HEALTH TECH ACADEMY

Thoracic and Pulmonary Surgery

Additional Surgical Techniques

Lesson Objectives:

1. Identify key anatomical features of the respiratory structures in the thoracic cavity
2. Describe diagnostic procedures of the respiratory system
3. Discuss pathology of the respiratory system
4. Discuss specific elements of case planning in surgery of the thoracic cavity and respiratory system
5. List and describe common thoracic procedures of the respiratory system

Thoracic and Pulmonary Surgery

Scope

Procedures of the respiratory system and thoracic cavity, excluding cardiac interventions.

Involves lungs, bronchi, and peripheral bronchial system.

Procedures

Surgeries on lungs, bronchi, and other thoracic organs like the esophagus and thymus.

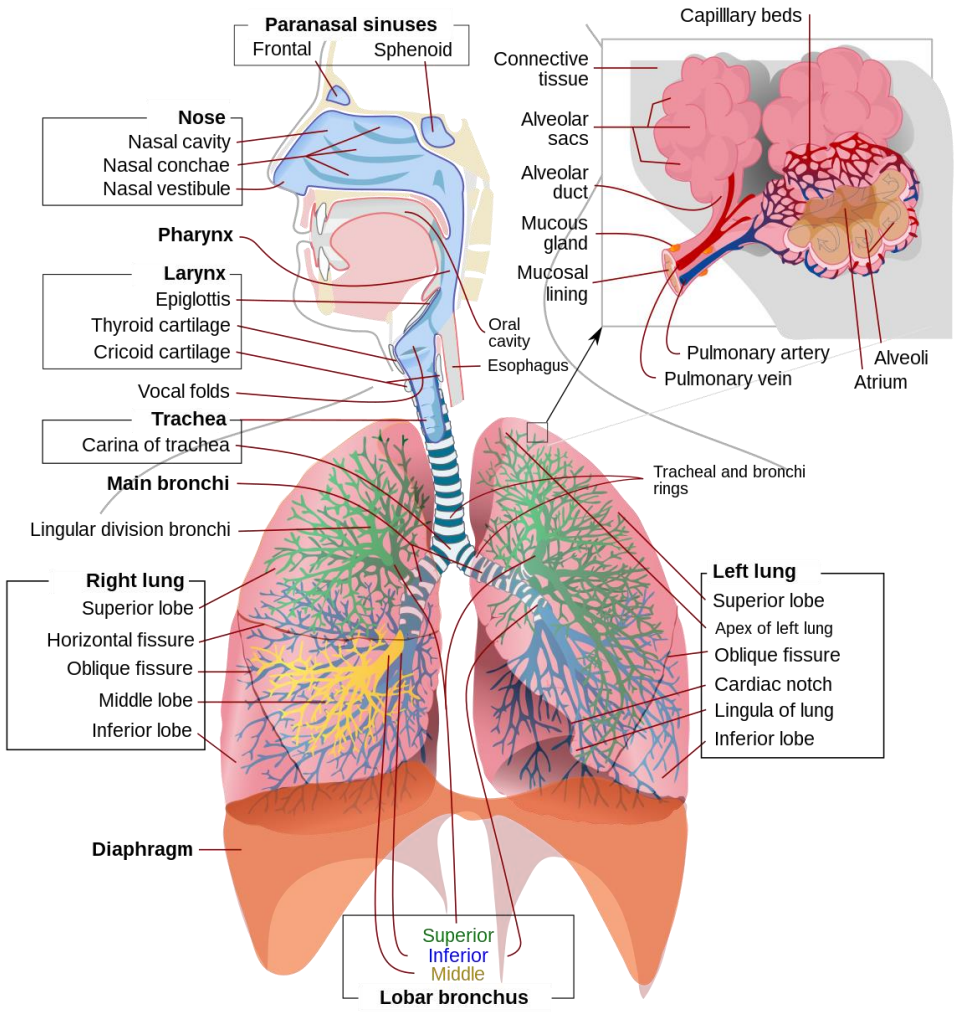
Techniques

Open or video-assisted thoracic surgery commonly used.

Flexible endoscope or rigid bronchoscope used for interventional procedures.

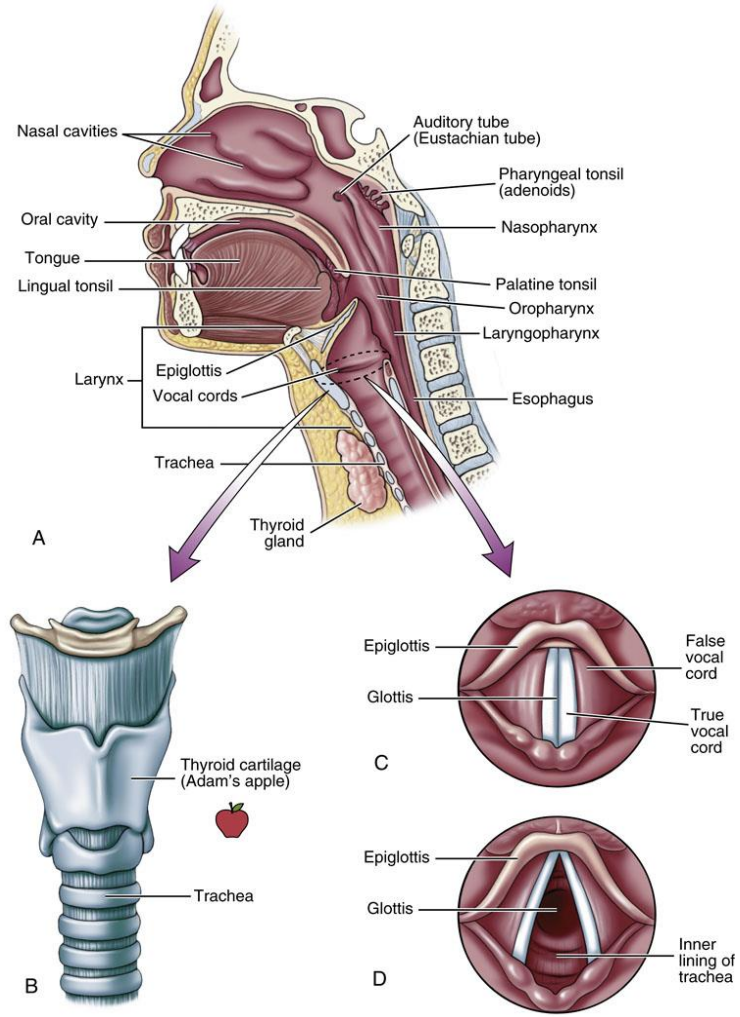
Respiratory System Overview

- Divided into upper and lower tracts.
- **Upper tract:** Nose, nasal cavities, mouth, pharynx, larynx.
- **Lower tract:** Trachea, bronchi, bronchioles, lungs.
- **Function:** Oxygen intake, carbon dioxide elimination.



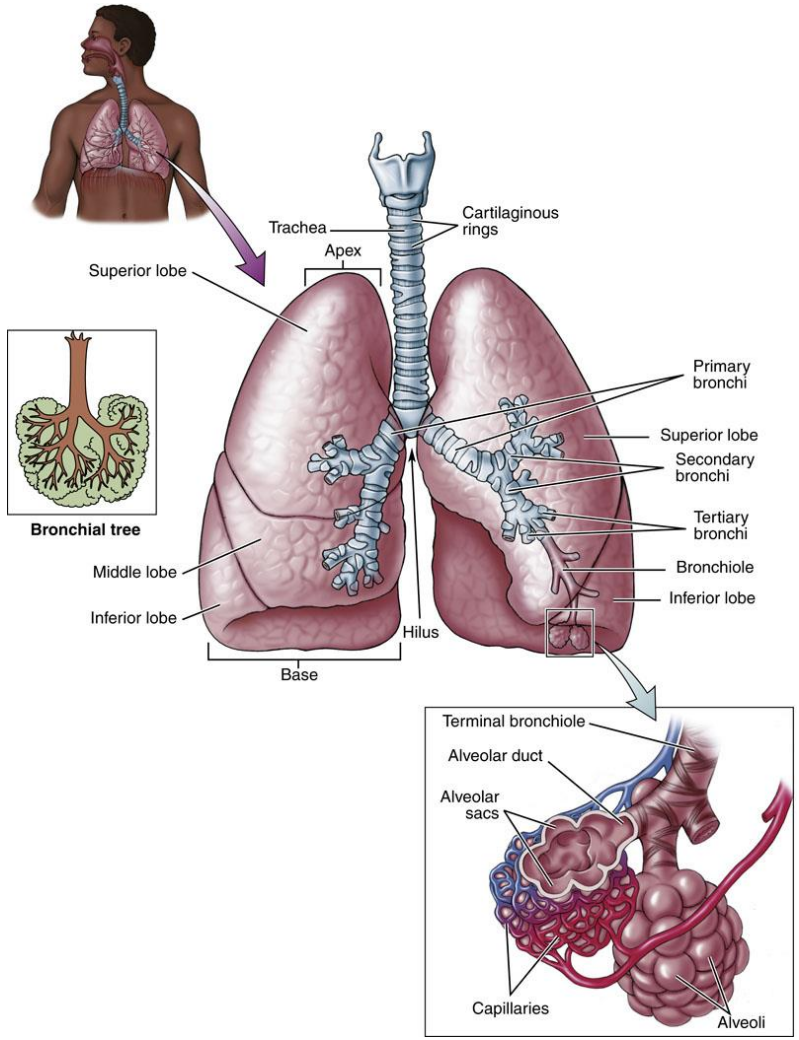
Upper Respiratory System

- **Respiratory Processes:**
  - Ventilation: Breathing process, involving diaphragm contraction.
  - Diffusion (oxygen): Transfer from alveoli to bloodstream.
  - Perfusion (oxygenation): Movement into body tissues.
- **Upper Respiratory Tract:**
  - Nasal anatomy: Cartilage, bone, mucous membrane.
  - Nasal sinuses: Structures formed by bony projections.
  - Functions: Filtration, warming, humidification.



Lower Respiratory System

- **Trachea and Bronchi:**
  - Tracheal structure: C-shaped cartilaginous rings.
  - Bronchial branching: Right and left primary bronchi, bronchioles.
  - Bronchial walls: Cartilage support, smooth muscle, epithelium.
- **Lungs:**
  - Lobes and segments: Right (3) and left (2) lobes.
  - Bronchopulmonary segments: Functional units.
  - Pleural cavity: Double membrane, pleural fluid, negative pressure.

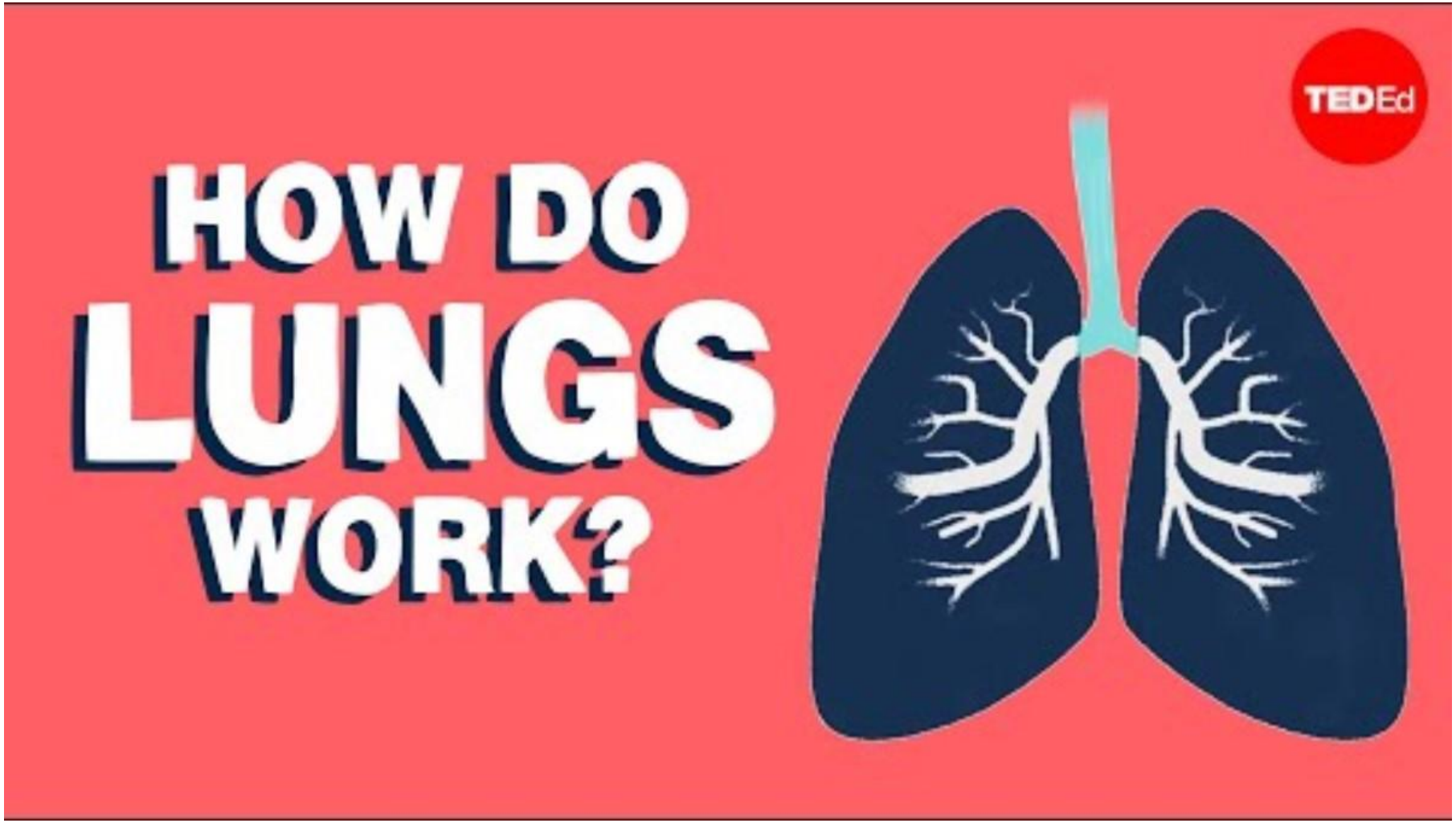


Mechanism of Breathing

- Controlled by autonomic nervous system & voluntary control
- Thoracic cavity: closed space
- Diaphragm continuous with parietal pleural membrane
- Pressure: negative between pleural membranes, equal to atmospheric pressure in airways
- **Inhalation**: Diaphragm contracts, decreasing potential space, pulling air into lungs
- **Exhalation**: Diaphragm relaxes, air flows passively out of lungs

Watch the "How Lungs Work" Video

How Lungs Work Video



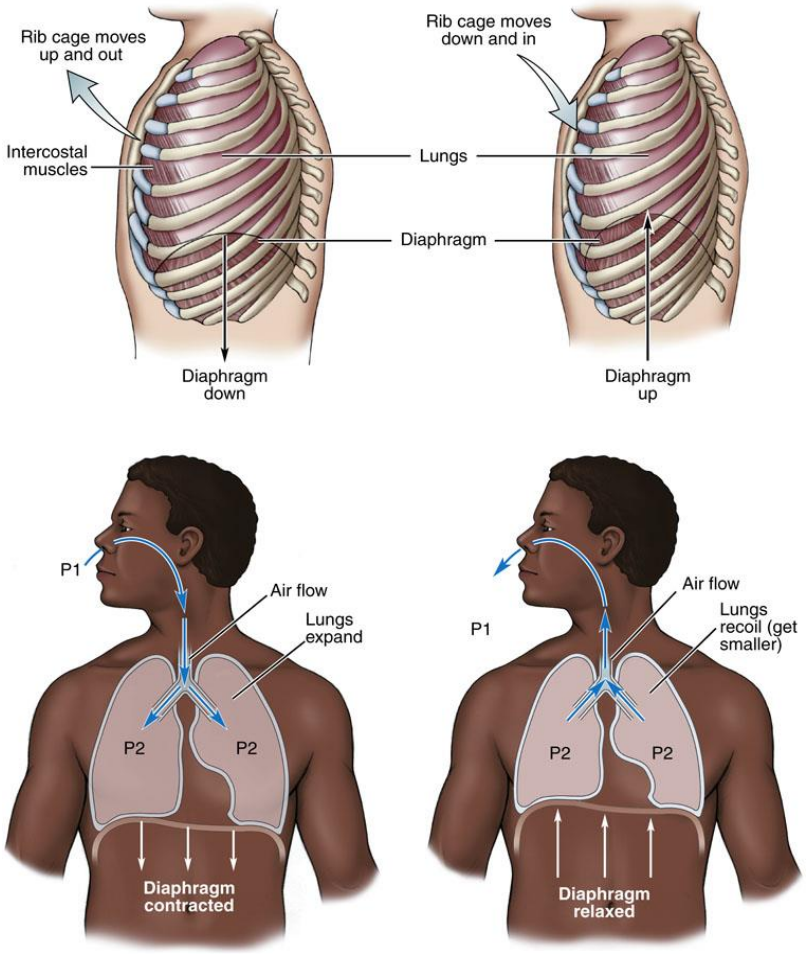
How Lungs Work Video

Summary of Video:

- Autonomic Nervous system – Breathing happens automatically
- Diaphragm – muscle under the lungs above the abdomen
- Lungs exchange Oxygen and CO2
    - Aveoli are air sacs where this takes place through diffusion

Factors Affecting Breathing

- **Intact Pleural Membrane**: Maintains negative pressure, like a vacuum-sealed package
- **Penetrating Trauma**: Collapses lungs, e.g., pneumothorax, hemothorax
- **Alveolar Elasticity**: Diseases like emphysema constrict alveoli, impairing gas exchange
- **Intact Central Nervous System**: Initiates diaphragm control; e.g., barbiturate drugs can depress CNS
- **Chest Cavity Expansion**: Pathological restrictions like eschar from burns

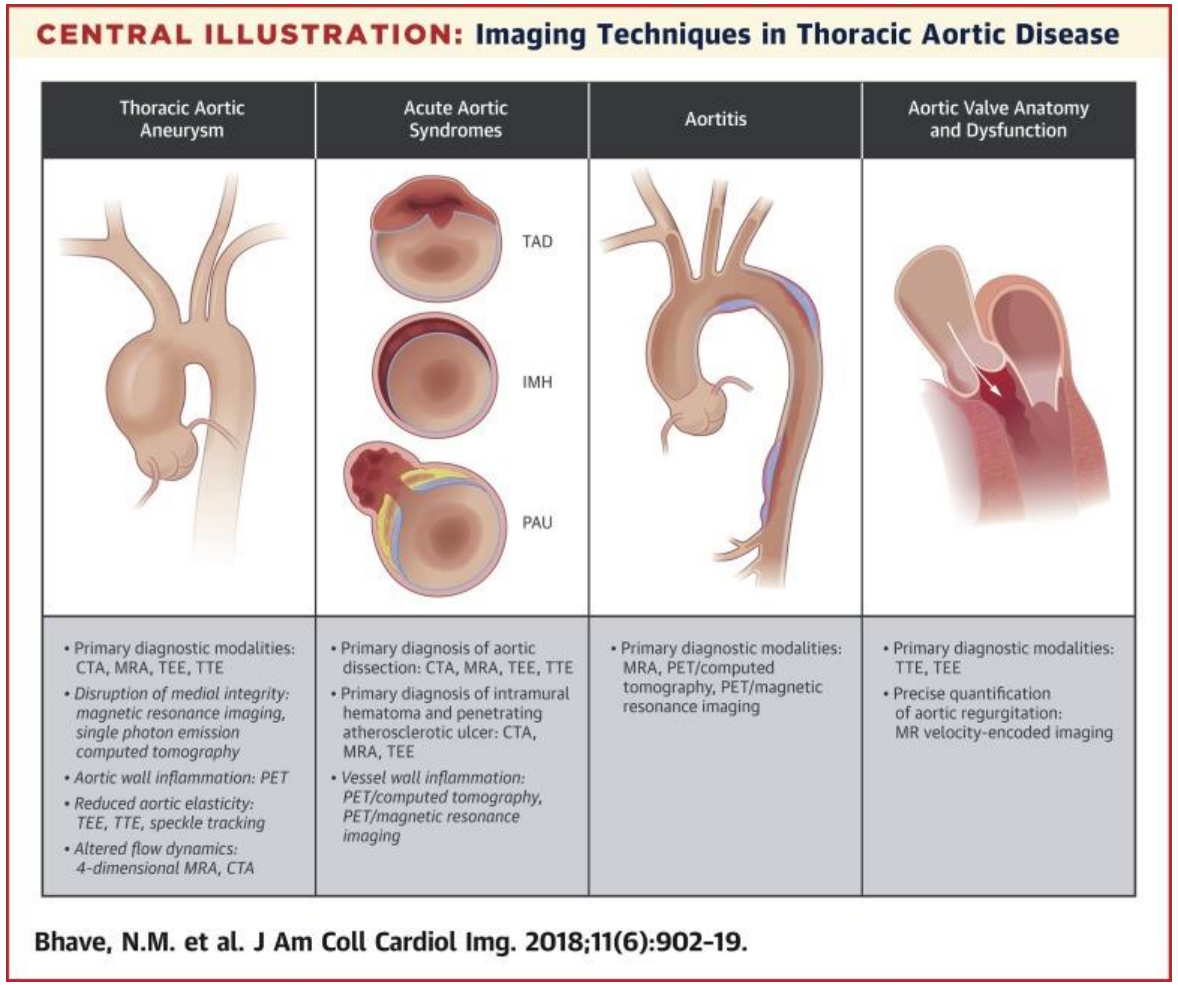


Diagnostic Testing

Diagnostic tests for the respiratory system assess the function of the lungs, thoracic space, and bronchial system

Diagnostic tests include:

- Pulmonary function
- Laboratory test
- Imaging studies

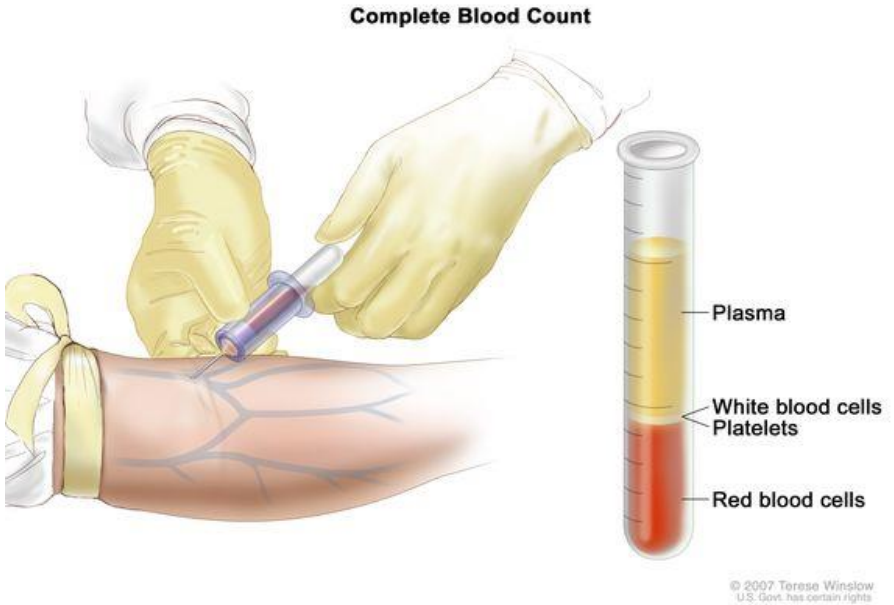


Pulmonary Function Tests (PFTs)

- Measures lung function
- Following tests are included in this group
  - **Tidal Volume**: Air exhaled during normal respiration
  - **Minute Volume**: Air exhaled per minute
  - **Vital Capacity**: Total air exhaled after maximum inspiration
  - **Functional Residual Capacity**: Volume of air remaining in lungs after exhalation
  - **Total Lung Capacity**: Total air in lungs when fully inflated
  - **Forced Vital Capacity**: Air expelled in first, second, and third seconds after exhalation
  - **Peak Expiratory Rate**: Maximum air expelled in forced expiration

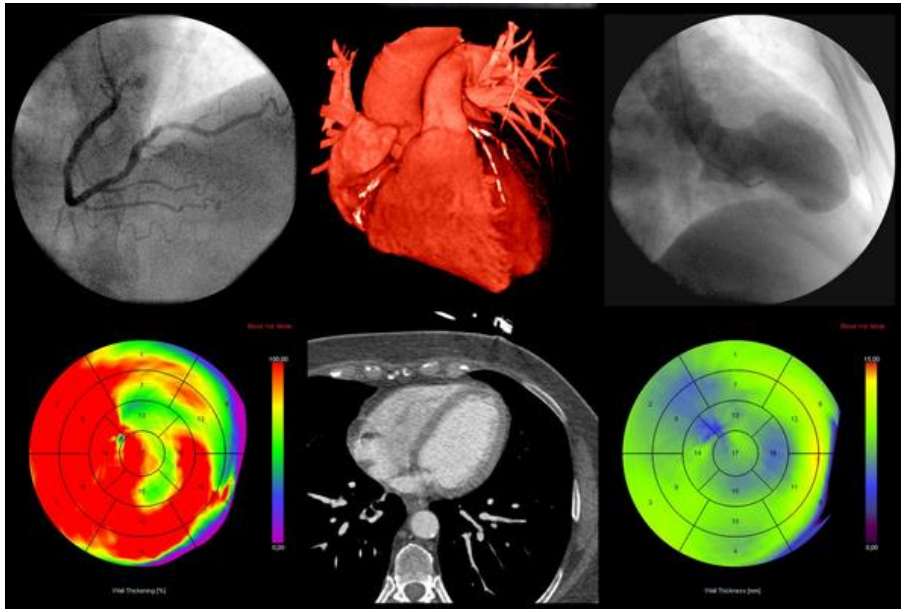
Laboratory Tests

- **CBC (Complete Blood Count)**: Basic screening tool for surgical patients
- **Arterial Blood Gas (ABG)**: Determines oxygen, carbon dioxide levels, and pH
- **Culture and Sensitivity Tests**: Assess exudate collected from respiratory tract



Imaging Studies

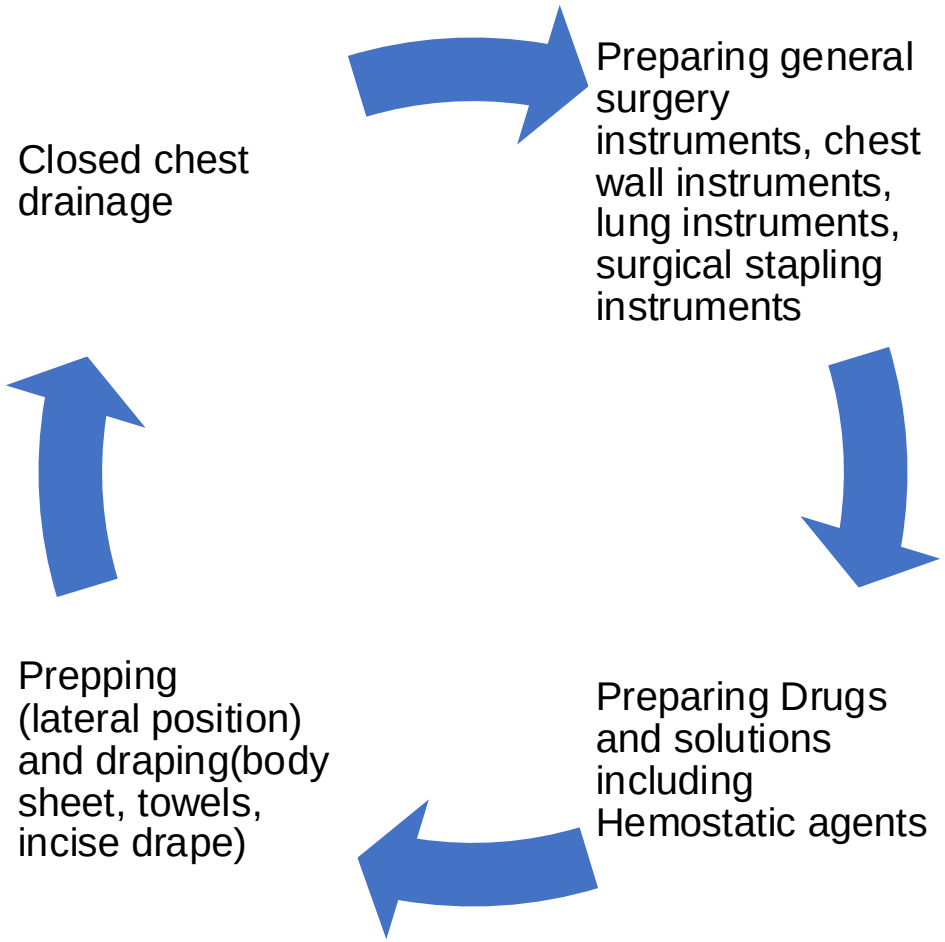
- **Radiographs**: Screening for tuberculosis and fibrotic diseases
- **MRI (Magnetic Resonance Imaging)**: Detailed analysis of masses
- **Ultrasound Scans**: Assessment of pulmonary and thoracic structures
- **CT (Computed Tomography)**: Definitive analysis of masses, fluid, and air in pleural space
- **Pulmonary Angiography**: Injection of contrast medium to detect abnormalities in lung blood vessels



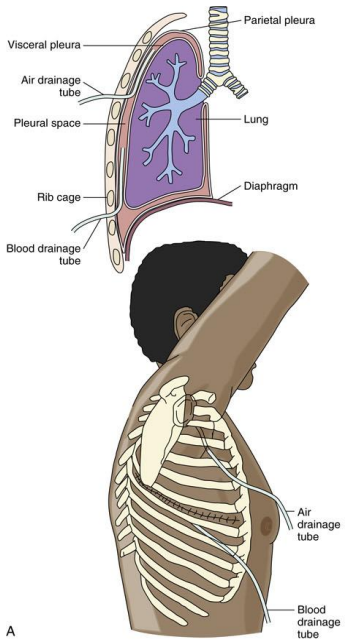
Instrumentation and Equipment

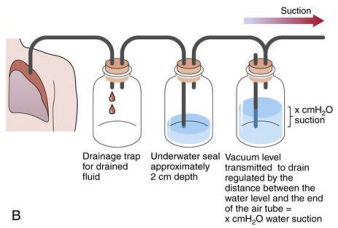
- **Instrumentation**
  - Thoracic procedures: instruments needed to remove a rib (e.g., Bethune rib shears and Mat son rib stripper/elevator) and expose and repair the organs of the thorax
  - Thoracotomy: vascular instrument set and thoracotomy instrument set
- **Anesthesia monitoring equipment**
  - Swan Ganz and arterial catheters-
    pulmonary wedge pressure and central venous pressure readings
  - Electrocardiography equipment
  - Oxygen saturation equipment
  - Temperature equipment-Temperature foley
  - Blood pressure equipment-arterial line
  - Double-lumen endotracheal tube-to be able to collapse a lung if necessary

Case Planning



Chest Drainage System





Surgical Procedures

- Insertion of chest tubes
- Flexible bronchoscopy
- Navigational bronchoscopy
- Rigid bronchoscopy
- Mediastinoscopy
- Video-assisted thoracic surgery (VATS)
- VATS lung biopsy
- Acute pulmonary thromboembolectomy
- Lung volume reduction surgery (LVRS): Open technique
- Thoracotomy
- Lobectomy: VATS
- Open pneumonectomy
- Decortication of the lung
- Lung transplantation

Watch the "VATS Right Upper Lobectomy" Video

VATS Right Upper Lobectomy

VATS Right Upper Lobectomy

Summary of Video:

- Lung lobe/mass removed for cancer treatment
- Lymph nodes for cancer staging
- Lateral position, port placement
- Blood vessels controlled
- Lung lobe stapled and removed

Watch the "Thoracotomy Decortication" Video

Thoracotomy Decortication Video

Thoracotomy Decortication Video

Summary of Video:

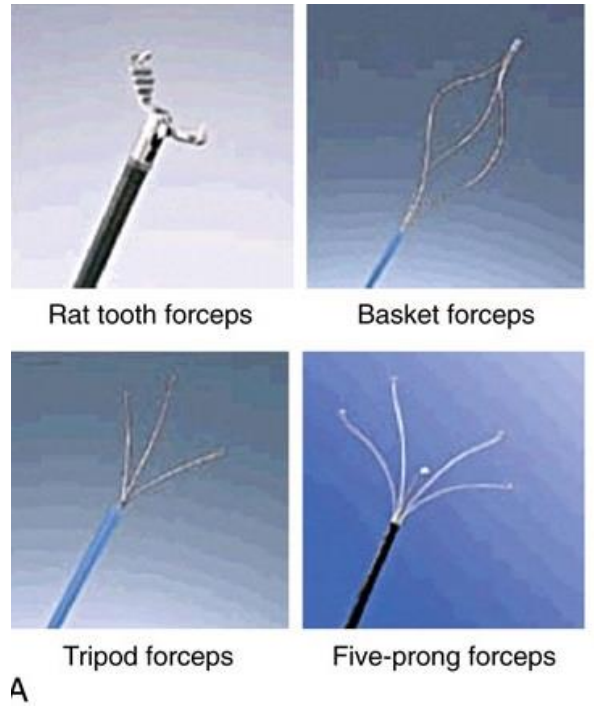
- Thoracotomy may be done if VATS is not possible
- Decortication helps the lung to expand – reduces restriction

Insertion of Chest Tubes

- **Purpose of Chest Tube Insertion:**
  - Provide closed chest drainage
  - Restore negative pressure for lung expansion
- **Procedure for Insertion:**
  - Surgically inserted during thoracotomy
  - Inserted just before chest closure
- **Indications for Chest Tube Insertion:**
  - Spontaneous or traumatic air leak
  - Open surgical procedure in pleural cavity
- **Tube Composition and Placement:**
  - Heavy Silastic or polyvinyl chloride tubing
  - Numerous perforations at proximal end
  - Sutured with heavy, non-absorbable sutures
- **Post-Insertion Care:**
  - Dressing with petroleum gauze and fluffed, flat gauze
  - Connected to water-seal chest drainage system
  - Application of suction

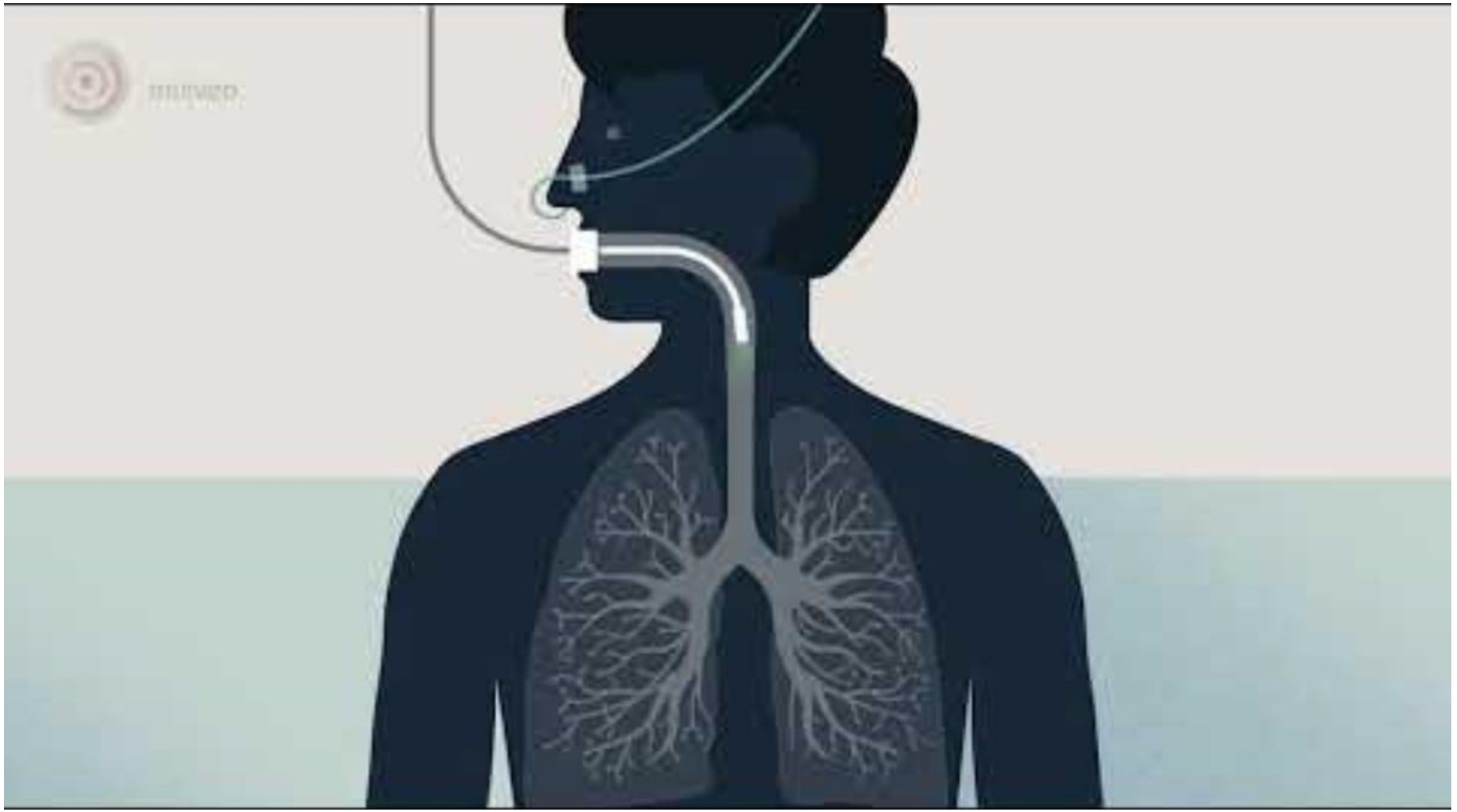
Flexible Bronchoscopy

- **Flexible Bronchoscopy Overview:**
  - Slender fiber-optic endoscope for primary and peripheral bronchi
  - Capable of interventional procedures like foreign body retrieval, cryosurgery, and laser surgery
  - Sizes range from 2.8 mm to 5.9 mm
  - Commonly performed in ambulatory surgery facilities or hospital departments
  - Often combined with rigid bronchoscopy in the same procedure
- **Technical Points and Discussion:**
  - Patient preparation and draping
  - Insertion of bronchoscope through mouth or nose
  - Collection of cytology or biopsy specimens
  - Innovations in tumor-ablating devices for tissue debridement



Watch the "Bronchoscopy – examination of your airways" video to gain insight into the procedure

Bronchoscopy Video



Bronchoscopy Video

- **Summary of the video!**

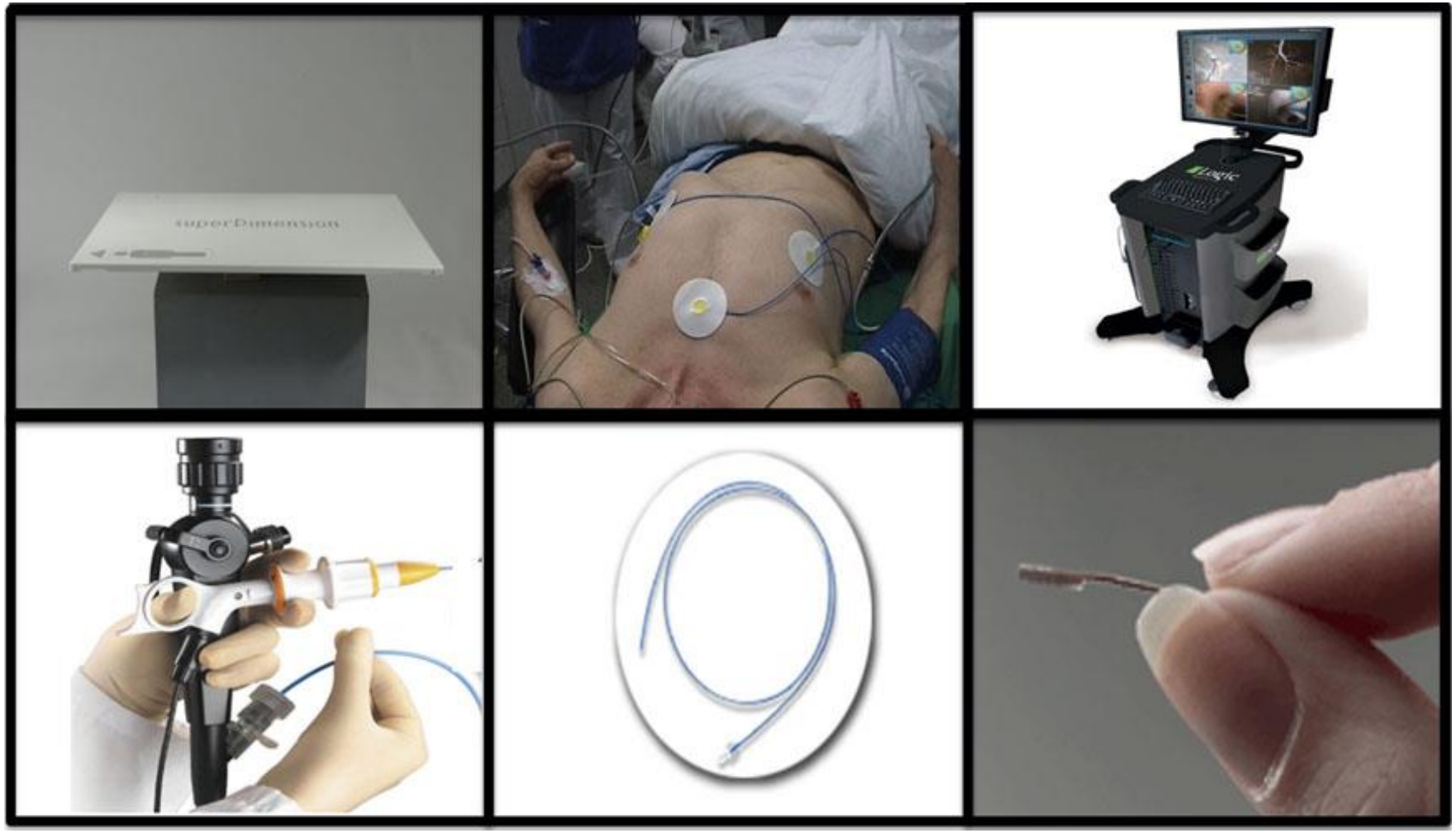
Overview of Bronchoscopy procedure:

  - Patients escorted to examination room and numbed throat.
  - Sedation causes throat swelling and difficulty swallowing.
  - Bronchoscope inserted via nose or mouth, with mouth guard if needed.
  - Physician examines airways, collects samples, rinses if necessary, and removes bronchoscope slowly.

Navigational Bronchoscopy

- Performed during flexible bronchoscopy.
- Aims to accurately locate suspicious lymph nodes.
- **Electromagnetic Navigational Bronchoscopy (ENB):**
  - Utilizes navigational software and electromagnetic field.
  - Guides bronchoscope with sensing probe, tracked by computer.
  - Virtual map aligned with CT scan anatomy on monitor.
  - Surgeon positions bronchoscope using monitor guidance.
- **Endobronchial Ultrasound (EBUS) with Needle Biopsy:**
  - Identifies mediastinal and hilar lymph nodes.
  - Radial probe and ultrasound assist in node identification.
  - Needle biopsy confirms diagnosis.

Navigational Bronchoscopy



Rigid Bronchoscopy

- Endoscopic procedure for trachea and bronchi assessment and interventions
- Requires large-bore instruments

- **Procedure and Anesthesia:**
  - Performed under general anesthesia
  - Ventilation circuit attached for intermittent ventilation and anesthesia delivery
- **Role of Surgical Technologist:**
  - Hands-on training on equipment and techniques
  - Assembly and setup of bronchoscope and supplies
  - Direct assistance to surgeon during surgery
  - Specimen collection and management

- **Instruments and Equipment:**
  - Components of rigid bronchoscope
  - Imaging system requirement
  - Basic instruments required
- **Team Positions:**
  - Surgeon at patient's head
  - Surgical technologist next to surgeon or at chest level
- **Complications:**
  - Injury to tracheobronchial structures
  - Autonomic gag reflex
  - Possible complications like lacerations and infections

Mediastinoscopy

- Endoscopic examination of the mediastinum through an incision.
- Thymus and lymph node biopsies performed for diagnosis.
- Often replaced by EBUS.
- **Pathology:**
  - Diagnostic or interventional surgery.
  - Biopsy of thymus gland and regional lymph nodes.
  - Determines or rules out cancer diagnosis.
- **Technical Points and Discussion:**
  - Patient prepped and draped.
  - Incision made over suprasternal notch.
  - Lymph node biopsy performed routinely.
  - Wound closed with absorbable sutures and staples.

Watch "How to perform a mediastinoscopy" video to know the step-by-step procedure of this surgery

How to perform a mediastinoscopy Video

Pulmonology and Lung Surgery

Thoracic Procedures

How to perform a mediastinoscopy?

How to series

Min P. Kim, MD

Vice Chair, Department of Surgery
Head, Division of Thoracic Surgery
Houston Methodist Hospital

How to perform a mediastinoscopy Video

- **Summary of the video:**
  - Patient positioned with neck extended.
  - Three cm incision made above sternal notch.
  - Platysma layer divided transversely.
  - Lymph nodes identified and dissected.
  - Hemostasis achieved and incision closed.

Read Chapter 31 from the E-Book

Read Chapter 31 from your E-Book to pass the upcoming quiz from **Surgical Technology - Elsevier eBook on VitalSource, 8th Edition.**

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Thank you!

Get ready for your quiz and rest of the activities now. Best of luck!

Congratulations!

Lesson 31 is complete.