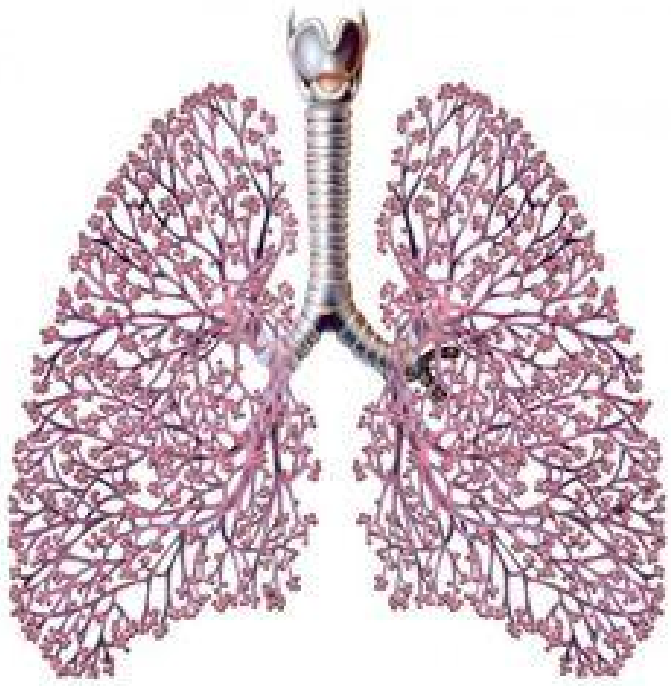

Presentation & management of common thoracic disease

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Objectives:

1.Surgical Anatomy, Blood Supply, Airway Anatomy
2.Congenital Diseases lungs
3.Assessment of the patient
4.Bronchogenic Carcinoma Primary: (SCLC - NSCLC)
5.Assessment for pulmonary resection
6.Metastatic Disease
7.Other lung tumors
8.Mediastinum
9.Pneumothorax (Types and management)
10.Chest trauma
11.Pleuro-pulmonary infection: (Lung abscess, Bronchitis, Tuberculosis, Aspergilloma, Hydatid cyst, Empyema)
12.Chest wall deformities
13.M. Postoperative Care

Color Index:
-Doctor's Notes -Surgery Recall -Doctor's Slides+433 team -Important -Extra

Correction File
Email: Surgeryteam434@gmail.com

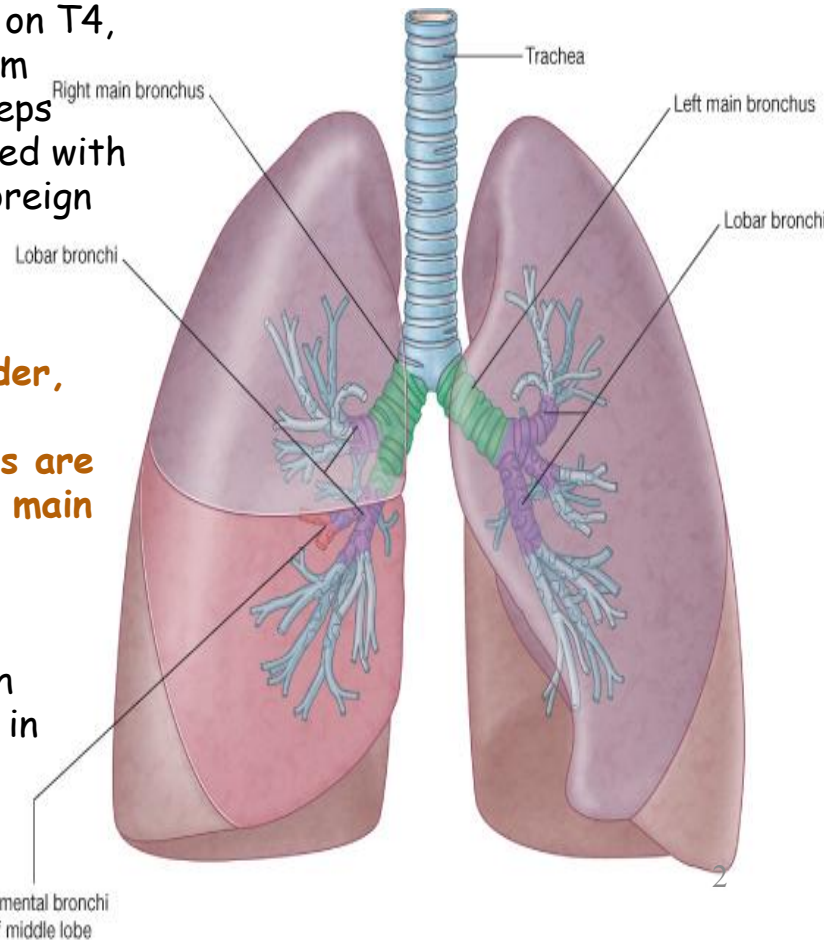
The Lung

Embryology	Anatomy
▪ **Bronchial system** ▪ **Alveolar system**	• **Lobes and fissures:** The right lung is divided into 3 lobes by the oblique and horizontal fissures. The left lung is divided into 2 lobes by the oblique fissure • **Segments** • **Blood supply:** Lungs don't receive any vascular supply from the pulmonary vessels (pulmonary artery or vein) Blood is delivered to lung tissue via the bronchiole arteries Vessels evolve from aortic arch Travel along the bronchial tree

Airways

Trachea, primary bronchi, secondary bronchi, tertiary bronchi out to 25 generations.
All comprised of hyaline cartilage

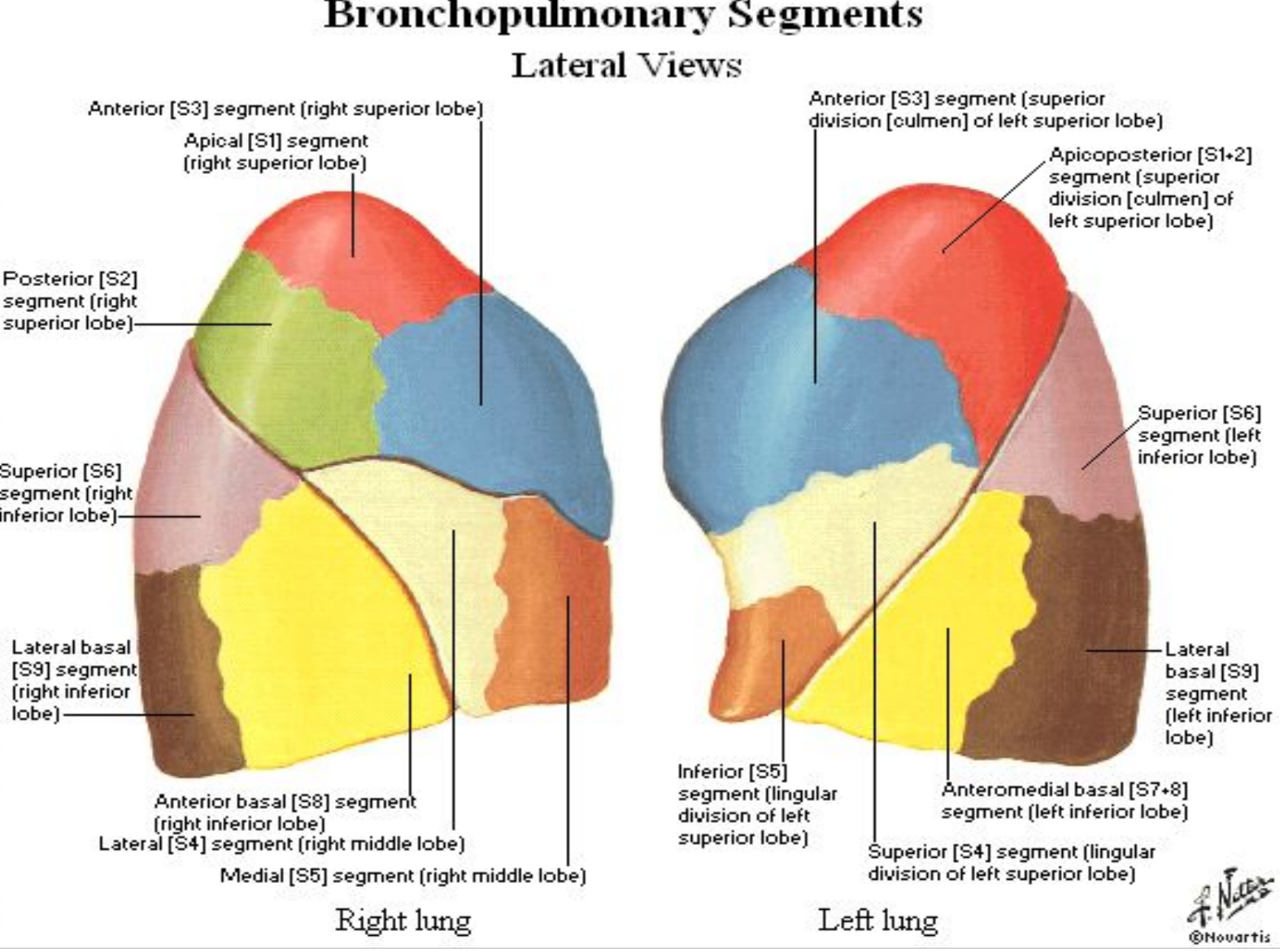
Trachea:
Begins where larynx ends (about C6) divid on T4,
10 cm long, half in neck, half in mediastinum
20 U-shaped rings of hyaline cartilage, keeps lumen intact but not as brittle as bone Lined with epithelium and cilia, which work to keep foreign bodies/irritants away from lungs



Primary bronchi:
- Right primary bronchus is shorter, wider, and more vertical than the left primary bronchus.Therefore, when foreign bodies are aspirated, they often lodge in the right main bronchus.

Bronchioles:
First level of airway surrounded by smooth muscle; therefore can change diameter as in bronchoconstriction and bronchodilation
Terminal bronchioles
Respiratory bronchioles 3-8 orders

Alveoli



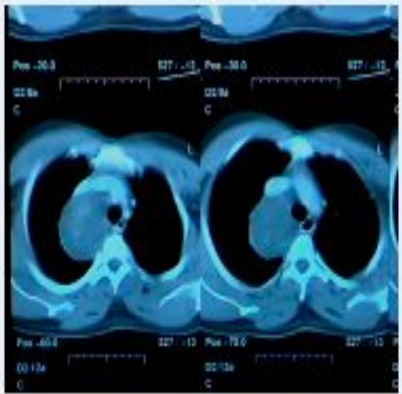
Bronchopulmonary segments:

Each of the tertiary bronchi serves a specific bronchopulmonary segments.. There are 10 segments in the right lung and 8-10 segments on the left and each have their own artery.
Each segment is a discrete anatomical and functional unit, so a segment can be surgically removed without affecting the function of the other segments.

LUNG DISEASES		
Congenital	**Infectious**	**Tumors**
• Agenesis: • Hypoplasia • Cystic adenomatoid malformation • Pulmonary sequestration • Lobar emphysema • Bronchogenic cyst	• Lung Abscess • Bronchiectasis • Tuberculosis • Aspergillosis • Hydatid cyst	Malignant - Primary lung carcinoma - Secondary lung carcinoma Benign

Congenital lung diseases

Agenesis	Absence of the lungs
Hypoplasia	Incomplete development of the lungs
Cystic adenomatoid malformation	A cystic area within the lung that stems from abnormal embryogenesis. Usually an entire lobe of lung is replaced by non-functioning cystic area of abnormal lung tissue. **Presenting clinical features include:** **respiratory distress and recurrent respiratory infections. The usual appearance of *CCAM* on CXR is a mass containing air-filled cysts (Swiss cheese pattern),**
Pulmonary sequestration	It consists of a nonfunctioning mass of normal lung tissue that lacks normal communication with the airways, and often receives its own arterial blood supply from the systemic circulation (esp. thoracic aorta). Most of the time it is located in the left lower lobe. Treated surgically to prevent infections.
Lobar emphysema	Over-inflation of a pulmonary lobe (replacement of a whole lobe by bullae), which may compress the other remaining normal lobes. Air enters the lungs but cannot leave easily causing respiratory function to decrease. Treated surgically (lobectomy) in serious cases to allow normal lung to inflate.
Bronchogenic cyst	They can be located: In the mediastinum most commonly attached to trachea or below the carina (paratracheal or subcarinal) Or within the lung parenchyma (intraparenchymal) o Clinical features: They consist of semi-solid cartilaginous that secretes cheese like material, which is prone to infections. It may also result in hemorrhage and compression of the surrounding structures (i.e. trachea, aorta, and esophagus) patient then complains of SOB, stridor, cough and dysphagia. Could be asymptomatic found accidentally on CXE as a smooth opacity. They may transform to malignant adenocarcinoma. Treatment: surgical excision is done to confirm diagnosis, avoid complications such as malignancy, rupture, infection, and compression on vital organs.



infectious lung diseases

Lung abscess

causes	clinical features	investigations
As a complication of pneumonia, bronchial obstruction (by tumor or inhaled foreign bodies esp. in children), bacteremia, and septic emboli.	- copious production of **foul smelling sputum.** - Gradual onset - Productive cough - High fever - Night sweats - Weight loss & lethargy - Chest pain (pleuritic)	- CXR (air-fluid level) - CT scan 

treatment

- Antibiotics
- Drainage: internal and external
- Pulmonary resection (surgical treatment)

Indications of Pulmonary resection:

1. Failure of medical treatment
2. Giant abscess (>6 cm)
3. Hemorrhage (patient presents with hemoptysis)
4. Inability to rule out carcinoma (e.g. a 65 y/o very ill smoker can have lung cancer superimposed by abscess)
5. Rupture with resulting empyema

Type of Pulmonary resections:

- Lobectomy (main) or bilobectomy (2 lobes)
- Pneumonectomy

*** Empyema= collection of pus in an anatomical cavity (e.g. pleural empyema).**

infectious lung diseases

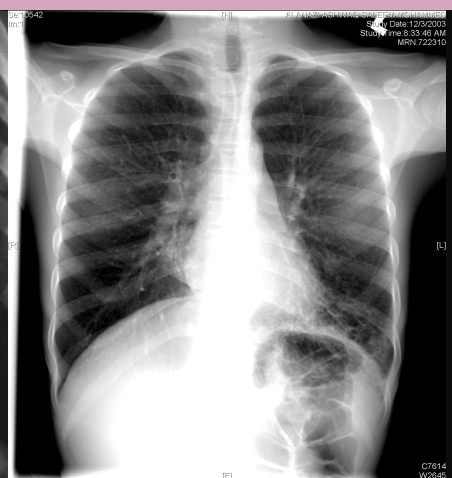
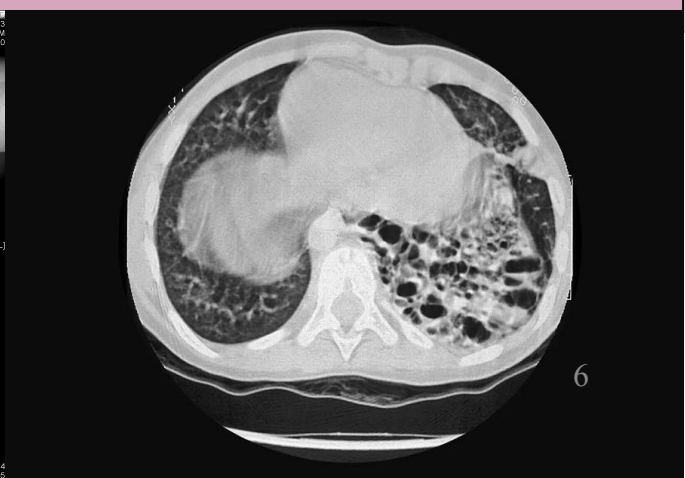
Bronchiectasis
Bronchial dilatation, usually affecting the lower lobes

causes	clinical features	Investigations
o Congenital (i.e. cystic fibrosis and immotile cilia syndrome) o Infection (repeated pulmonary infections and childhood infections) o Obstruction (by tumors/ inhalation of foreign bodies)	o Cough mostly in morning with copious amounts of sputum o Dyspnea o Hemoptysis (50%) o Clubbing (it is a chronic disease) **Types:** o Cystic o Cylindrical	o Bronchogram (invasive) o CT scan (more accurate) o Bronchoscopy (not commonly used nowadays) o CXR (cystic formation)

Treatment: (Cystic? Localized? Non-perfused? > Surgical)
(Cylindrical? Bilateral? Perfused? > Medical)

o Medical:
Resolve most cases (bronchodilators, antibiotics, and physiotherapy with postural drainage)

o Surgical indications:
Failure of medical treatment (E.g. a child inhales a foreign body > leading to bronchial tree obstruction (> right main bronchus) mom explains that her child was ok 6 months ago but now he has been getting repetitive chest infections/SOB/wheezing suspect foreign body inhalation bronchiectasis)
Cystic dilatation (not cylindrical which is treated medically)
Localized disease
Not perfused (assessed by V/Q scan), most of cystic bronchiectasis are not perfused whereas most of cylindrical are perfused.

infectious lung diseases

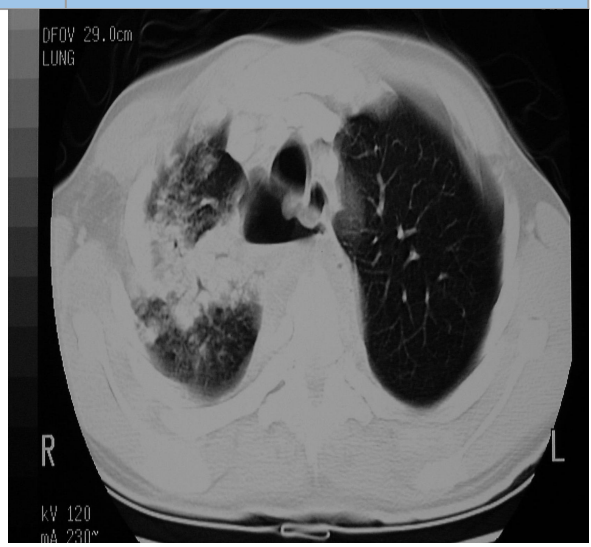
Tuberculosis

30,000 new cases occur annually in U.S.A

causes	Investigations	Treatment
o Pulmonary o Extrapulmonary (empyema, mediastinal lymphadenopathy)	o **CXR** (scarring in **apex**) o **AFB sputum culture** (if positive confirms TB) o **Tuberculin skin test** (latent TB) o **Bronchoscopy** o **Chest CT scan** (infiltration, abscess formation, lymph nodes) o **Mediastinoscopy** (caseating granuloma)	o Medical: Effective in most cases o Surgical indications - Failure of medical treatment - Destroyed lobe or lung - Pulmonary hemorrhage - Persistent open cavity with positive sputum - Persistent broncho-pulmonary fistula

Trachea is devoted to the left side, it's either:

- **Pushed**: massive pneumothorax, hemothorax, pleural effusion, malignancy.
- **Pulled:** lung collapsed, destroyed lung, post lobectomy, no ventilation.



Left bronchus syndrome:

- Chronic condition that leads to unilateral post TB lung destruction as a result of untreated/resistant TB.
- Fibrosis > Loss of space > loss of ventilation on left side > left lung is smaller, infective, and bronchiectatic pulling the trachea towards it.
- Don't operate on active open TB b/c of the risk of spread of infection.
- Manage them medically first for 4 weeks before surgery.

infectious lung diseases

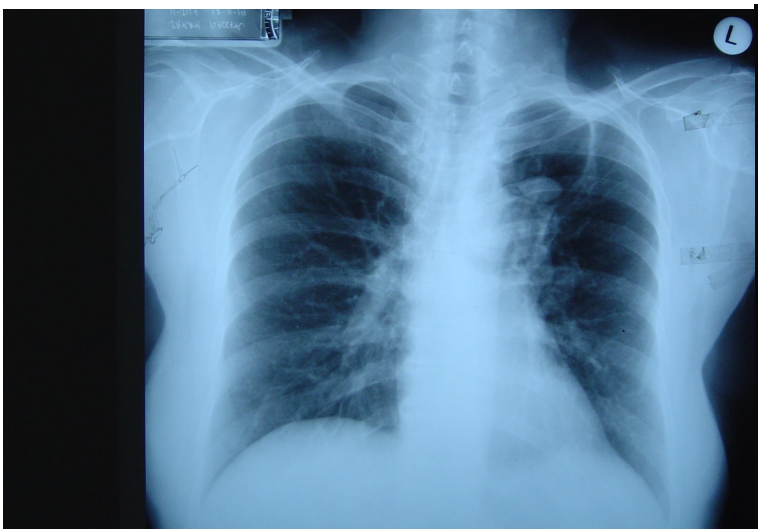
Aspergillosis
caused by: Aspergillus fumigatus, A. niger

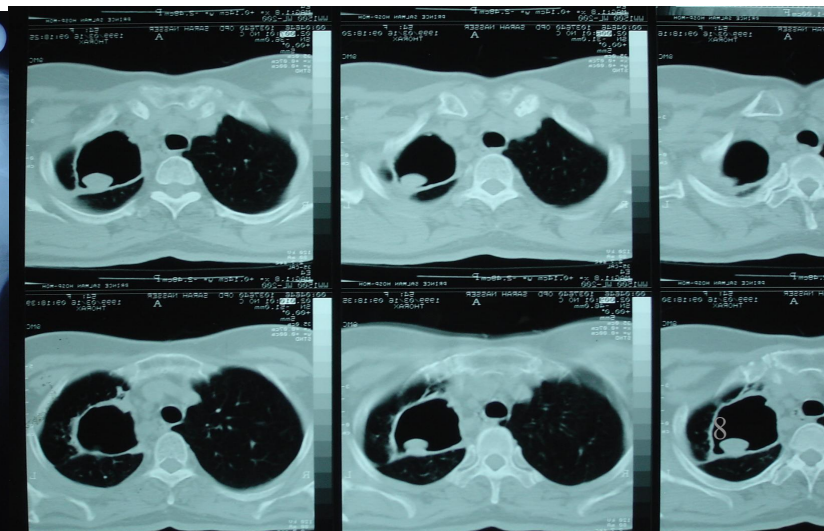
Mode of transmission	Forms	Clinical features
o Inhalation of airborne conidia o Contaminated water (during showering) o Nosocomial infections (hospital fabrics and plastics) o Esp. in immunocompromised individuals	o Allergic (allergic bronchopulmonary aspergillosis) o Saprophytic (aspergilloma/mycetoma) o Invasive	**o Aspergilloma/mycetoma** - Comes with a warning sign of hemoptysis - At this stage, the doctor must act quickly because morbidity and - mortality are very high in these patients - Hemoptysis (patient with preexisting disease) - Chronic productive cough - Sometimes found accidentally on CXR Saprophytic Aspergillosis: Characterized by Asp infection without tissue invasion. The most common underlying causes are TB and sarcoidosis.

Investigations:
o Skin test
o Sputum (fungal culture)
o Biopsy (invasive)
o CXR (radiolucent)
o CT scan (cavity with aspergilloma complex and air crescent sign, DDx TB)

Treatment:
o Medical (antifungal)
o Surgical indications:
- A significant aspergilloma (with serious clinical features)
- Hemoptysis
- Types of resection: depends on the affected side

1) Segmentectomy
2) Lobectomy (mainly)
3) Pneumonectomy





infectious lung diseases

Hydatid cyst

Parasitic infestation by Echinococcus granulosus (tapeworm) Hosts: dogs, cats, and sheep (e.g. by eating raw contaminated sheep liver)

Transmission	Clinical Presentation	Diagnosis
Dog (definitive host) → sheep (intermediate host) → human by eating raw sheep liver → enteric system → portal system to the liver then IVC followed by heart and lungs lastly systemic! **- The liver is the most common organ involved, followed by the lungs (brain, bones, kidneys... can also be involved)**	o Asymptomatic (accidentally found) o Symptoms are the result of compression by the cyst (e.g. dyspnea)	o Skin test (Casoni's reaction) o CXR o CT scan (a chronic cyst will appear calcified on CT) o High echinococcus titers and other serologic tests o Routine blood work (nonspecific)

Treatment

o Radical surgical excision (cyst resection or partial affected organ resection) coupled with chemotherapy using albendazole and/or mebendazole before and after surgery.

o If multiple cysts are present in multiple organs surgery becomes impractical and chemotherapy is indicated.

Hydatid cyst layers:

1. The outer pericyst, composed of host cells that are formed as a reaction to the parasite (false layer).
2. The middle laminated membrane (external layer of cyst)
3. The inner germinal layer of cyst where the scolices are produced and contained. 2+3 form the true wall of the cyst

Hydatid cyst

- Surgeon must be careful when doing this procedure, because each cyst contains millions of scolex (highly infective) so if ruptured it'll spill millions of scolex into surrounding cavities which leads to the formation of new cysts!
- Injection of scolicidal agents such as hypertonic 20% saline is used during surgery to kill scolex.
- Rupture of the cyst ***depends on the size of feeding bronchus***, if it was a big feeding bronchus a small cyst can get ruptured, but if the feeding bronchus was small, the cyst won't rupture.

- ***Radiopacity could be a mass, effusion or cyst***

★ Recall Notes:

Pulmonary Sequestration is an abnormal benign lung tissue with separate blood supply that **DOES NOT** communicate with the normal tracheobronchial airway, **have systemic arterial blood supply.**

Interlobar: Sequestration in normal lung tissue covered by normal visceral pleura, **pulmonary venous drainage.**

Extralobar: Sequestration not in normal lung covered by its own pleura, **systemic venous drainage.**

Lung Tumors

A. Primary lung carcinoma

Incidence	Risk factor	Pathology	Classification
Worldwide, lung cancer is the most common cause of cancer death.	-Smoking (most important) -others: radiation, industrial chemicals, diet, genetic factors, radon.	1- Non-Small Cell Carcinoma: • Adenocarcinoma • Squamous cell carcinoma. • Large cell carcinoma. 2- Small Cell Carcinoma.	• must differentiate between SCLC & NSLC because treatment approach is completely different.

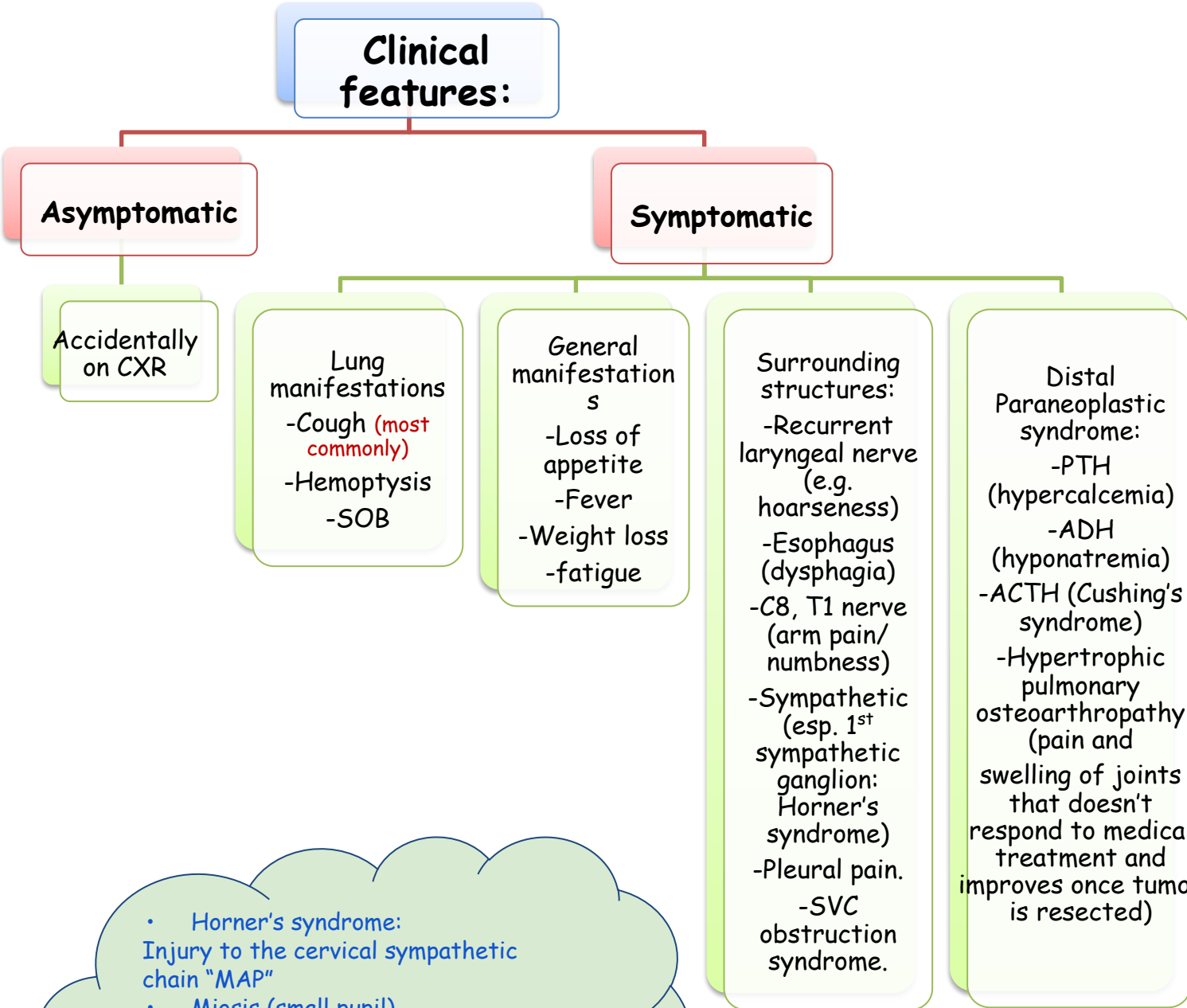
Non-Small Cell Lung Carcinoma (NSCLC)

- Epithelial origin
  75-80%
- Adenocarcinoma (40%) : peripherally located.
  Squamous cell carcinoma (30%): centrally located.
  Large cell carcinoma (9%): peripherally located.
- Treatment:
  Early: surgery +/- adjuvant chemotherapy
  Intermediate: neoadjuvant chemotherapy + surgery.
  Late/metastasis: Non-surgical (chemo/radiotherapy + palliative management)

Small Cell Lung Carcinoma (NSCLC)

- Neuroendocrine origin
  20-25%
- Centrally located
  Poor prognosis
  Patient usually present with systemic disease (eg. large mediastinal LAD)
  Mostly discovered late when tumor has already metastasized.
- Treatment:
  NON-surgical (chemotherapy only +/- radiotherapy)

A. Primary lung carcinoma



- Horner's syndrome:

Injury to the cervical sympathetic chain "MAP"

- Miosis (small pupil)
- Anhidrosis of ipsilateral face
- Ptosis
- Cancer arises more often in

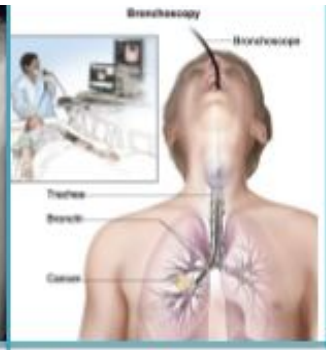
Right lung> Left lung & upper lobes> lower lobes

A. Primary lung carcinoma

Investigations:

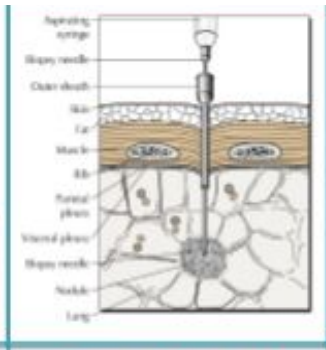
CXR

- find a previous CXR(of the patient) for comparison, if lesion is stable for more than 2 years, it is most likely benign



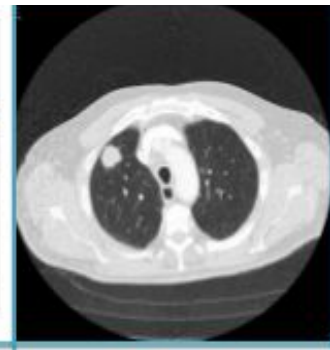
Bronchoscopy

- Method of choice of centrally located masses (squamous cell and small cell).



Transthoracic Needle Aspiration

- CT guided
- Method of choice for peripherally located nodules



CT scan

- Best modality for staging extent of metastasis

MRI

- poor modality in staging, its helpful to rule out involvement of major structures in the apex: brachial plexus, vertebral column, and spinal cord e.g. superior sulcus tumor

Management:

Depends on:	- **Stage** - **Cell Type** - **Patient Physical fitness**
NSCLC	- **Surgical** - **Radiotherapy** - **Chemotherapy**
SCLC	- **Chemotherapy** - **Radiotherapy**

Staging:

Stage 0	TIS
Stage IA	T1, NO, MO
Stage IB	T2, NO, MO
Stage IIA	T1, N1, MO
Stage IIB	T2, N1, MO
	T3, NO, MO
Stage IIIA	T1-3, N2, MO
	T3, N1, MO
Stage IIIB	T4, Any N, MO
	Any T, N3, MO
Stage IV	Any T, Any N, M1

B. Secondary lung carcinoma

- Neoplasms that have spread from a primary lesion in another organ.
- Secondary lung tumors appear as solitary lung nodules (well-marginated, single mass <3 cm, intraparenchymal opacity)

- **Solitary Lung Nodule DDx: (coin lesions)**

- **Primary carcinoma.**
- **Tuberculous Granuloma**
- **Mixed Tumor**
- **2 ° Carcinoma (metastatic)**
- **Miscellaneous**

- **Diagnosis: CXR, chest CT**

Benign Solitary Pulmonary Nodules	Malignant Solitary Pulmonary Nodules
Age < 50	Age >50
Nonsmoker	Smoker
Size < 2 cm	Size > 3cm
No Growth Over 2 Year Period	Steady Growth
Circular And Regular Shaped	Irregular Nodule Or Speculated Margins
Central Laminated/Concentric Calc	Stippled/Eccentric Calc.

- **Hamartoma – Carcinoid**

- Hamartomas are the most common type of benign lung tumors, accounting for 75% of all benign lung tumors and most of them are asymptomatic.

- **Age:** hamartomas occur primarily in adults >50 y/o
- **Sex:** Males 3 times more likely than females.
- **X-ray** (usually peripherally located)
  - size: usually small <4cm in diameter, rounded
  - time: grows slowly
  - calcification: sometimes with varying patterns

- Characteristic appearance of hamartoma on CXR>>> "popcorn" calcification

THE MEDIASTINUM

➢ Anatomy

Mediastinum is the space in the thoracic cavity between the lungs.

- **Boundaries:**

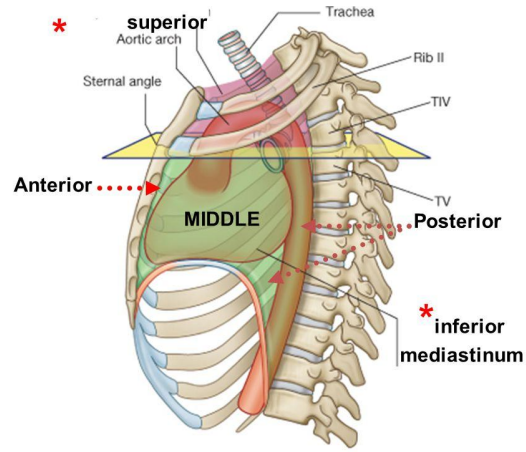
-Superior: thoracic inlet.

-Inferior: diaphragm

-Anterior: sternum and costal cartilages

-Posterior: thoracic spine

-Lateral: mediastinal pleura



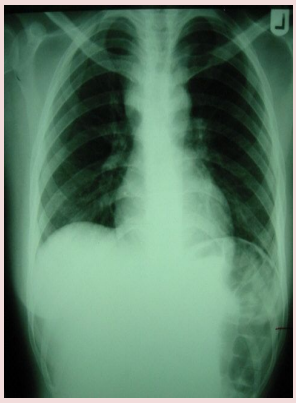
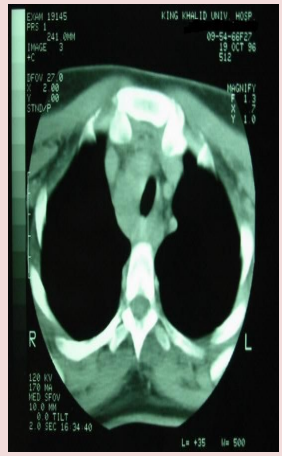
- **Divisions:**
- **Superior mediastinum (above sternal angle)**
- **Inferior mediastinum (below the sternal angle) subdivided into: Anterior, Middle, Posterior.**

- **Access:**
- **Mediastinoscopy, mediastinotomy**

➢ Mediastinal mass lesions

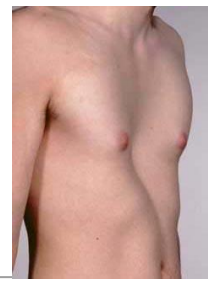
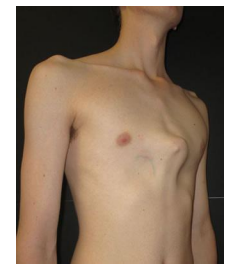
Anterior Mediastinum	Middle Mediastinum	Posterior Mediastinum
5TS -Teratoma -Thyroid (retrosternal goiter) -TB lymphadenitis -Tcell lymphoma -Thymoma	Cysts - Pericardial cyst - Bronchogenic cyst	Neurogenic tumors (e.g. dumbbell tumor of neurofibroma, paravertebral mass.

Thymoma

Incidence	Pathology	Clinical Features & Investigations	Treatment
-The commonest tumor of anterior mediastinum.. -Peak 40-60 y/o. - M : F (1 : 1) equally affected. 	•**Classification:** -Epithelial. -Lymphocytic. -Lymphoepithelial. -Spindle cell. • **Benign Vs. Malignant.** •**Stages:** **I, II, III, IV** 	**Clinical Features:** ✓ Asymptomatic ✓ Symptomatic **-mass effect** **-systemic effect:** autoimmune disorders, most commonly myasthenia gravis. 40-50% **Investigations:** **-CXR** **-CT scan** **- Biopsy** **-Bronchoscopy** **-Esophagoscopy** **-Angiogram**	•**Benign** → complete excision •**Malignant** → complete excision if possible. If non-resectable (invasive and large) → **preoperative (neoadjuvant) chemotherapy or radiotherapy maybe used to decrease the size and improve resectability or incomplete resection.**

Chest Wall

Deformities:

Pectus excavatum: caved-in or sunken appearance of the chest. 	**Pectus carinatum: protrusion of the sternum & ribs (pigeon chest)** 

★ **Infections:** (e.g. abscess, empyema, costochondritis)

★ **Chest wall tumor:** Those that grow on the ribs and sternum (>benign)

★ **Thoracic outlet syndrome:**

- Compression of the neurovascular structures traversing the thoracic outlet.
- The most often involved nerve is Ulnar nerve.

Pleura

Spontaneous pneumothorax	
Pleural effusion	collection of fluid in the pleural cavity.
Empyema	collection of pus in the pleural cavity.
Mesothelioma	rare cancer , usually caused by asbestos exposure.

Airways

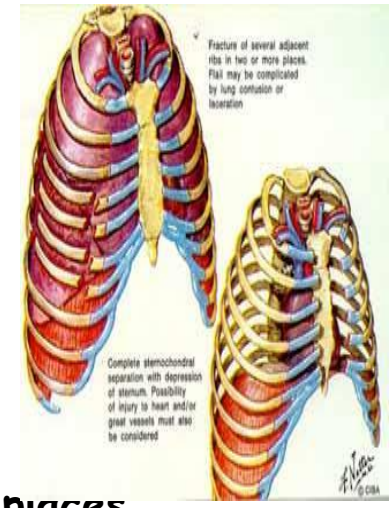
- Congenital tracheal anomalies
- Tracheal Stenosis
- Tracheostomy

Trauma

RTA (Road Traffic Accidents)

Fracture Ribs (Simple / Complicated)

- most common blunt thoracic injuries.

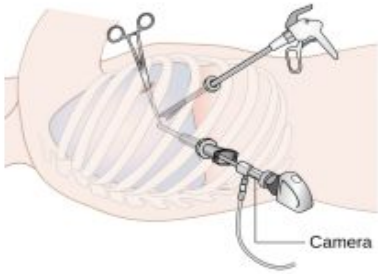


- **Haemothorax**
  - Accumulation of blood in pleural cavity.
  - Appears as radio-opacity on CXR.
  - Cause is mostly traumatic.
- **Pneumothorax**
- **Flail chest**

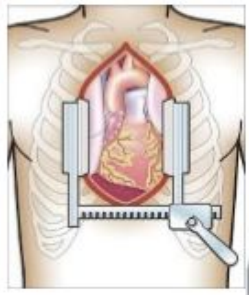
Fractures of several adjacent ribs in two or more places producing a free unstable segment of chest wall that results in paradoxical movement. There is usually associated lung contusion.

- **Lung Contusion and ARDS** (no surgery needed unless massive bleeding)

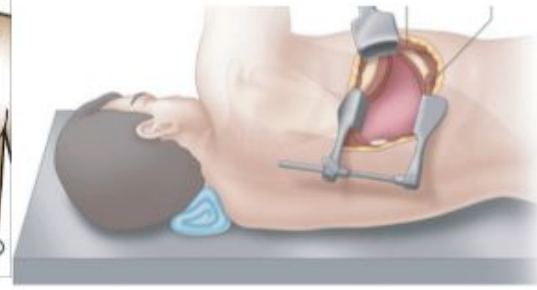
Surgery:



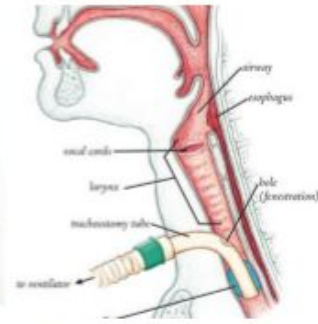
Thoracoscopy



Sternotomy



Thoracotomy



Tracheostomy

Figure 1: Chest X-ray, hemothorax

Figure 2: Chest X-ray with catheter in situ

Figure 1: Chest X-ray, pneumothorax.

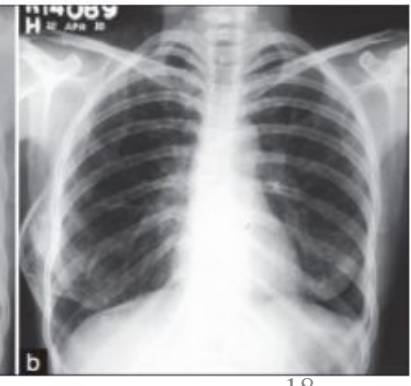


Figure2: Chest X-ray with intercostal tube in situ and fully expanded right lung

Pneumothorax:

Definition: Air in the normally airless pleural space.

Classification:

- **Spontaneous pneumothorax: (non-traumatic)**

Caused by a rupture of a cyst or a small sac(bleb) on the surface of the lung.

- Primary/simple, typically occurs in young(15-35 years) without any underlying lung disease.
- Secondary/complicated, as a result of underlying lung disease, most commonly COPD, develops in elderly patients (55-75years)

- **Traumatic pneumothorax**

Occur due to traumatic injury (penetrating or blunt chest trauma)

- **Tension pneumothorax:** life threatening condition. The most common type of pneumothorax, caused by leakage of air from lungs due to either traumatic puncture wound or spontaneous leakage.
- **Open pneumothorax:** often associated with a sucking wound where air moves in and out of a chest wound with respiration.

	Spontaneous pneumothorax	**Tension pneumothorax**
Clinical features:	- Sudden ipsilateral chest pain. - Dyspnea and cough. - Decreased breath sounds over affected side. - Hyperresonance over the chest. - Decreased tactile fremitus. - Mediastinal shift toward side of pneumothorax.	- Hypotension and tachycardia. - Distended neck veins. - Shift of trachea away. - Decreased breath sounds on affected side. - Hyperresonance.
Diagnosis:	**CXR**	**Clinically** (no time for CXR)
Treatment:	✓ **Primary spontaneous pneumothorax** ✓ <u>If small and patient is asymptomatic >></u> a. Observation (should resolve spontaneously in 10 days) reassess with CXR. b. Small chest tube may benefit some patients. - <u>If large and patient is symptomatic >></u> a. Administration of supplemental oxygen. b. Chest tube insertion to allow air to be released. ✓ **Secondary spontaneous pneumothorax** - Chest tube drainage.	**Medical emergency!** - If tension isn't relieved patient is likely to die from hemodynamic compromise. <u>Immediately decompress the pleural space via large-bore needle or chest tube.</u>

Thank you