Bronchoscopy
An Inside Look

Rena Laliberte BS, RRT, CPFT, FAARC
Clinical Education Specialist
Henry Ford Hospital Detroit

Disclosures

- Honorariums received by Respiratory Associates
- No other disclosures that would jeopardize this lecture or promote any particular product.

Objectives

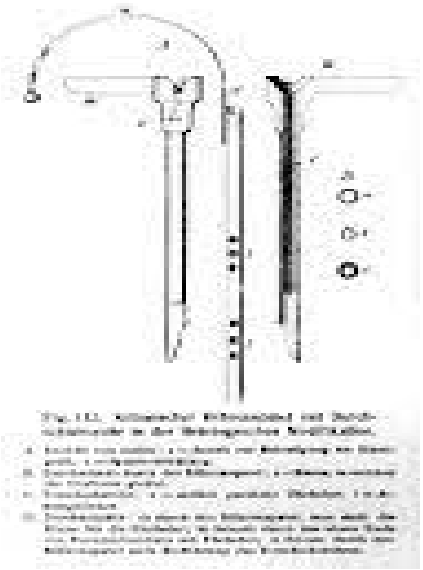
- Discuss the history of bronchoscopy
- Review the various types of bronchoscopies and scopes and equipment used
- Examine pathologies of bronchoscopies
- Describe the role of RTs in bronchoscopy

Historical Dates for Bronchoscopy

- 1895 Early Views of the larynx and trachea, Manual Garcia, a Spanish music teacher who wanted to look at the “voice box” of his students with a dental mirror
- Alfred Kirstein (1895/Germany) first to report visualization of vocal cords and proximal large airways using the esophagoscope. He called this process autoscopy – he convinced his self that one could pass the vocal cords intentionally with the scope into the cocainized trachea to the bifurcation.
- 1876-1904 Killian (an otolaryngologist/Germany) used volunteers to visualize the trachea and went on to remove the pork bone, along with other foreign objects. These experiences led Killian to coin the term “directe bronkoscopie”

In the beginning..

- In 1876 Gustav Killian removed a pork bone from a farmers airway using an esophagoscope.
- Because of this accomplishment Chevalier Jackson (ENT) laid the platform for the modern day rigid bronchoscope in the early 20th century.
- Numerous innovators have furthered the horizons of this technology including Ko Pen Wang in the 1980's who introduced transbronchial needle aspiration to sample mediastinal lesions.



Panchabhai TS, Mehta AC. Historical perspectives of bronchoscopy. Connecting the dots. Ann Am Thorac Soc. 2015 May;12(5):631-41. doi: 10.1513/AnnalsATS.201502-089PS. PMID: 25965540.

Chevalier Jackson, ENT Philadelphia

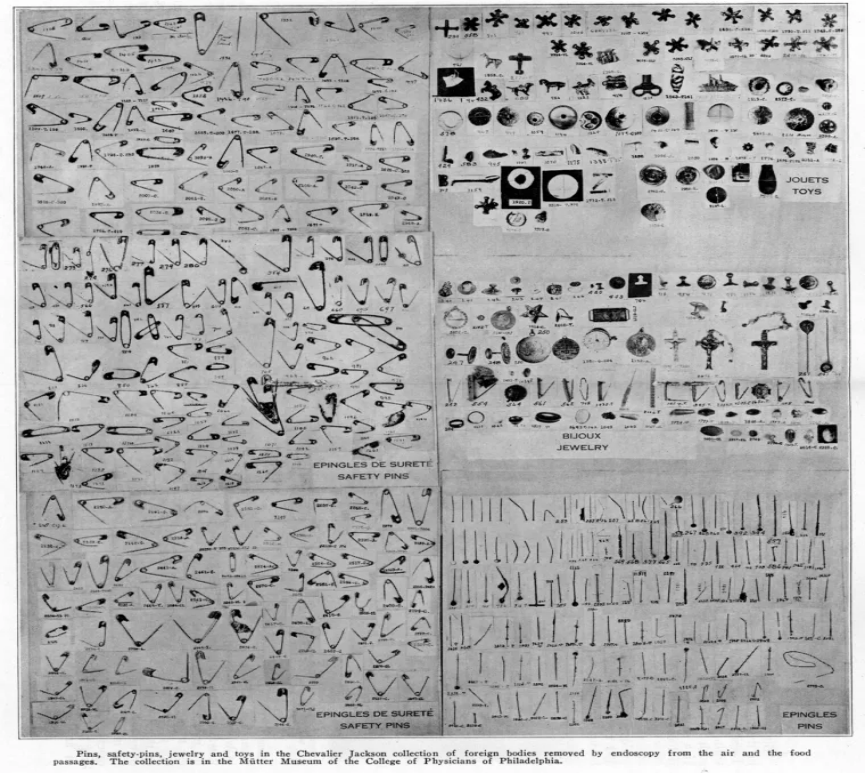
- Dr. Jackson is considered the "Father of Bronchoscopy"

In 1904 he developed a direct ocular mechanism which consisted an illumination and suction tubing attached to a rigid esophagoscope. Derivatives of this device are now called a rigid bronchoscope.

He became renowned for extracting aspirated or swallowed foreign bodies and kept meticulous records for every object removed to help other doctors learn from his techniques.

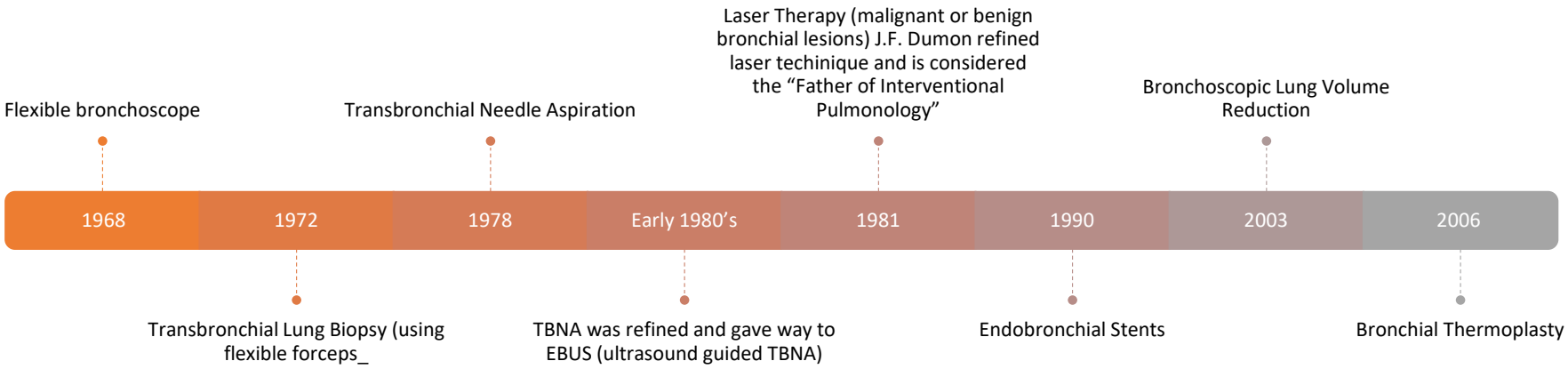
The Mutter Museum in Philadelphia displays 2,374 object recovered by Dr. Jackson during his 75 year long career.

Chevalier Jackson, MD 1865-1958



Pins, safety-pins, jewelry and toys in the Chevalier Jackson collection of foreign bodies removed by endoscopy from the air and the food passages. The collection is in the Mütter Museum of the College of Physicians of Philadelphia.

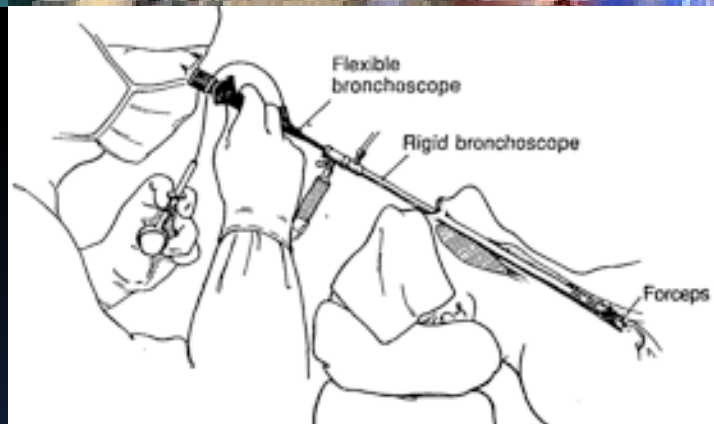
Other Significant Dates



Rigid Bronchoscopy

Let’s take a look….

Rigid Bronchoscopy



Rigid Bronchoscopy

Uses and Pathologies

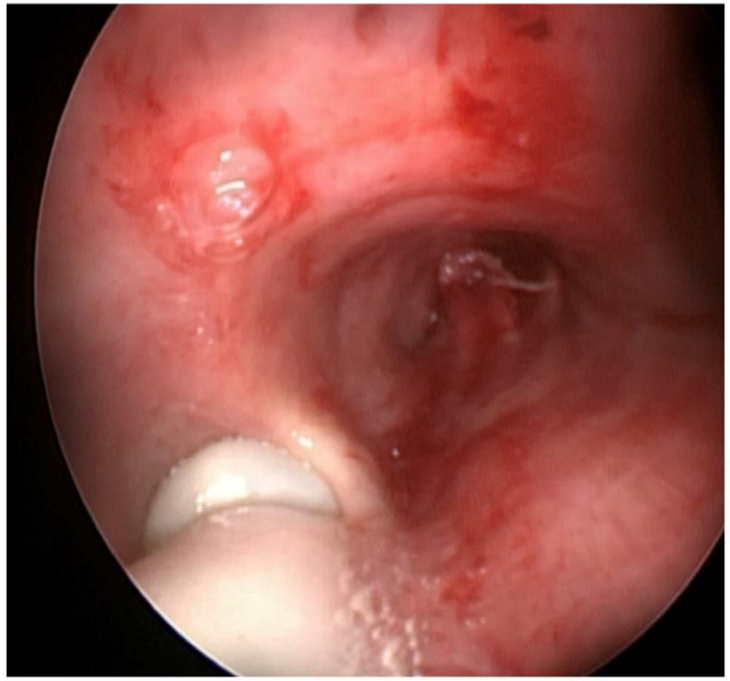
Rigid Bronchoscopy

- Indications
  - Bleeding / Hemorrhage
  - Foreign body obstruction/airway obstruction
  - Deep Biopsy
  - Dilation of trachea of bronchial strictures
  - Sent insertion (Tracheal Y)
  - Laser Therapy
  - Tumor Ablation

Rigid Bronchoscopy Indications & Techniques, Daniel G Nicastri, MD, Todd S Weiser, MD https://doi.org/10.1053/j.optechstcvs.2012.03.001

Lung Cancer Central Airway Obstruction

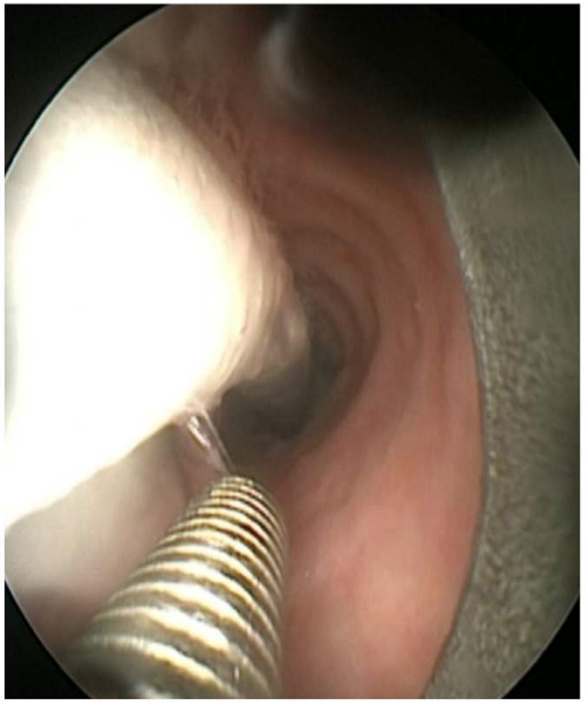
Ventilation challenge in rigid bronchoscopy: Laser tube as an alternative management in patients with lung cancer and central airway obstruction



Thoracic Cancer, Volume: 14, Issue: 1, Pages: 24-29, First published: 23 November 2022, DOI: (10.1111/1759-7714.14671)

Rigid scope runs along side of laser tube under direct visual endoscopy guiding placement of laser tube

Ventilation challenge in rigid bronchoscopy: Laser tube as an alternative management in patients with lung cancer and central airway obstruction



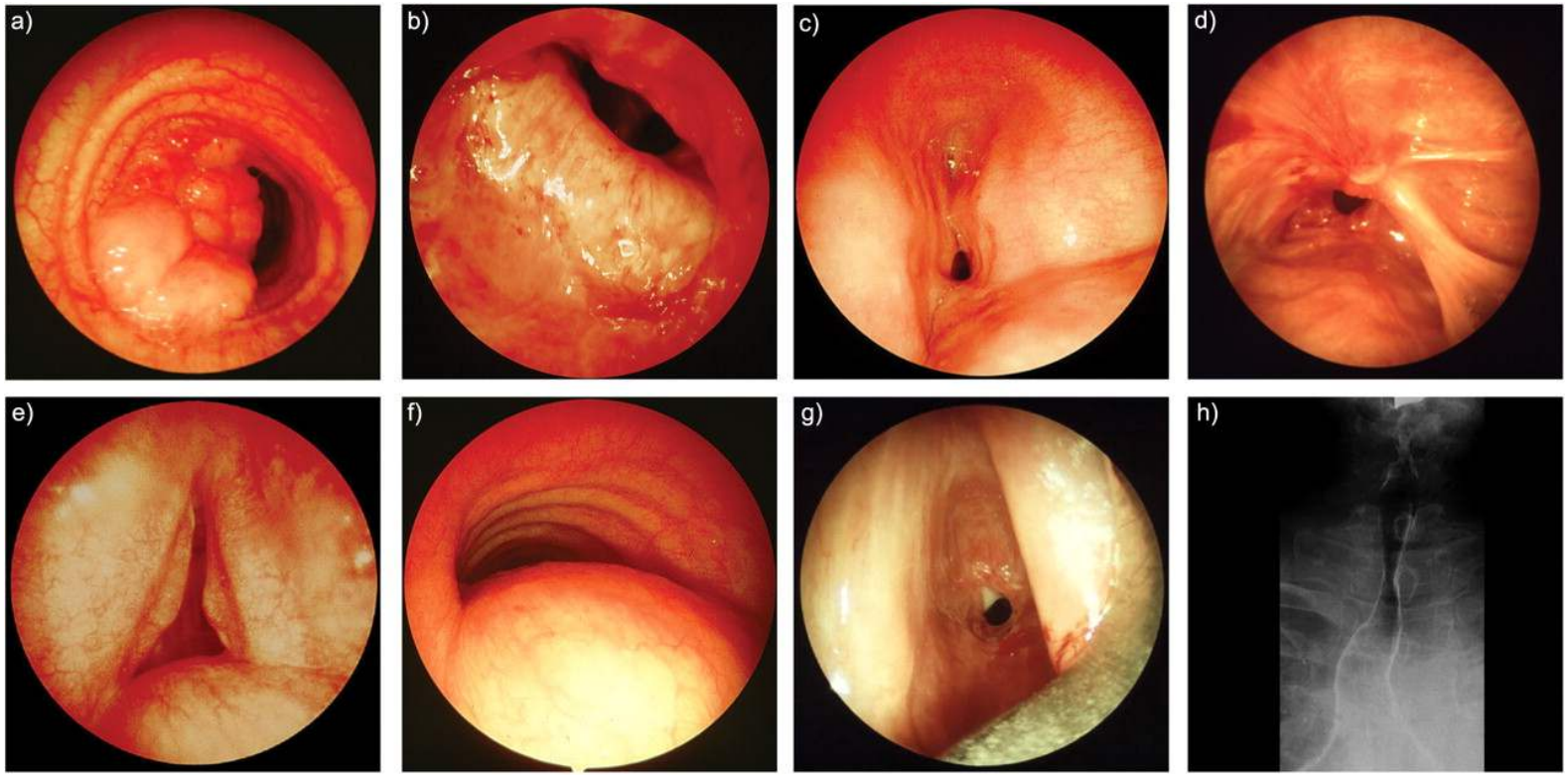
Thoracic Cancer, Volume: 14, Issue: 1, Pages: 24-29, First published: 23 November 2022, DOI: (10.1111/1759-7714.14671)

Laser tube is a tracheal tube, laser resistant: two cuffs, one inside the other; laser guard foil. Rigid bronchoscopy remains a “ventilation challenge” because of the intrinsic nature of the surgical procedure, which occupies the same channel through which the anesthetist ventilates the patient.

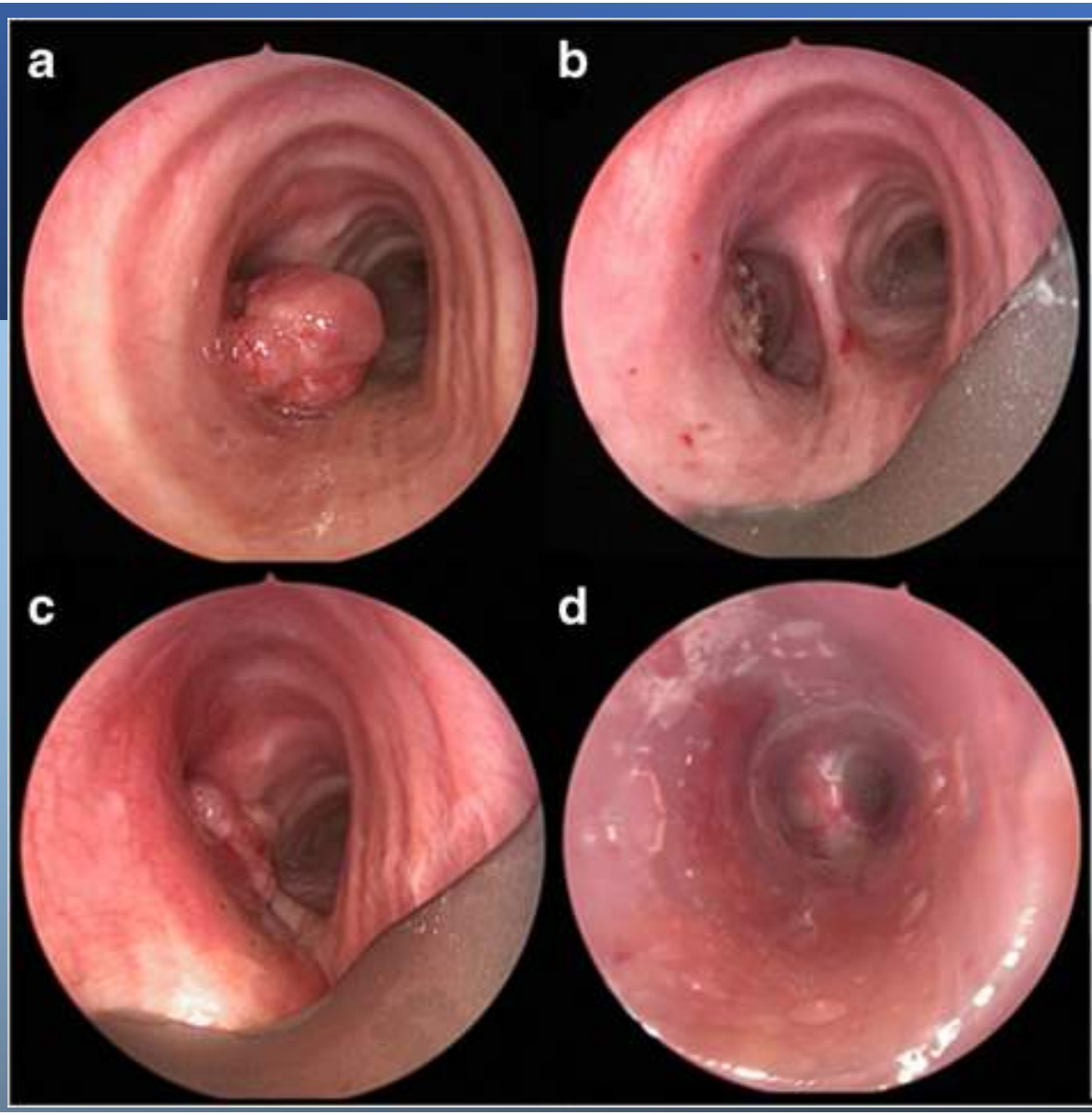
Ventilation challenge in rigid bronchoscopy: Laser tube as an alternative management in patients with lung cancer and central airway obstruction

Thoracic Cancer, Volume: 14, Issue: 1, Pages: 24-29, First published: 23 November 2022, DOI: (10.1111/1759-7714.14671)

Clinical examples of the degrees of stenosis. a) Intraluminar tumour or granulation; b) distortion or buckling; c) extrinsic compression; d) scar stricture; e) scabbard trachea; f) floppy membrane; g) abrupt transition (web stenosis); h) tapered transition hourglass stenosis



L. Freitag et al. Eur Respir J 2007;30:7-12



Management of central airway tumor by rigid bronchoscopy

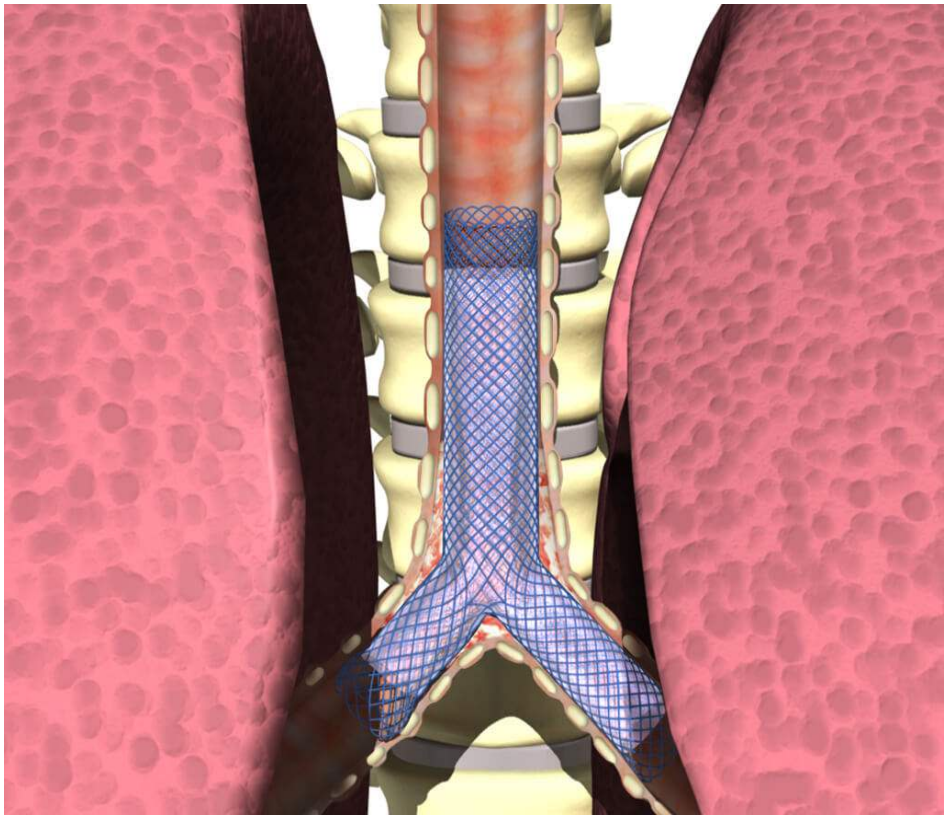
A: tumor obstructing left mainstem bronchus.

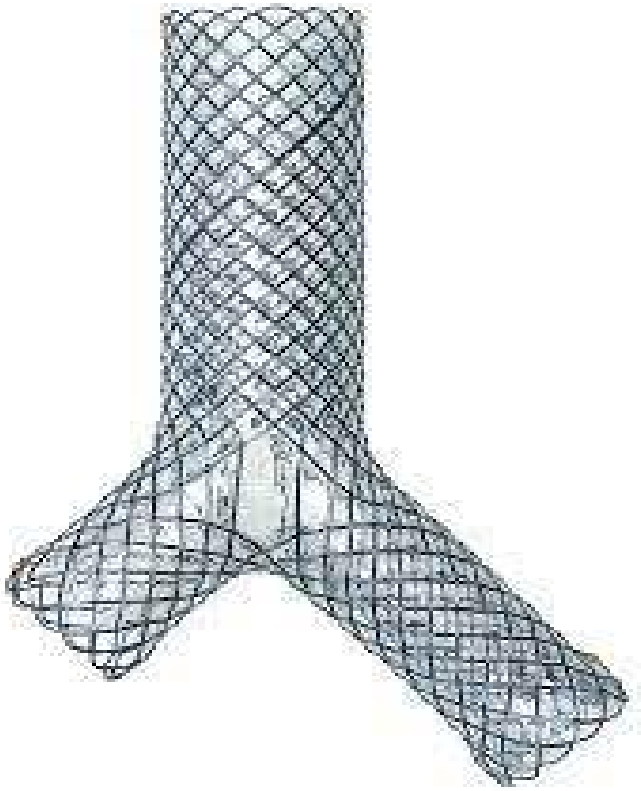
B: tumor debrided and ablated by rigid bronchoscopy

C: Tumor recurrence with mixed endobronchial tumor and extrinsic compression of LMS and trachea

D: Obstruction relieved with silicone Y-stent

Bronchial Y Stent

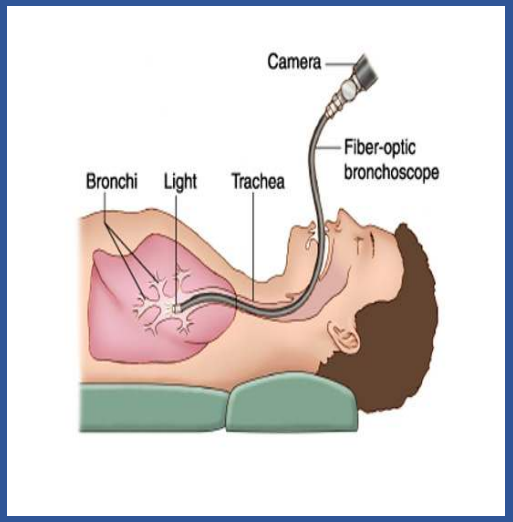


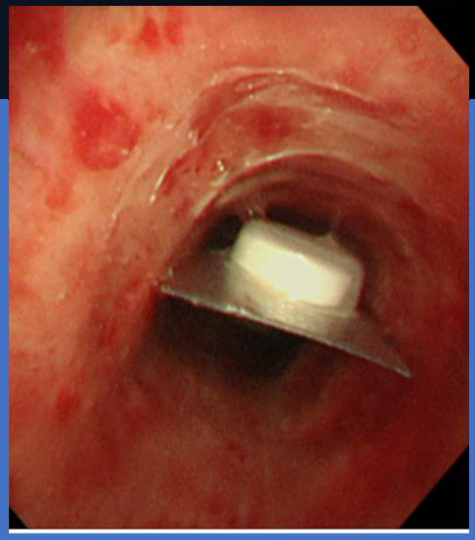


Flexible Bronchoscopy

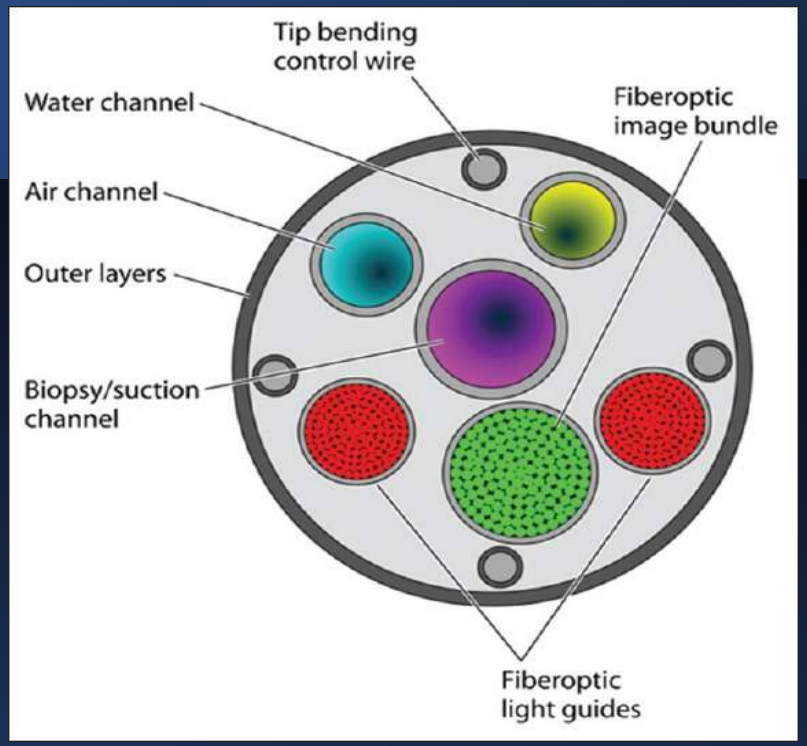
Let’s take a look

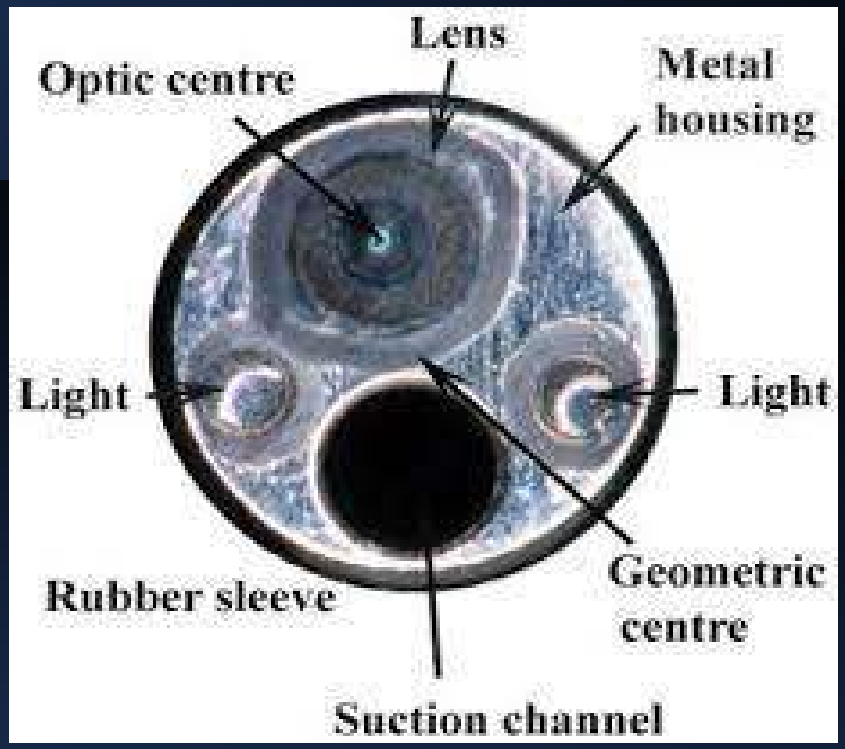
Flexible Bronchoscopy





Scope differences Diagnostic/Therapeutic





Diagnostic vs Therapeutic Bronchoscopy

Diagnostic Bronchoscopy	Therapeutic Bronchoscopy
• Bronchoalveolar lavage (BAL) • Endobronchial biopsy (EBB) • Transbronchial lung biopsy (TBLB) • Radial endobronchial ultrasound guided TBLB (R-EBUS-TBLB) • Conventional transbronchial needle aspiration (C-TBNA) • Endobronchial ultrasound guided transbronchial needle aspiration (EBUS-TBNA)	Tuberculosis associated tracheobronchial stenosis (TTBS) Hemoptysis (especially massive hemoptysis) Tuberculosis related prolonged air leaks (PAL), with bronchpleural fistula

Indications for Flexible Bronchoscopy

Airway obstruction

Stridor/noisy breathing

Persistent recurrent wheezing

Radiographic abnormalities

Atypical/unknown infiltrates

Localized hyperinflation

Chronic cough

Suspected foreign body aspiration

Hemoptysis

Evaluation of artificial airway

Therapeutic bronchoscopy

Restoration of airway patency

Mucus plugs or blood clots

Alveolar filling disorders (alveolar proteinosis, lipid pneumonia)

Special Procedures

Bronchial Alveolar lavage

Brushing or biopsy of bronchial mucosa

Biopsy of endobronchial lesions

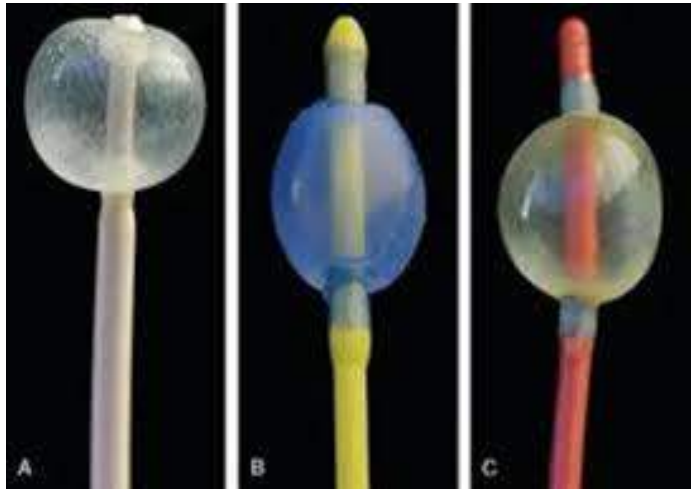
Transbronchial biopsy

Administration of drugs

Endoscopic intubation

Qanash S, Hakami OA, Al-Husayni F, Gari AG. Flexible Fiberoptic Bronchoscopy: Indications, Diagnostic Yield and Complications. Cureus. 2020 Oct 24;12(10):e11122. doi: 10.7759/cureus.11122. PMID: 33133790; PMCID: PMC7586410.

Equipment



Flexible Bronchoscopy

Uses and Pathologies

Case Study

A 14-year-old male with a past medical history of asthma developed acute cough and wheezing immediately following an episode of intense laughter. Actually, he was holding a thumbtack between his teeth when his brother made a funny comment. Bursting into laughter, he suddenly aspirated the thumbtack. He did not tell his parents. Several days later, his intractable cough prompted his parents to bring him to the hospital, where he told physicians about the accident. Flexible bronchoscopy revealed the foreign object in the distal left main bronchus, but despite multiple attempts, it could not be removed and was inadvertently dropped over and into the right bronchial tree. He was transferred to our facility a few days later. His vital signs showed a BP of 150/85, HR of 110, RR of 22, temperature of 100.5° F, and O2 sat of 94% on room air. On examination, he had no wheezing, but air entry at the right base was diminished. The child was a nonsmoker and had no significant family history. His asthma was well controlled on inhaled fluticasone 110 mcg twice a day, with which he was usually noncompliant. Laboratory data were normal, except for a WBC of 18,000. Chest radiograph showed a radiopaque object projecting over the right lower lung field (Figure 25-1). During rigid bronchoscopy, a thumbtack surrounded by inflamed mucosa and granulation tissue was found and was causing complete obstruction of the right lower lobe bronchus (see Figure 25-1).

Imaging and bronchoscopy results

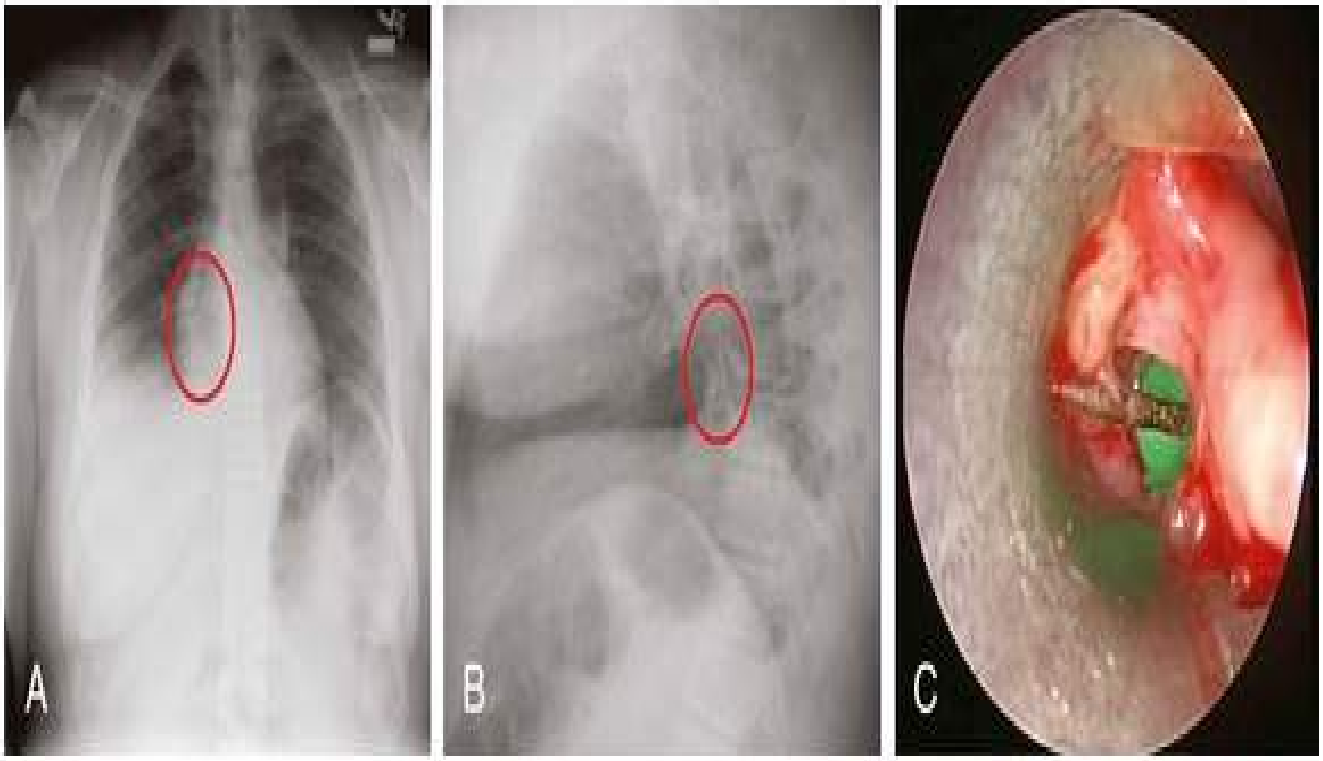
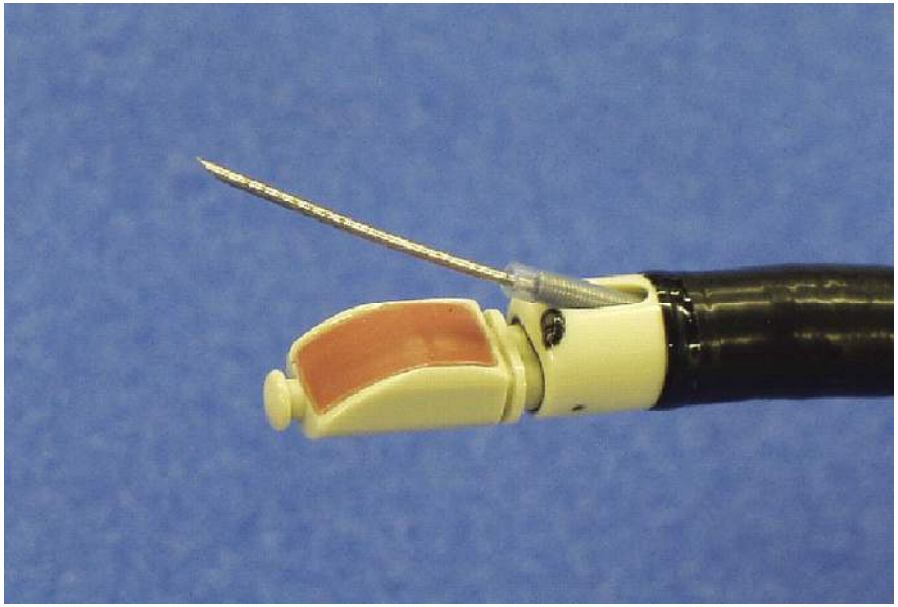
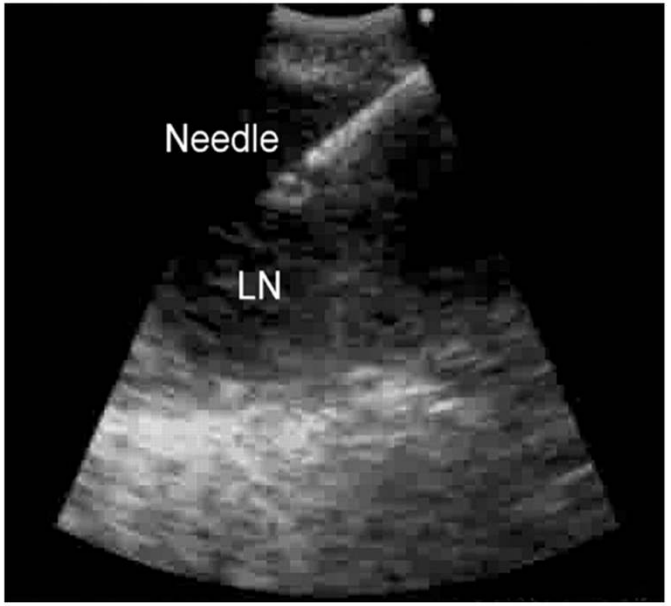


Figure 25-1 A and B, Chest radiographs (posteroanterior [PA] and lateral views) show the radiopaque object projecting over the right lower lobe lung field. C, During rigid bronchoscopy, a thumbtack is seen. It completely occludes the right lower lobe bronchus, and the surrounding mucosa is inflamed and friable.

EBUS Flexible Bronchoscopy

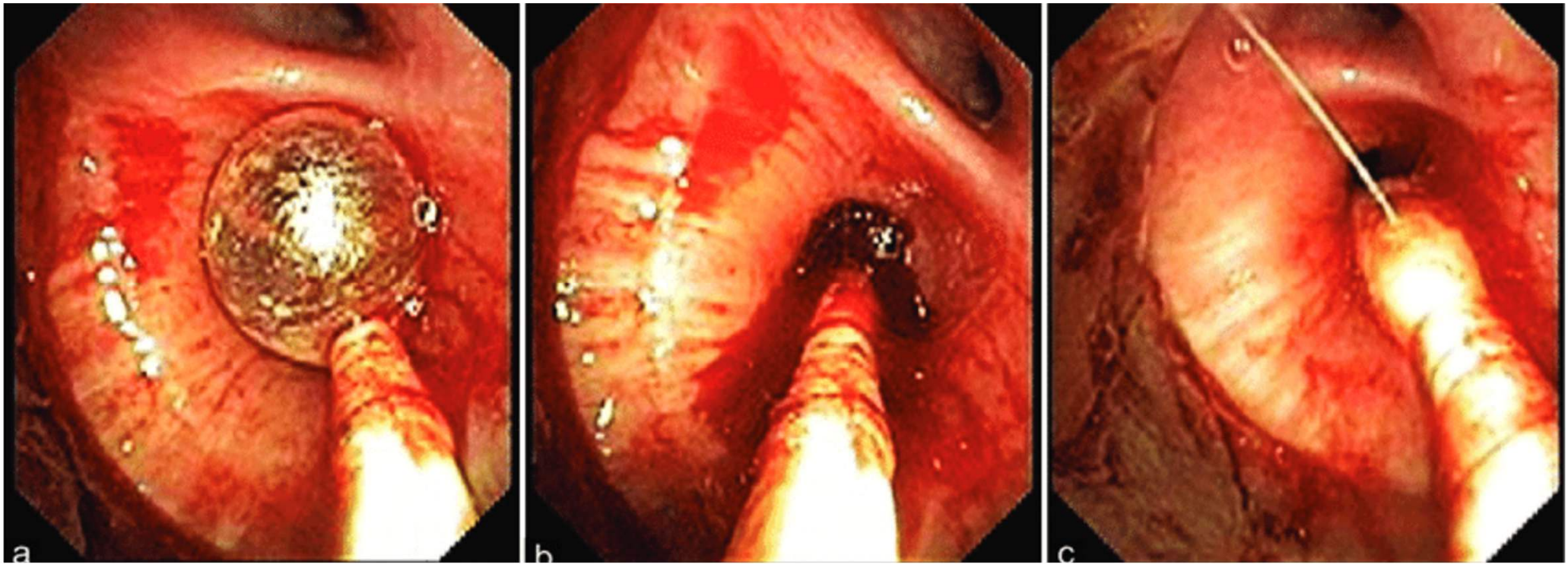


Endobronchial ultrasound image of the needle puncture.



F J F Herth et al. Thorax 2006;61:795-798

Forceps used in bronchoscopy Media



Fogarty Catheter Rigid or Flexible Bronchoscopy

- May 2019 Lung India 36(3):263-265 accessed Feb. 18, 2024DOI: 10.4103/lungindia.lungindia_152_18

Bronchial Thermoplasty (Asthma)

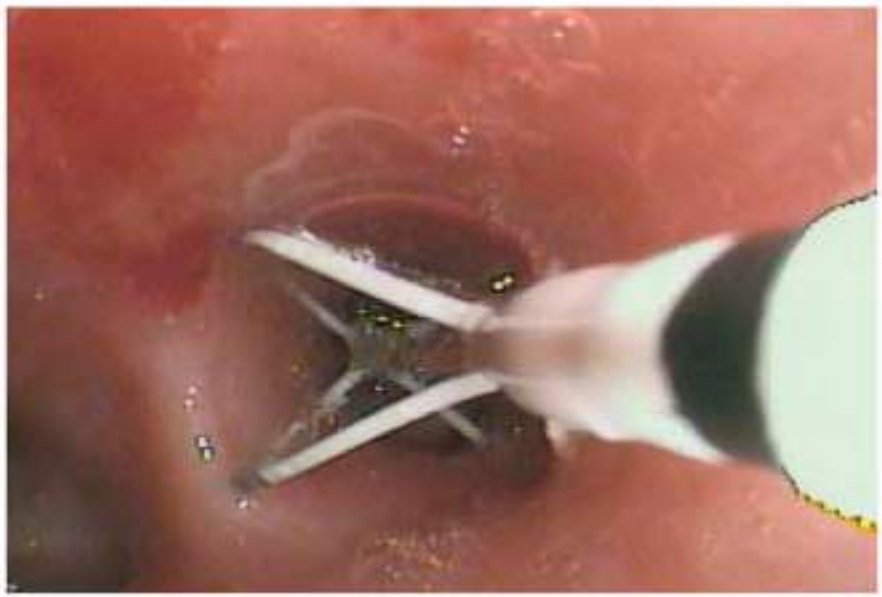
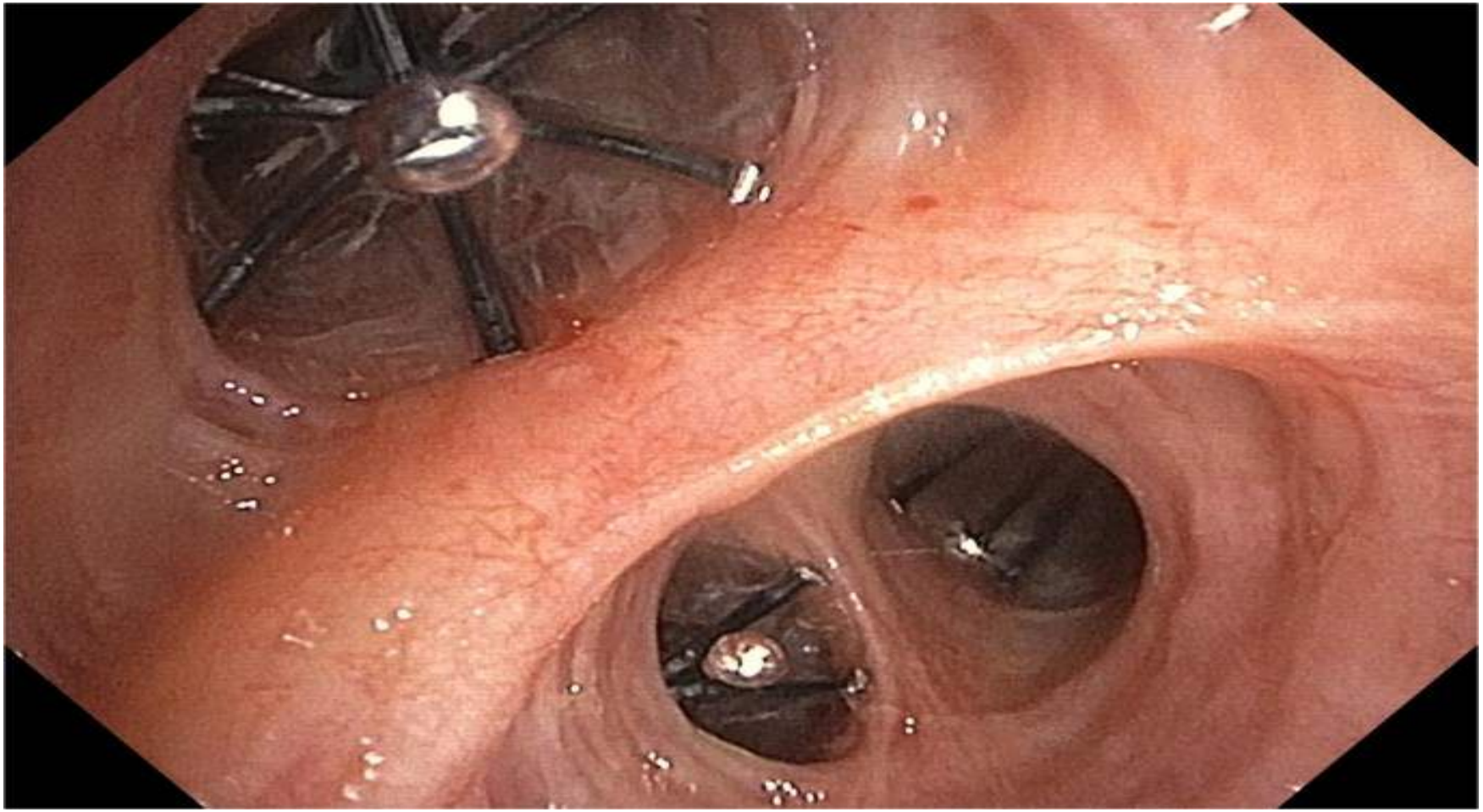


Figure 2. Bronchial thermoplasty treatment in the airways. (*A*) Application of thermoplasty in a distal airway; the basket should remain in bronchoscopic view during the application. (*B*) Application of thermoplasty in a proximal airway; the electrodes are in close contact with the airway wall.

Cytology Brush used in Bronchoscopy

Intrabronchial Stents (Zephyr Valve)

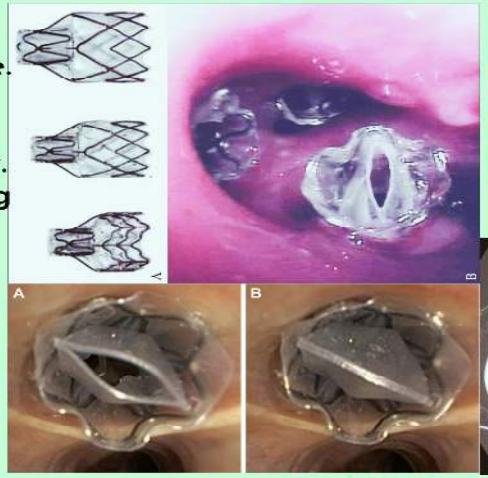


Zephyr duckbill Endobronchial valves(EBV)

@DharSaty

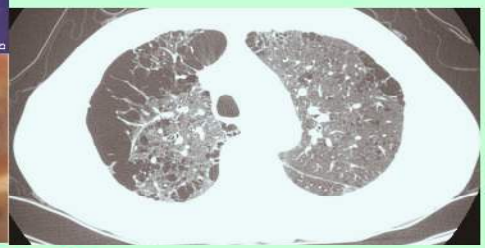
Device Features

- Implantable device to occlude all airways feeding hyperinflated lobe.
- One-way valve designed for bronchoscopic placement
- Allow air & mucus to exit treated area, but not air to re-enter.
- Facilitates atelectasis of emphysematous, hyperinflated lung distally.
- Remaining lobes expand more fully & work more efficiently, reducing pressure on diaphragm & improving overall lung function.



Indications

Hyperinflation due to severe emphysema who remain symptomatic despite optimal medical therapy & pulmonary rehabilitation

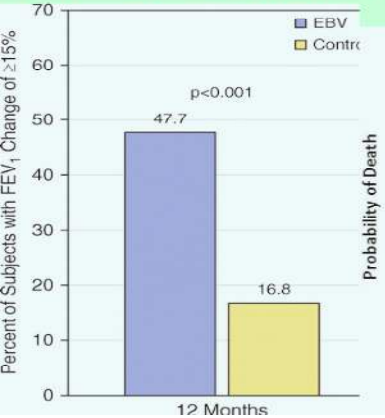


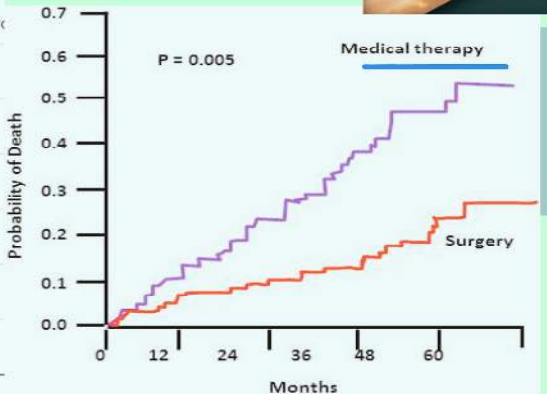
Inclusion Criteria

- Clinical presentation consistent with emphysema
- Symptomatic despite optimal medical Rx (mMRC ≥2)
- Clinically stable on ≤ 20 mg prednisone
- Nonsmoking for ≥4 months
- BMI <35 kg/m2
- FEV1 ≥15% predicted but ≤45% predicted
- TLC ≥100% predicted
- RV ≥175% predicted
- 6 minute walk test ≥100 m & <500 m

Exclusion criteria

- Prior lung transplant, LVRS, median sternotomy, lobectomy
- HF(LVE <45%), unstable cardiac arrhythmia, MI, CVA.
- PaCO2 >60 mmHg
- PaO2 <45 mmHg
- Active pulmonary infection
- Allergy to nitinol, nickel, titanium, or silicone
- Large bullae >30% either lung
- CI to bronchoscopy or high risk postop morbidity or mortality



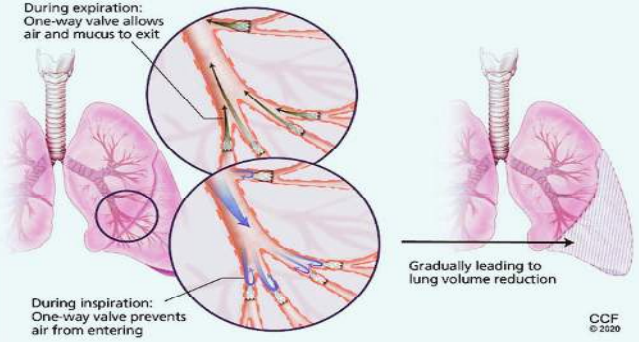


Benefits

- Modest improvements in symptoms
- Improve Lung Function
- Improve Exercise Capacity
- Improve Quality of Life

Complications

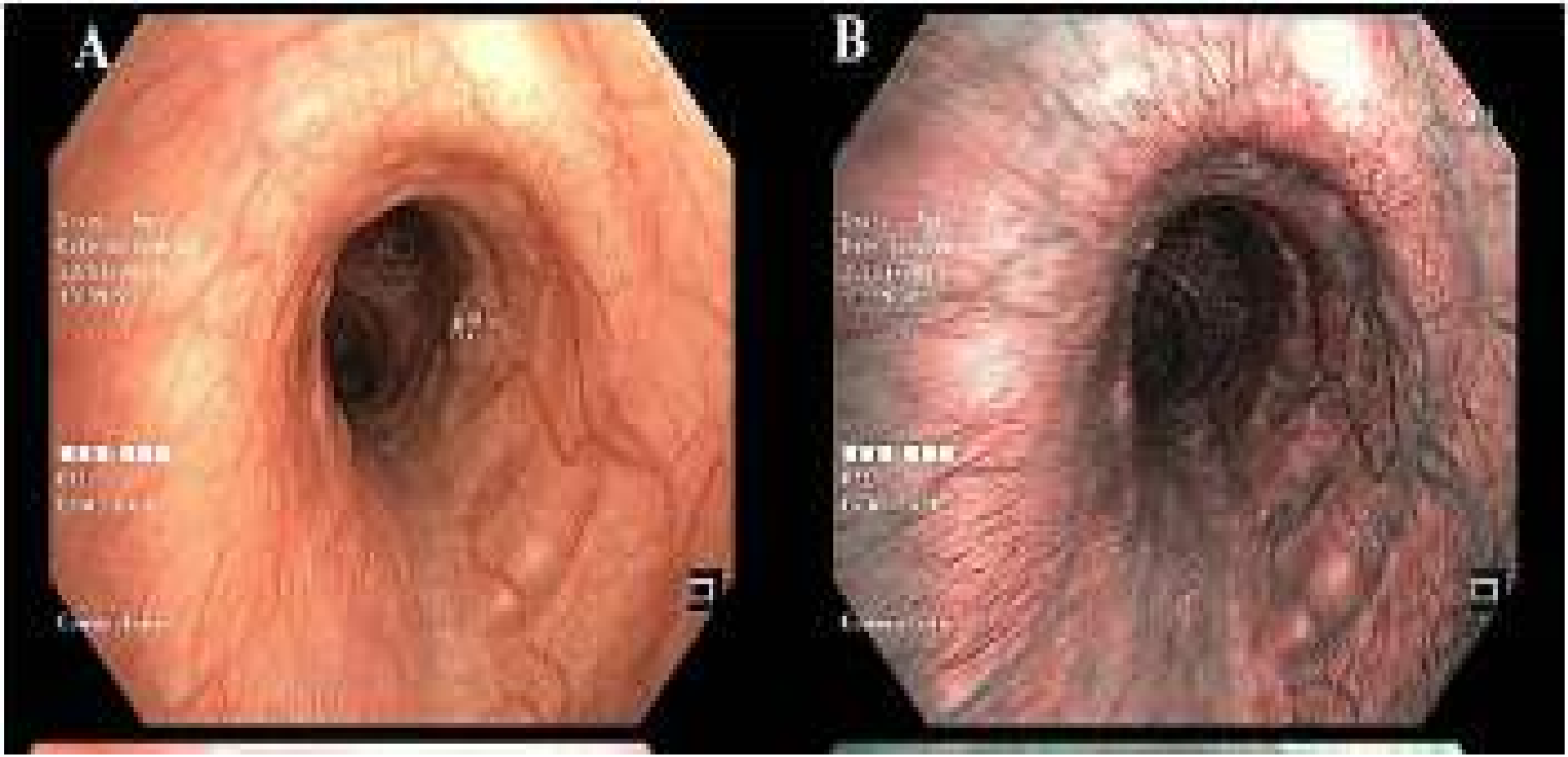
Pneumothorax (25-30%)
Worsening of COPD symptoms
Hemoptysis
Pneumonia



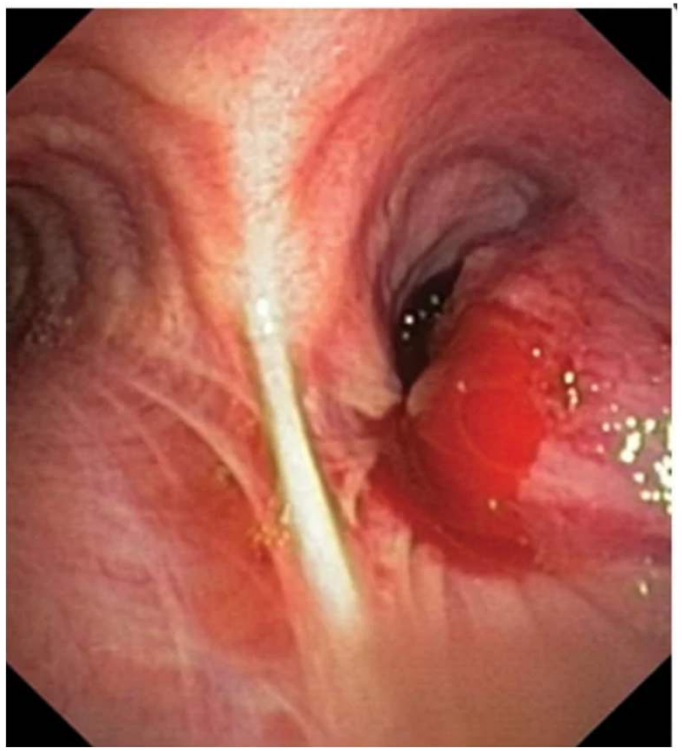
Case Study

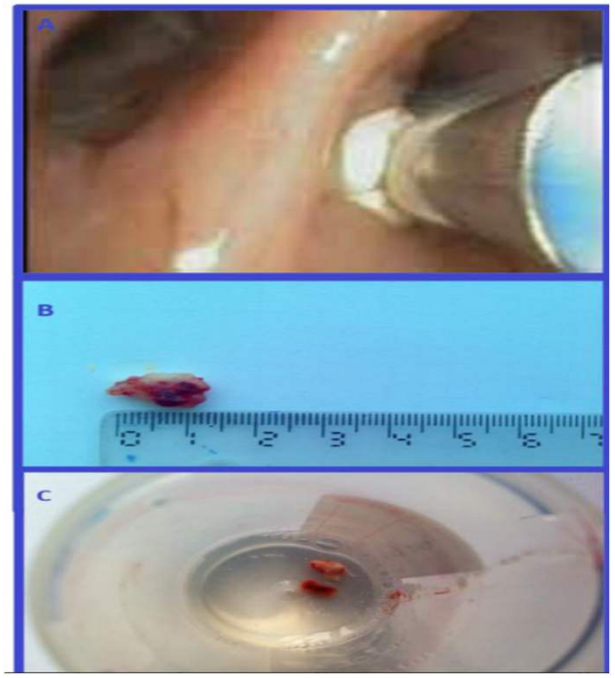
A 37-year-old man was hospitalized for suspicion of COVID-19 pneumonia on January 27, 2021. This non-smoker and athletic patient was only treated for hypertension (Ibesartan) and worked as a host in a nursing home where a COVID-19 cluster raged at this time. His symptoms began on January 17, with fever, dry cough, dyspnoea, headache, myalgia, diarrhea. In this context, the patient underwent two RT-PCR pharyngeal swabs (January 18, 2021 and January 21, 2021) that were negative for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The symptoms persisted despite a prescription of amoxicillin and he was addressed to our university hospital. The patient presented with fever (39°C), asthenia, headache, and dyspnea. On clinical examination the BMI was 26 kg/m^2; blood pressure 135/80 mmHg; crackles were heard bilaterally, and the transcutaneous O2 saturation was 92%. Laboratory tests: WBC = 3,900 $cells/mm^3$ (57% neutrophils, 32% lymphocytes), CRP: 14.7 mg/L, normal d-dimer value (0.38 µg/ml), arterial blood gas while breathing room air: pH, 7.45; PaO_2, 59.9 mm Hg; and $PaCO_2$, 36.4 mm Hg. Thoracic computed tomography (CT) showed mild evidence of pulmonary lesions related to COVID-19 (15% lung involvement by ground glass opacities). A third pharyngeal swab RT-PCR (January 27, 2021) was negative as well as the blood hemocultures. A diagnostic bronchoalveolar lavage (BAL) was proposed, and performed on January 28 (Olympus bronchovideoscope BF-H190, Tokyo, Japan), 12 days after the onset of symptoms. Bronchoscopy examination using white light (WL) was unremarkable without any abnormal aspect of the bronchial mucosa except a striking unusual presence of bronchial vessels. Narrow band imaging (NBI) bronchoscopy revealed a diffuse hypervascularization of the mucosa from the trachea to the sub-segmental bronchi, associated with dilated submucosal vessels which were developed on the axis of the bronchi (Figures 1A,B). Bronchoalveolar lavage (BAL) was performed in RB4 and its RT-PCR analysis confirmed the presence of SARS-CoV-2. The patient received cefotaxim and dexamethasone during 6 days. He became apyretic with an O_2 saturation of 100% and returned home on February 2, 2021.

Case study bronchoscopy view



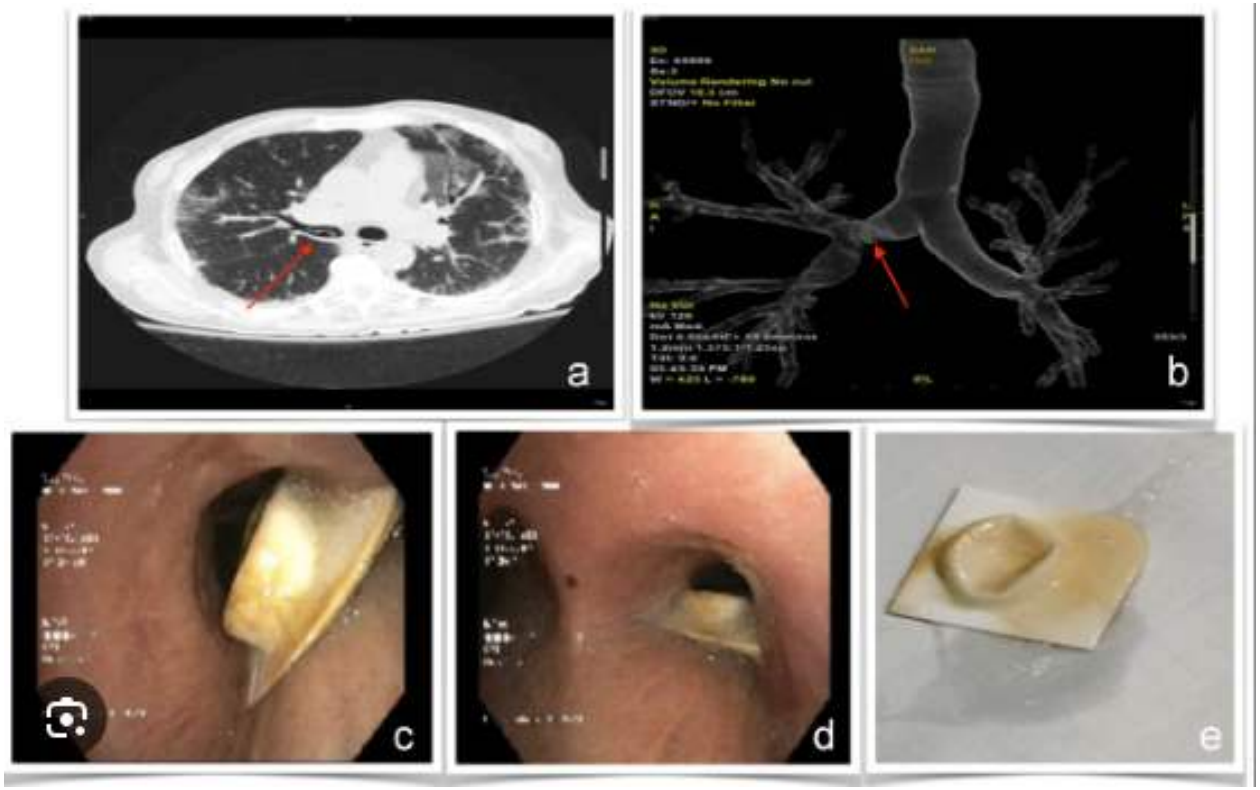
Forceps biopsy of a right mainstem tumor



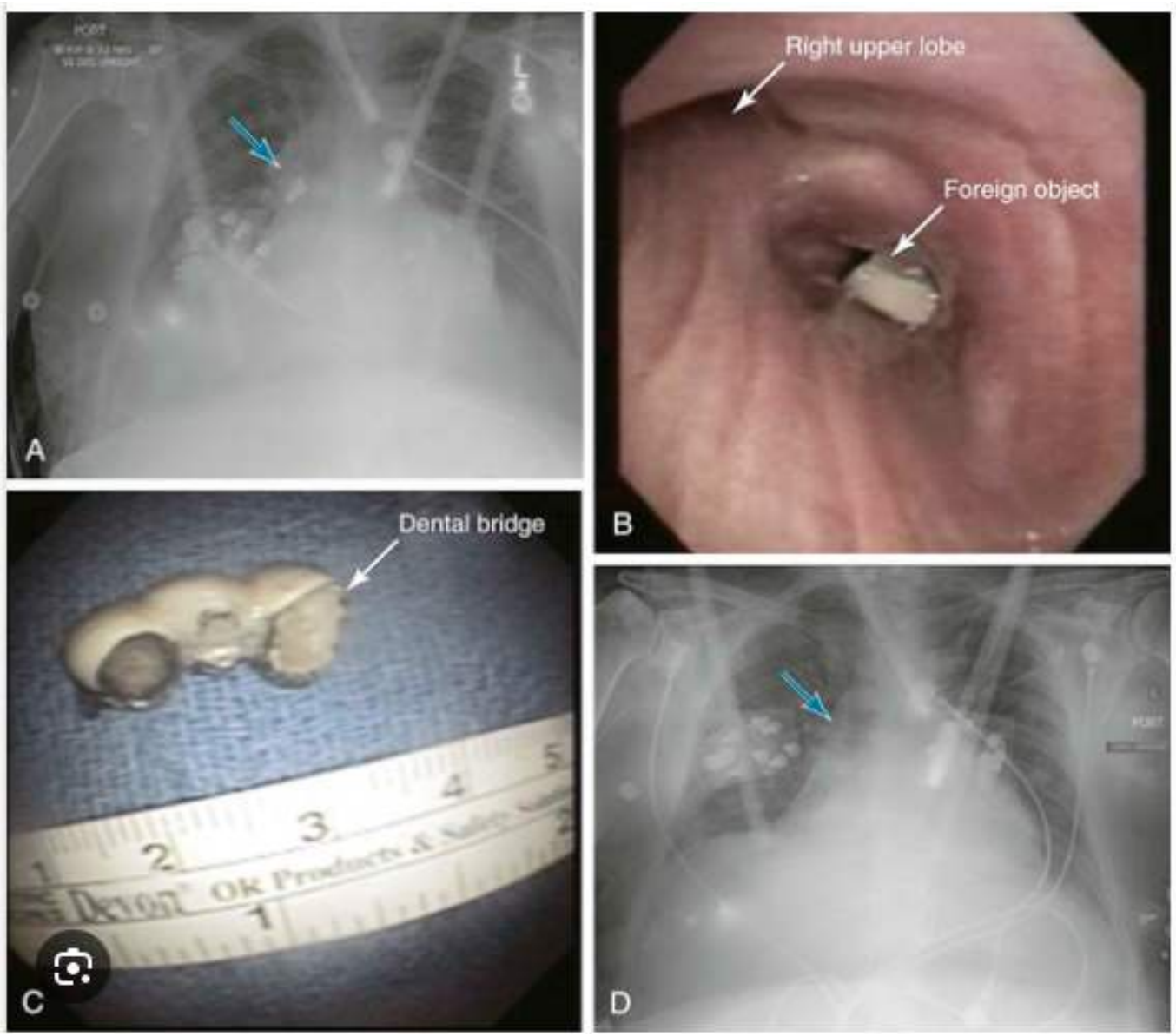


Medicina **2023**, *59*(10), 1723; https://doi.org/10.3390/medicina59101723 accessed Feb. 18,2024

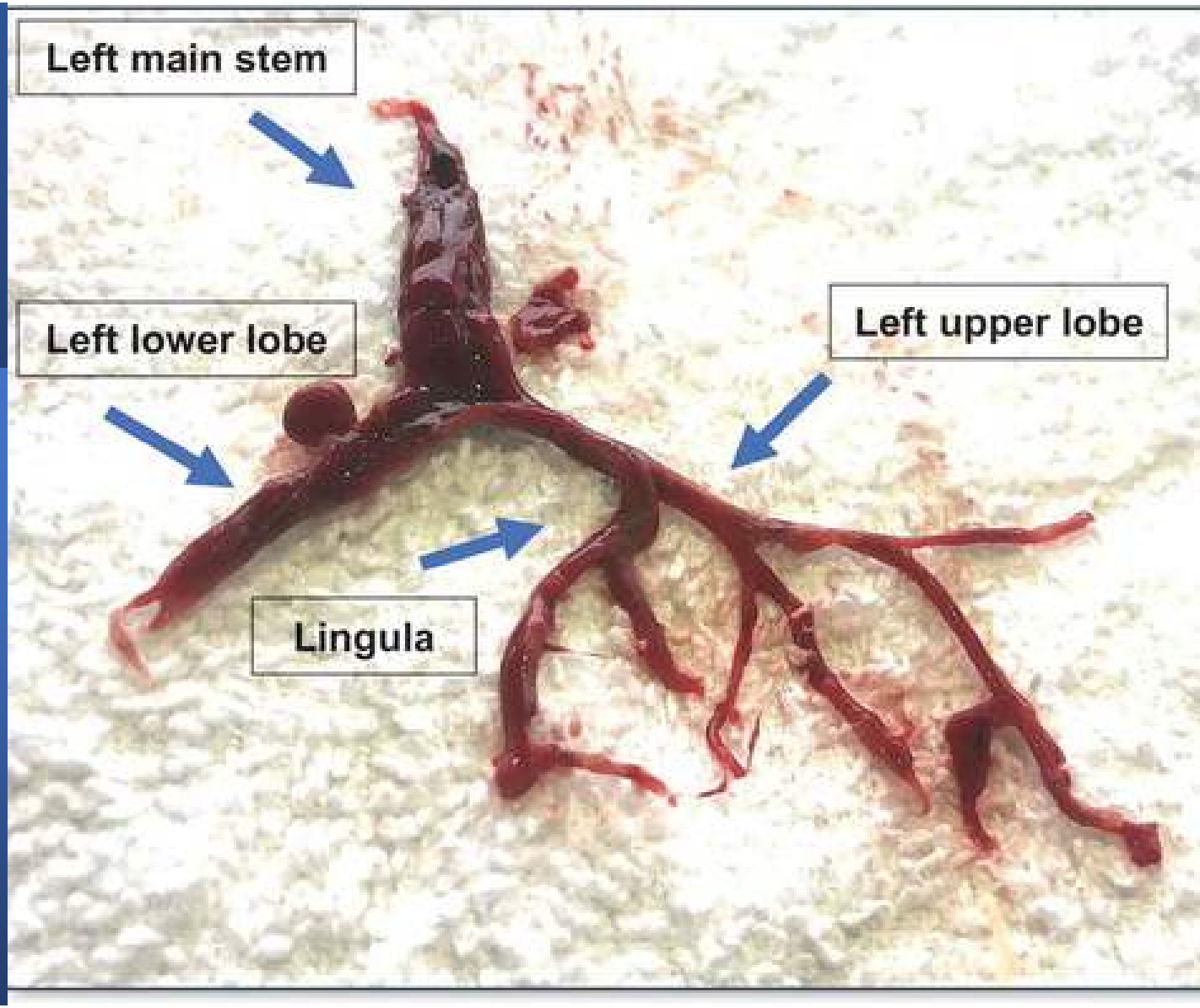
You never know what you will see or find



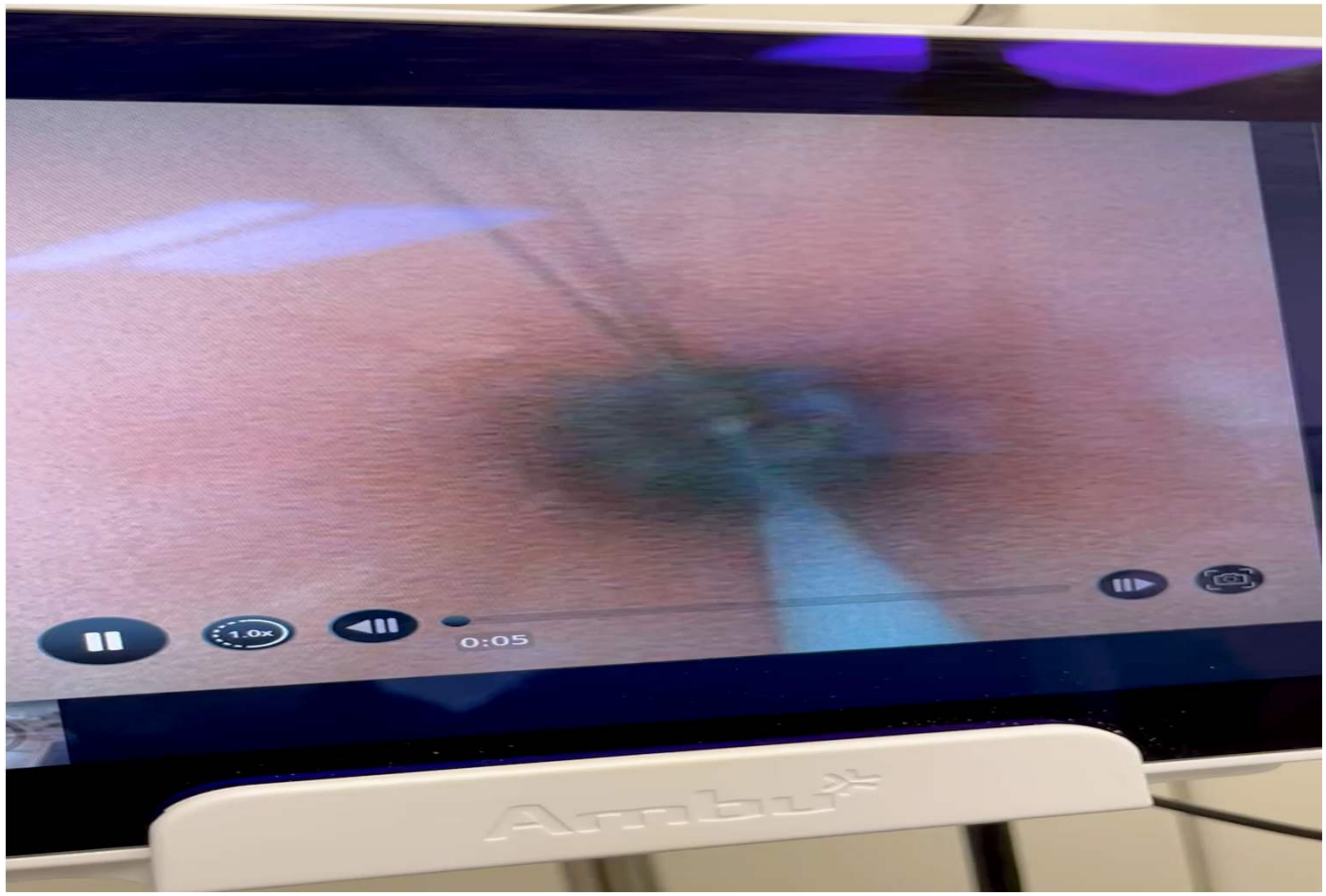
Dental Bridge



Bronchial casting



Therapeutic Bronch Cancer Patient



Bronchial Wall Perforation

Use of Forceps for coil retrieval

Respiratory Therapists in bronchoscopy

> Respir Care. 1985 May;30(5):323-7.

A role for the respiratory therapist in flexible fiberoptic bronchoscopy

D P Coppolo, L T Brienza, D S Pratt, J J May

PMID: 10315659

Abstract

All bronchoscopies in our institution are performed by physician-respiratory therapist teams. The therapist instructs the patient, anesthetizes him, does the biopsies, and prepares specimens for laboratory testing.

Methods: We undertook a retrospective study of our performance to evaluate the safety, yield, and cost of this system.

Results: Of 216 procedures evaluated, therapist-performed biopsies provided a specific diagnosis in 55%. When a tumor-like mass was seen directly, biopsies were positive 95.7% of the time. No procedure was associated with death. Complications included fever in about 9%, hoarseness in 2%, hemoptysis in 1%, and pneumothorax in one procedure (0.5%). Our institutional costs for flexible fiberoptic bronchoscopy by a physician-respiratory therapist team were only 34% of what they would have been if the same procedures had been performed in the operating room. RESULTS performed were comparable to all others reported in the literature.

Conclusion: This study clearly demonstrates that respiratory therapists can provide high quality, low cost, safe bronchoscopic assistance to pulmonary internists.

Respiratory Therapists

- Site dependent
- Some sites have Respiratory Therapists in bronch suites
- Most RT's assist in Bronchoscopies in Intensive Care Units
  - Set up and prepare equipment
  - Prepare patient (ventilator, bite block, lidocaine, 02)
  - Monitor ventilator, hemodynamics (adjust alarms, volumes, saturations)
  - Instill lidocaine, epi, saline flush
  - Monitor suction, change traps, keep track of aliquots and medications
  - Assist in processing slides, formalin, BAL specimens
  - Monitor patient post procedure, return to previous ventilator settings, clean room, process equipment and document in EMR.

Conclusion

- The role and use of bronchoscopes continues to advance
- Respiratory Therapists play an important role in bedside and lab procedures.
- There are many interesting papers on cases available through multiple databases for knowledge advancement.

Questions?