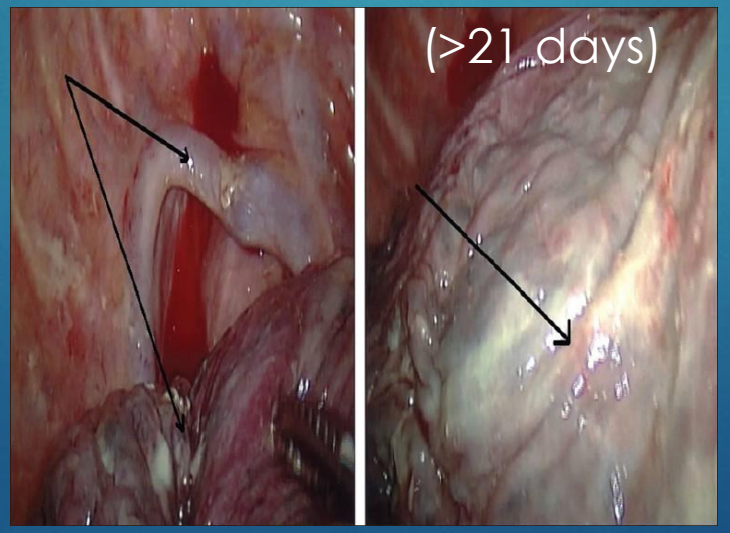


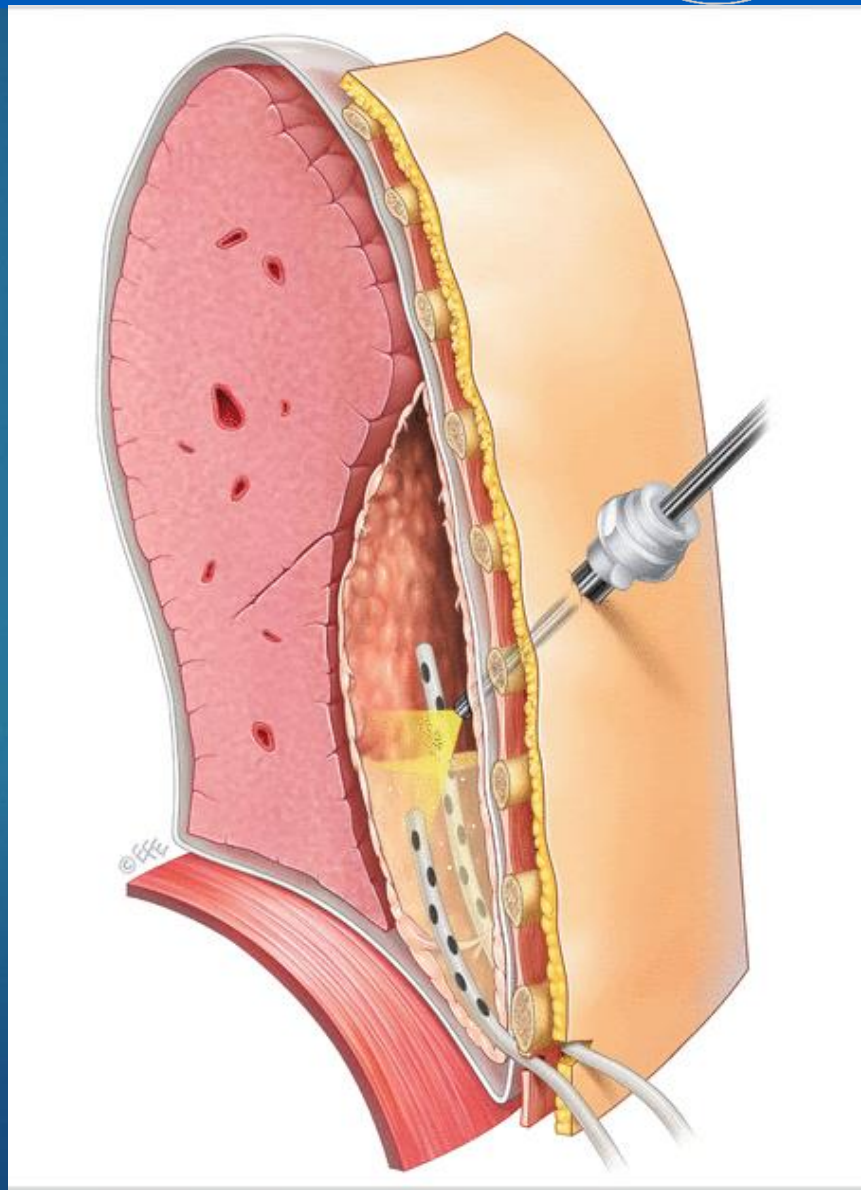
Rahman et al. NEJM 2011

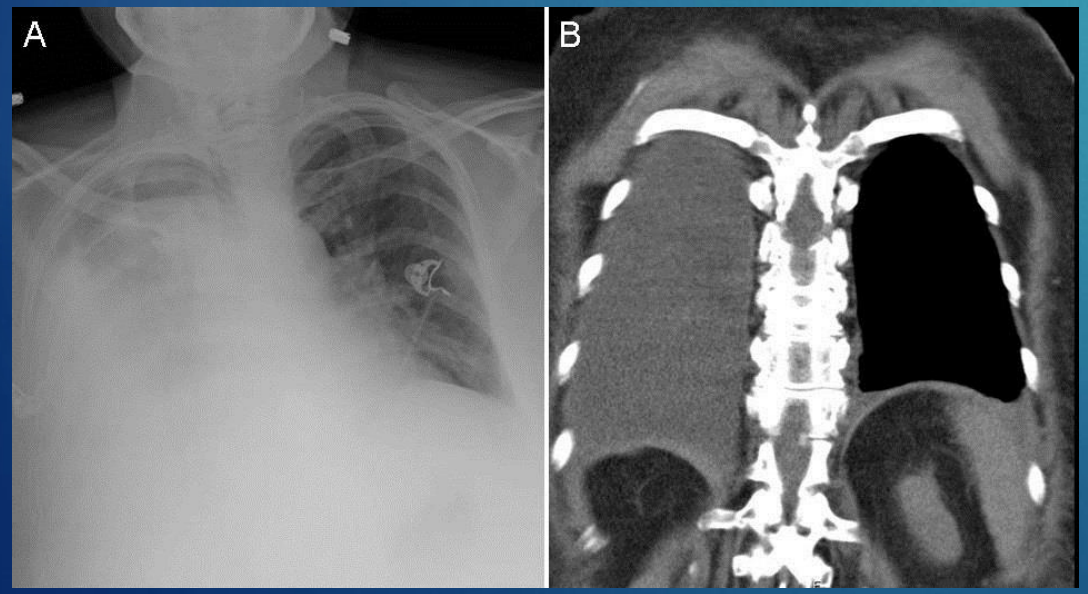
Exudative (pus) stage (0-7 days)

Fibrinopurulent stage (7-21 days)

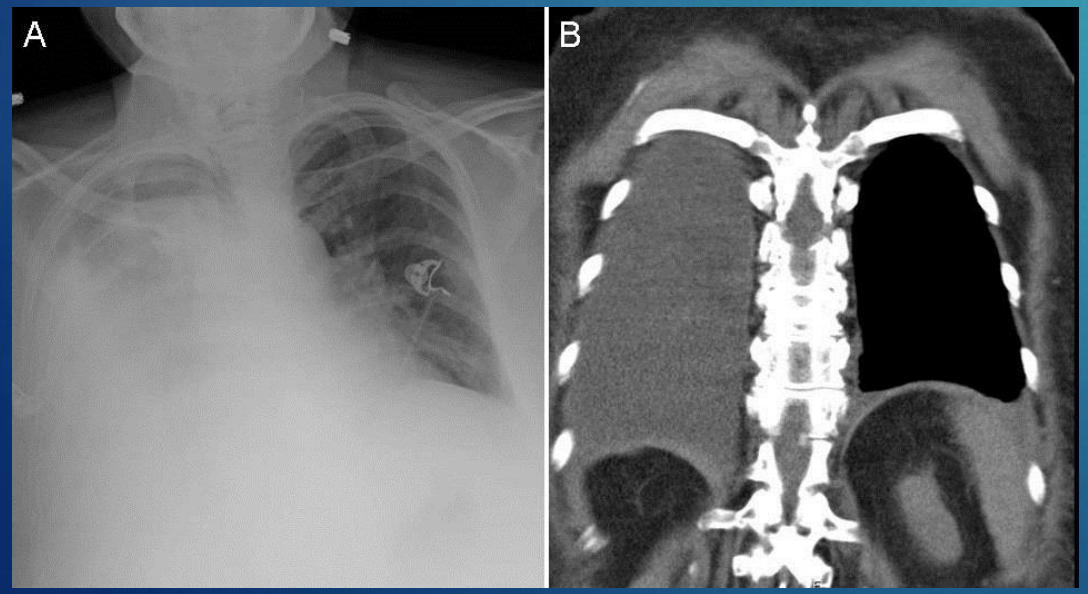
Organizing stage with pleural peel (>21 days)



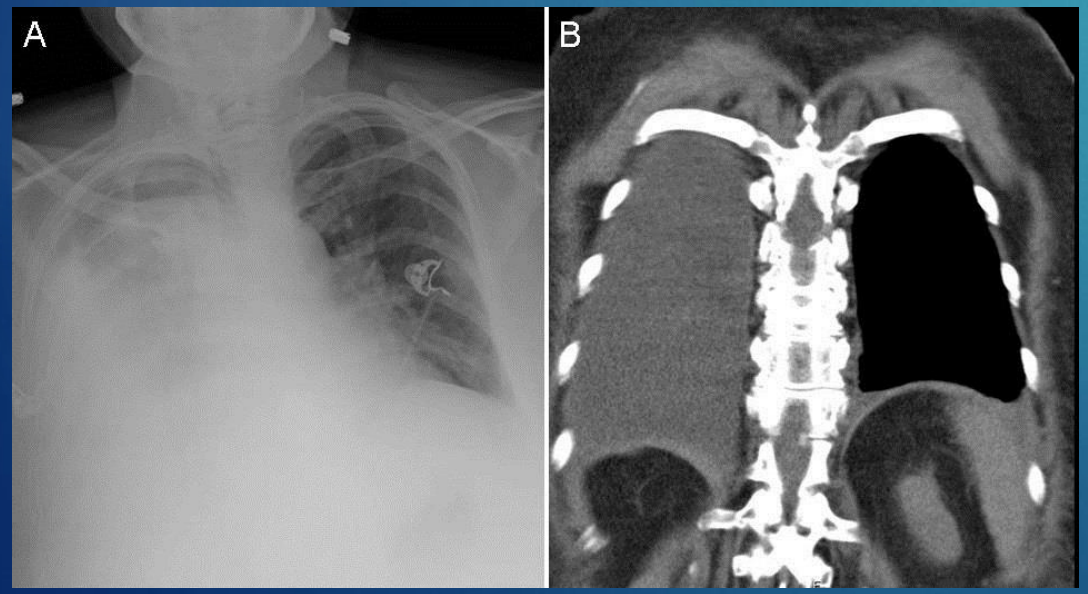




- When should you not place a chest tube?



- Hepatic hydrothorax
- Occurs due to diaphragmatic defects from being stretched by the ascites



- Treat by salt restriction, diuretics
- Patient requires a liver transplant or TIPS
- Thoracentesis ok for symptomatic relief, but will reaccumulate
- Chest tube will cause more problems, leads to massive protein loss and electrolyte depletion, infection, renal failure, and bleeding.

- Take away points:
  - EBUS: for mediastinal staging
  - Navigation bronchoscopy: obtaining tissue diagnosis for peripheral nodules
  - Tumor board: bimonthly (will be weekly come September) discussions of both inpatient and outpatients within the region
  - Bedside ultrasounds, Pleurx catheter placements, thoracentesis, chest tube placement
  - Rigid bronchoscopy for central airway tumors, stent deployment

- perform procedures in the dedicated bronch suite
- Weekly clinic on Friday at BGH (currently located A2 Great Lakes Cancer Clinic)
- Participation in the Thoracic tumor board

May-July 2020

Bronchoscopy with EBUS
30

Thoracentesis
7

→ 3 bilaterals

Chest tube
1

Pleurx
4

→ 1 bilateral

May-January 2021

Bronchoscopy with EBUS
84

Thoracentesis
17

→ 5 bilaterals

Chest tube
4

Pleurx
8

→ 1 bilateral

Jacobs School of Medicine and Biomedical Sciences
University at Buffalo

UB|MD Physicians' Group

Great Lakes Cancer Care

Kaleida Health

general physician pc


Sandip Saha, MD


Celestino Pietrantoni, DO


Manoj Mammen, MD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Sanjay Sethi, MD


John McGrath, MD


Christopher Nicholas, MD

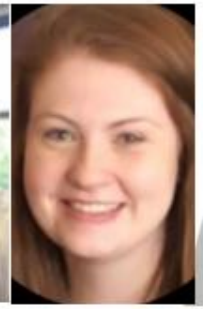

Omar Chohan, DO


Anne Curtis, MD


Steven Schwaitzberg MD


Victor Filadora MD


Amanda Aikin


Samantha Gunn RN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Yaron Perry, MD


Dhiren Shah, MD


Matthew Thurman, MD


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Michele Hubert, RN


Ramon Rivera, MD


James Corasanti, MD


John Tomaszewski, MD


Hassan Nakhla, MD


Lucia Balos, MD


Jenny Romero, MD


Basem Goueli, MD,PhD


Herbert Duvivier, MD


Naheed Alam, MD


Haider Khadim, MD


Roberto Pili, MD

- Where do we go from here?
  - Upgrading the bronchoscopy suite at BGH
  - Acquiring the presence of ROSE in the endoscopy unit for our cases
  - Acquiring certain pieces of technology (rigid bronch, APC, cryo, robotic bronch)

- Where do we go from here?
  - Building our thoracic oncology program (Thoracic Surgery, Oncology, Radiology, Interventional Radiology, Radiation Oncology, Pathology)
  - Starting lung nodule program
  - Developing the bronchoscopic lung volume reduction program

Jacobs School of Medicine and Biomedical Sciences
University at Buffalo

Thank You!

OFFICE: BUFFALO GENERAL HOSPITAL B610

CLINIC: 2ND FLOOR BGH, A-ELEVATORS, GREAT LAKES CANCER CLINIC (EVERY FRIDAY MORNINGS)

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