Presentation and Management of Common Thoracic Diseases

Objectives

- Identify the symptoms of common thoracic and lung disease
- Discuss the physical examination
- Describe the surgical Anatomy, Blood Supply, Airway Anatomy.
- Recognize the congenital Diseases of the lungs.
- Discuss the assessment of the patient, full history and examination.
- Describe bronchogenic Carcinoma: Primary: SCLC, NSCLC.
- Discuss the assessment for pulmonary resection
- Discuss metastatic Disease
- Discuss other lung tumors
- Describe the Mediastinum
- Recognize pneumothorax (Types, Presentation, and management)
- Discuss chest trauma
- Discuss the pleuro-pulmonary infections like:
    - Lung abscess, Bronchiectasis, Tuberculosis, Aspergilloma of the Lung, Hydatid cyst and Empyema
- Recognize the chest wall deformities, like Pectus
- Recognize the chest tube indications

Colour Index

- Main Text
- Males slides
- Females slides
- Doctor notes
- Textbook
- Important
- Golden notes
- Extra

Summary File

Editing File

Anatomy of the lung:

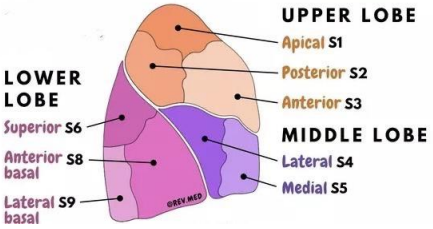
- Embryology
  - Bronchial system
  - Alveolar system
- Anatomy
  - Lobes
  - Segments
  - Fissures
  - Blood supply

Bronchopulmonary segments:

- The segments aren't separated anatomically by fissures, but they have their own blood supply

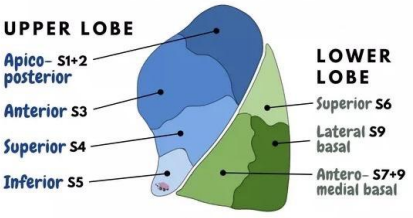
Right Lung

- **Has 3 lobes with total of 10 segments:**
  - **Upper lobe**, divided into 3 segments [Apical (S1), Posterior (S2), Anterior (S3)].
  - **Middle lobe**, divided into 2 segments [Lateral (S4), Medial (S5)] (present in the left lung as Lingular division of upper and lower lobe)مبـاطراب
  - **Lower lobe**, divided into 5 segments [Superior or Apical lower (S6), Medial basal (S7), Anterior basal (S8), Lateral basal (S9) Posterior basal (S10)], so the basal segments include (anterior, posterior , medial , and lateral)
- **Has 2 fissures:**
  - Oblique fissure: divides the lower lobe from other lobes. (Between the middle and the lower lobes)
  - Transverse (horizontal) fissure: divides the upper and middle lobes.



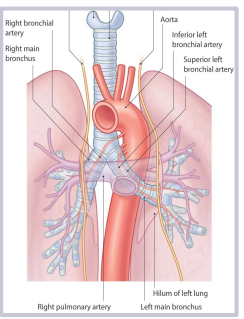
Left Lung

- **Has 2 lobes with total of 8 segments:**
  - **Upper lobe**, divided into [Apico-posterior (S1+S2), Anterior (S3) segments] and has Lingular division [Superior (S4), inferior (S5) segments].
  - **The lungula** is opposite to the middle lobe of the Rt lung.
  - **Lower lobe**, divided into Superior or Apical lower (S6), Anterior-medial basal (S7+8), Lateral basal (S9) and Posterior basal (S10) segments], has no medial segment due to the position of the heart, so the basal segments include anterior, posterior, lateral segments, there is no medial segment to give space for the heart.
- **Has oblique fissure which divides the left lung.**



Blood supply:

- Lungs do not receive any vascular supply from the pulmonary vessels (pulmonary artery or veins) As they are part of the pulmonary circulation , they are involved in oxygenation process of the blood.
- Blood delivered to lung tissue via the bronchial arteries.
- Vessels evolve from **intercostal arteries** (below each rib there're vein+artery+nerve, thus when we put a needle or chest tube we avoid this area) or **directl**y from aortic arch (systemic artery) .
- Travel along the bronchial tree.
- The lung mainly consist of alveoli and it has poor blood supply so it is a poor organ,
- It takes time to heal unlike other organs e.g. liver (solid organ).
  - In case of injury to the lung tissues, the healing process would be very slow due to the poor and weak blood supply to the lung.



Airways:

Trachea → 1ry bronchi → 2ry bronchi → 3ry bronchi (out to 25 generations)

All comprised of hyaline cartilage

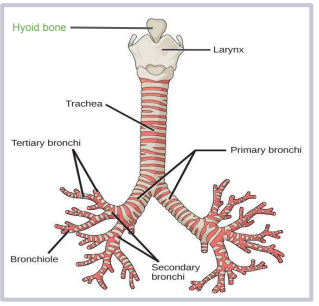
Terminal bronchiole → Respiratory bronchiole (3-8 orders) → Alveoli

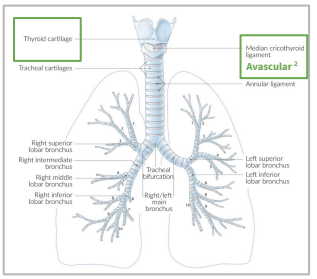
Trachea:

- **Begins:** where larynx ends (about C6) , D shaped and bifurcates to right and left primary bronchi (at the site of primary carina).
- It's the main structure cancers arise from.
- 10 cm long, half in neck, half in superior mediastinum behind the manubrium.
- 20 U-Shaped rings of hyaline cartilage, keeps lumen intact but not as brittle as bone.

- **Lined** with epithelium and cilia that move in two directions which work to keep foreign bodies/irritants away from lungs and bronchial tree.

- **Anterior & lateral walls** are formed of cartilage while the **posterior wall** is membranous with smooth muscles to keep the major airways opened and not collapsed, it's in contact with the esophagus.
  - If there's increased pressure necrosis of the posterior wall of the trachea (iatrogenic injury, blunt chest or neck trauma, prolonged mechanical ventilation via endotracheal or tracheostomy tube, and excessive tube cuff pressure in patients ventilated for lung disease) it may lead to tracheoesophageal fistula (emergency).
  - Bronchiectasis and immotile cilia syndrome may lead to impaired cilia motility.
- **Structural relationships of trachea :** posterior (esophagus , descending aorta) , anterior (ascending aorta)

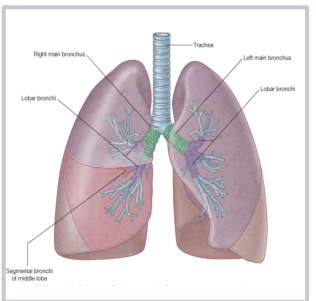




Primary -main- bronchi:

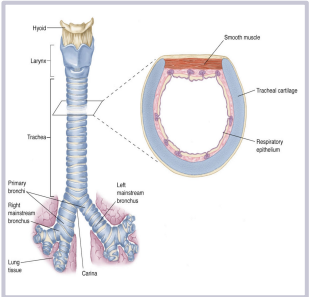
- The right main bronchus is shorter (1.5-1.7cm) , wider and vertical (more in continuation with the trachea) while the left main bronchus is longer (4.5cm), narrower and more angular.

- So when **foreign bodies get aspirated /** aspiration pneumonia , it will most likely go to the **right main bronchus** > inferior lobar bronchus > lower lobe of right lung (this is due to the structural differences).



Bronchioles:

- First level of airway surrounded by smooth muscle; therefore can change diameter as in bronchoconstriction and bronchodilation.



1. When mechanical ventilation is contraindicated, we establish an airway through Cricothyroid Membrane: Needle Cricothyroidotomy or Surgical Cricothyroidotomy
- **WHY cricothyroid membrane?** because it doesn't have a blood supply
- This procedure is very emergent, if not done within 3-4 min the patient will develop hypoxic brain damage.

Diseases of the lung:

1- Congenital Lung Diseases:

1. Agenesis
2. Hypoplasia
3. Cystic Adenomatoid Malformation
4. Pulmonary Sequestration
5. Lobar Emphysema
6. Bronchogenic Cyst

Agenesis

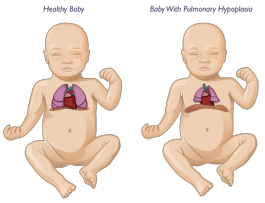
The organ is not present
عدم تكوين بالكامل

- No development / complete absence of the lungs (could be unilateral or bilateral).

Hypoplasia

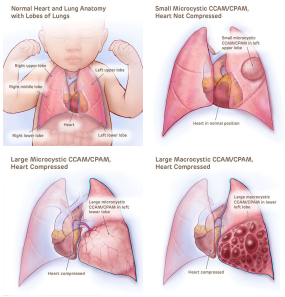
Underdevelopment of an organ
نقص في تكوين الرئة

- Incomplete development of the lungs
  (the patient may present with small non functioning lung).



Cystic Adenomatoid Malformation

- Overgrowth of abnormal lung tissue that does not function properly and may form fluid-filled cysts.
- Pediatric patients usually present with complication pneumothorax, hemothorax repetitive chest infections, fever and malformation & chest abnormality on CXR and CT-scan.
- Surgery is needed to remove the mass in the lung.

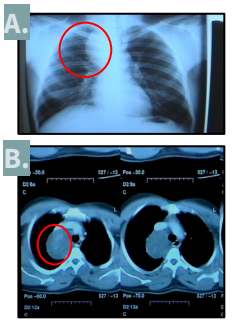


Lobar Emphysema النفاخ الرئوي

- It's a rare respiratory disorder in which air can enter the lungs but cannot escape, causing overinflation (hyperinflation) of the lung lobes.
- Also called Congenital Alveolar Overdistension.
- It can affect children and newborns, it happens when the entire lobe (usually the right upper lobe) is replaced with a big , thick cyst or emphysematous bullae* (congenital lobar emphysema) it seems clear in CXR.
- The newborn will not be able to breath and need to be put on +ve pressure mechanical ventilation.
- The longer they're put on a ventilator the more likely that the emphysematous bullae enlarges and starts to compress other parts of the lung (middle , lower lobe)"like a balloon". So the only way to relieve the patient from the ventilator is to do lobectomy (removal of the entire lobe surgically) and then inflate the lung again. usually the hypoxia gets relieved 1-2 days after the surgery and you can extubate the patient.

*A large blister containing serous fluid

Bronchogenic Cyst

Clinical Feature	• It's a benign cysts with malignant position, because it can compress vital organs (e.g. trachea, esophagus, vessels) and it's filled with fluid and supportive debris which makes it prone to infections. • Bronchus and cartilaginous components are benign in nature. • So it's A benign cyst in a malignant location • Thick cyst contain cheesy material / cartilaginous/ epithelium. This cheesy material is highly susceptible to infection, the cyst get enlarged as the patient grow • **Location:** right paratracheal (most common) and subcarinal. • Patient can present with dysphagia and stridor [1].
Investigation	• **Picture A**: CXR showing abnormal cyst in the middle posterior mediastinum which is compressing the esophagus and trachea. • **Picture B**: CT scan showing a big cyst posterior to SVC and near to trachea, if it increases in size, it will compress on trachea or esophagus, could even lead to compression of SVC and massive bleeding. 
Complications	• Infections, hemorrhage, • Dysphagia if esophagus is compressed • Dyspnea if the airways are compressed • Transformation into malignant adenocarcinoma if left untreated for a long time due to repetitive irritations and infections in the cysts sites as various studies have shown that "We also observe that in our practice"
Diagnosis	• Surgery is the only way to establish true diagnosis (confirm that the cyst is bronchogenic). • Although, Diagnosis usually done either by chance or when the patient start to have complications like (infection and bleeding) → then it will start to compress the trachea , esophagus, vessels , mediastinal structure. ○ so it has to be resected surgically especially if the patient still young (early stages) to prevent the complications
Treatment	• Surgical resection of the cyst by **Thoracoscopy** in order to relieve the compression on surrounding structures. • if it's adherent to SVC or the heart (tricky situations), a **Thoracotomy** is performed.

1. Stridor is a noisy or high-pitched wheezing sound with breathing. It is a sign that the upper airway is partially blocked.

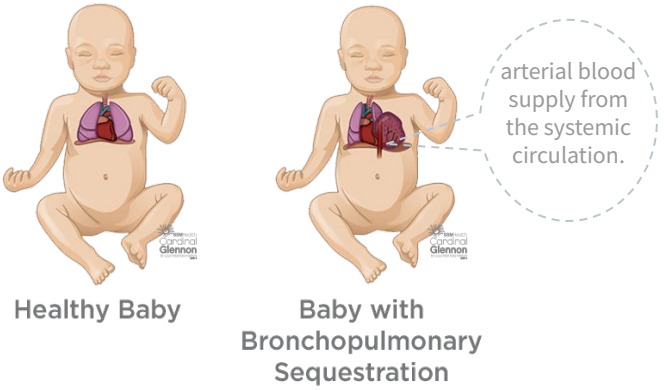
Pulmonary Sequestration تشظي الرئة

- It's congenital disease more commonly seen in pedia population however it can be present in adults.
- It's a nonfunctional mass of normal lung tissue that lacks normal communication with the airways.
- Part of the lung loses its connection from the major bronchial tree (appears as sequestered mass) and any secretions or inflammatory processes may precipitate chest infections. Thus, sometimes it misdiagnosed with asthma .
- patients present with repetitive infections.

- **Location:** It can be extra- or intralobar [1] (intraparenchymal , extraparenchymal) and it's usually located in the left lower lobe.

- **On CXR or CT-scan:** a mass is found (usually in the left lower lobe).

- **It is characterized by**: receiving its own arterial blood supply from the systemic circulation (especially thoracic aorta, it could be two or three major arteries).
  - So the surgeon should identify the blood supply (in case of resection) by CT angiogram with contrast to locate the blood supply (these vessels could be above, below, or directly on the diaphragm) to prevent massive bleeding.
  - We have to control the abnormal systemic blood supply coming from a major Aorta (especially when it comes from under the diaphragm) by carefully tying the blood vessel first during the surgical procedure.



1. **Intralobar:** Sequestration in normal lung tissue covered by normal visceral pleura; usually found in adults.
   Extralobar: Sequestration not in normal lung covered by its own pleura; usually found in children.

Diseases of the lung:

2- Infectious Lung Disease:

1. Lung abscess
2. Bronchiectasis
3. Tuberculosis
4. Aspergillosis
5. Hydatid Cyst

★Lung Abscess [1]:

Causes	Immunocompromised (Diabetic, HIV, etc), complication of pneumonia, bronchial obstruction (by tumor or inhaled foreign bodies especially In children), bronchiectasis bacteremia, and septic emboli.
Clinical Feature	1. Copious production of foul smelling sputum 2. Productive Cough +/- hemoptysis 3. Septic, toxic, high fever & chills , weight loss 4. Severe chest pain and difficulty breathing
★Investigation	1. CXR (air fluid level + big abscess cavity) **(pic A)** 2. CT To confirm the diagnosis 

Treatment	**Conservative management:**
	(if conservative management failed we go to surgery)
	• Antibiotics [2]
	• Drainage by pigtail catheters (interventional radiology):
	  ○ Internal (bronchoscope).
	  ○ External Through the chest wall (Percutaneous Tube Drainage).

Surgery	• Pulmonary resection
	• Type of Resection:
	  ○ Lobectomy
	  ○ Segmentectomy
	  ○ Pneumonectomy

	• **Resection Indications:** (Dr : we usually ask about it in exams)
	  ○ Failure of medical RX
	  ○ Giant abscess (>5cm)
	  ○ Hemorrhage complication
	  ○ Inability to rule out carcinoma due to old age, patient being a heavy smoker or the abscess being large with thick wall.
	  ○ Which carcinoma causes abscess? Squamous
	  ○ Rupture with resulting empyema (Pus in the pleural cavity)

1. 60 y/o male presented with weight loss, chest pain , and hemoptysis. He is a heavy smoker (long life smoker) , X-Ray show thick wall opacity and abscess formation?
This patient may have complicated squamous cell carcinoma in the lung , cavitation of the lung may present, to rollout or establish the diagnosis :
1- FNA (fine needle aspiration) → biopsy if we are not able to rule out the carcinoma surgery is needed
2- Resection

2. Do not wait for culture results to start antibiotics. Start empirical treatment immediately after obtaining samples for culture, and tailor therapy as needed once culture results are available.

★Bronchiectasis [1]

➔ It is a bronchial dilatation, (it could be a part of generalized disease)

Causes

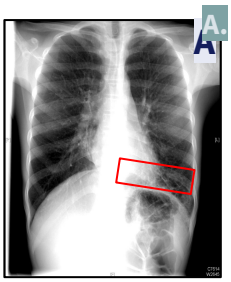
- Congenital e.g. Immotile cilia syndrome (kartagener syndrome), Mucoviscidosis (cystic fibrosis).
- Infection e.g. whooping cough, untreated pneumonia , measles disease if it is not treated or not immunized it will complicate to bronchitis usually localized in site of pneumonia
- Obstruction e.g. Foreign body when a frogein body stays for 6 months or longer (year) if it is not removed or reputedly treated wrongly of the last few month or year,
  - they presented with **repeated chest infection** and sometimes they're treated as asthmatics but the recurrent infections aren't relieved.
  - So in this case you should suspect foreign body obstruction especially if they've right lobes pneumonia + fixed wheezing → they're indicated to undergo bronchoscopy to exclude or confirm this issue.

Clinical Feature

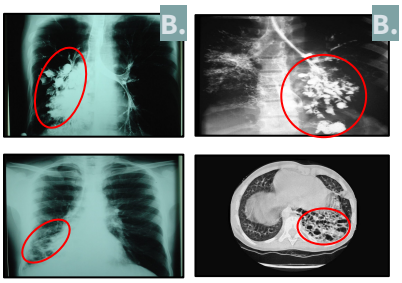
1. **Types:** cystic or cylindrical (cystic type is surgically corrected while Cylindrical type e.g. Cystic fibrosis, immotile cilia syndrome, are not surgically correctable)
2. **Productive morning cough** due to collection of secretions during sleep.
3. Dyspnea
4. **Haemoptysis** (50%) coughing with blood
5. Clubbing can be due to; pulmonary, congenital cardiac, GI disorders or idiopathic.
6. They usually present with psychological problem, especially children.

Investigation

- CXR
- **CT** Confirmatory
- Bronchogram Confirmatory +very rarely used
- Bronchoscopy to detect TB or obstruction if we suspect a foreign body



Picture A: CXR showing an area of **cystic changes** affecting the lower lobe of the left lung.



Picture B: Bronchogram (using catheter and contrast) shows **cystic formation in** the basal segment of left lower lobe , destroyed bronchi filled with **pus**.

Treatment

Medical:

- Medical Rx is usually for (usually **bilateral conditions** , cylindrical , disease affect both lung Mucoviscidosis , and cystic fibrosis they managed first by medication eventually by lung transplantation (to avoid removing two lungs)
- Antibiotics, supportive, Postural drainage.
- resolve most cases

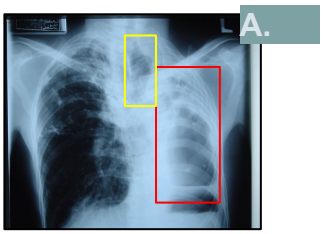
★Surgical:

- **Surgical:**
  - Failure of medical RX
  - Patient with localized disease in the lower lobe or lower and middle lobe
  - Cystic type , usually localized (in lower lobe or lower+middle lobes) & non perfused.
  - Non Perfused (perfusion is measured by Ventilation-perfusion scanning.)

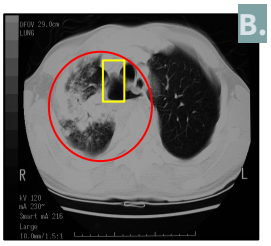
1. Dilatation of bronchi and bronchioles can follow childhood infections, e.g., measles or pertussis. The stagnant pools of secretions that collect are subject to continued infection, resulting in episodes of acute pulmonary infection or pneumonia and, more rarely, in haemoptysis.

Tuberculosis

Epidemiology	30,000 new cases occur annually in U.S.A
Causes	• Pulmonary • Extra-pulmonary : in the chest cavity e.g. TB Empyema, TB Lymphadenitis, Tuberculous empyema, or it can affect any organ (stomach, brain meningitis , tuberculoma, pericardium, bones..)
Investigation	• CXR • CT • Bronchoscopy



Picture A: CXR showing
-full destruction of the left lung (red) and deviation [1] of the trachea (yellow) to the left-towards the pathology.
And this patient was treated by left pneumonectomy.
-Abscess formation and fibrosis (loss of space) in the Left lower ,



Picture B: CT-scan showing:
-right upper lobe destruction (red)
-formation of fistula (bronchopleural fistula) (yellow) between the lung and the pleural cavity & major airways.

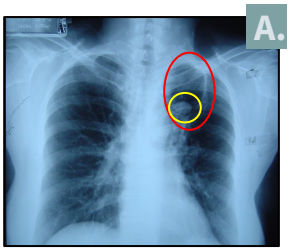
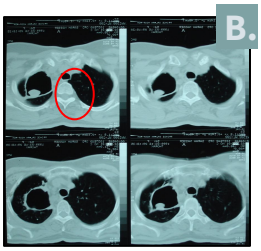
Treatment

Medical:	1st & 2nd lines of Anti-TB.
Surgical [2]:	• Failure of medical RX • Destroyed lobe or lung • Pulmonary haemorrhage Patients come to the ER with massive hemoptysis, - If interventional radiology failed to resolve it by embollisation then surgery is indicated. - If not treated immediately the hemorrhage will move from the diseased lung to the other causing severe hypoxia and death. • Persistent open cavity with +ve sputum • Persistent broncho-pulmonary (pleural) fistula: - A connection between the bronchial tree and pleural cavity due to serious lung disease e.g. TB, pneumothorax . - Surgery is indicated to drain fluids and air + resolve this pathological connection.

1.Trachea is midline structure : with lung disease it may pushed or pulled toward the pathology
-pushed (push trachea away) : massive pneumothorax , hemothorax , pleural effusion or tumours
-pulled: loss of space (fibrosis , post operative , lobotomy, collapsing lung)

2. Present indications for surgery in pulmonary tuberculosis also include the complications of pulmonary tuberculosis: pneumothorax, empyema, bronchopleural fistula, bronchiectasis, massive haemoptysis, lung abscess and aspergilloma in a tubercular cavity.

Aspergillosis داء الفطور

Causes	• Aspergillus fumigatus, Asp. niger
Formes	• Allergic, Saprophytic, Invasive "we very often face it in our practice"
Mode of transmission	• Inhalation of airborne exposure to mold spores: conidia, contaminated water (while showering), and nosocomial infections. Especially in immunocompromised patients .
Clinical Features	• Aspergilloma (mycetoma) cavity ball-like in CT • Hemoptysis (patients with preexisting disease like TB or immunocompromised) it starts very mild (a warning sign) then they suddenly die with massive hemoptysis. • Chronic productive cough
Investigation	• Skin test • sputum (culture) • biopsy (Invasive → LVA or open biopsy) • CXR (radiolucent) • CT **characteristic:** aspergilloma complex (mycetoma) **bilateral or unilateral cavity** in the upper lobes with fungating core that eats the bronchus away, and bleeds once it reaches a bronchial artery.
	 **Picture A:** CXR showing **aspergilloma** complex with cavity (red) and **mycetoma** (yellow) which is a mass-like fungus ball.  **Radiology sign of mycetoma :** Mobile fungus ball (demonstrated by moving the patient from a supine position to a prone or lateral recumbent position)
Treatment	
Medical:	○ Anti-fungal medications
Surgical:	• Indication: ○ A significant aspergilloma complex & Haemoptysis. • Type of resection: ○ Segmentectomy, Lobectomy, Pneumonectomy.

Hydatid Cyst

الكيسات المائية

Causes

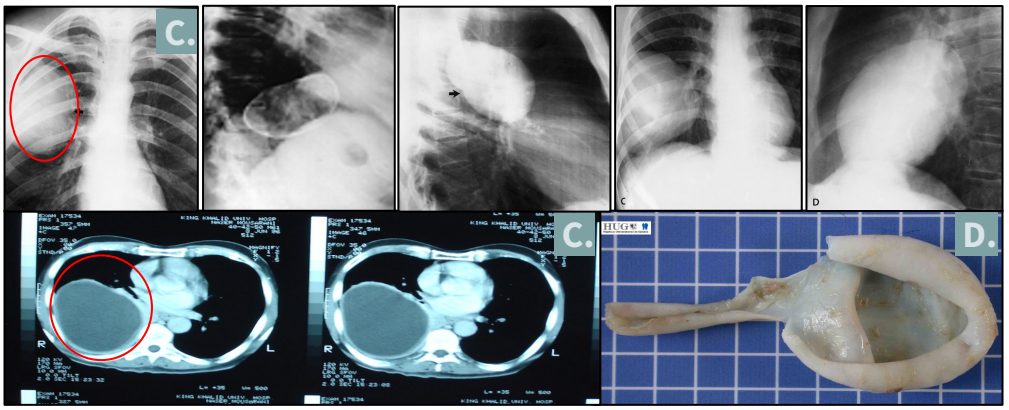
- Echinococcus granulosus الدوده الكبديه السربطيه

Lifecycle

- E. granulosus is made of 4 segments.
- The lifecycle of E. granulosus involves dogs as a definitive host where the parasite reaches maturity and reproduce. Sheeps, serve as an intermediate host and transmit the parasite to humans when undercooked meat is eaten (especially the liver).
- The parasite will go to the bowel → lymphatics chanels → portal system → portal veins → **liver** → venous system (IVC) → **lungs** (Therefore any patient with hydatid cyst in the liver, needs screening of the lungs and vice versa) → pulmonary artery → heart → systemic circulation → and goes anywhere (e.g. brain, bone, pancreas).
    - **In summary :**
      Definitive hosts: foxes, dogs, and cats ,
      Intermediate hosts: hoofed animals; sheep
      Humans are accidental hosts (e.g., sheep farmers)

Investigation

- Skin test (Casoni's reaction) & CXR
- CT scan (a chronic cyst appears calcified, can be found incidentally or after complications)
- High echinococcus titers and other serologic tests



Picture C: CXR and CT-scan both showing hydatid large cyst which is filled with toxic fluid (very highly infected) and 3-5 millions embryos, if it's ruptured it can lead to anaphylactic shock thus needles biopsy are contraindicated
So before doing the section we inject the hypertonic saline inside cyst to kill all the organism. The cyst can be located anywhere else in the body but mostly common in the lung and liver.
Picture D: the cyst is made of three layers:

- 1st 'false layer' adventitia
- 2nd laminated membrane
- 3rd germinal layer (gives eggs)

Treatment

- Surgery (previously we used to inject the cysts by hypertonic saline in order to kill them, then we remove them by suction catheter and clean up the whole area. But nowadays the surgical procedure is different.)
- Surgery + inject hyperosmotic saline + albendazole (Needle aspiration is contraindicated)
- **Any invasive procedure** (drainage or surgery) of hydatid cysts should be performed with the utmost care to prevent **spillage of cyst contents**, which could cause **life-threatening anaphylactic shock** and/or **secondary seeding of infection**
- Cyst rupture may lead to a severe allergic reaction and even death.

Diseases of the lung:

3- Lung tumors:

1 — 2

1 Benign

2 Malignant

Primary or secondary

Almost all cancers metastasize to the lungs, thus biopsy is needed to establish the right diagnosis

Malignant:

A . Primary lung carcinoma

Incidence

More common in males.

Risk factor

- Smoking (mainly) most common
- other: carcinogenic radiation, fatty diet, radioactive elements , asbestos and nickel.

Pathology

NSCLC (Non-Small Cell Lung Carcinoma)	**SCLC** (Small Cell Lung Carcinoma)
• Adenocarcinoma • Squamous cell carcinoma • Large cell carcinoma ➔ **Surgery is possible** **Treatment Depending on the stage** ➔ Early stage : **surgery** ➔ Intermediate : neoadjuvant chemotherapy before surgery to downstage the tumors **(surgery → (adjuvant chemotherapy)** Adjuvant chemo might be given to try to kill any cancer cells that might have been left behind or have spread but can't be seen, **-/+ radiation therapy**, post operative chemotherapy ➔ Late stage: **chemotherapy**, with or without radiation therapy stereo factory , if it is not treated we will go to pain management .	➔ Systemic dissemination, **surgery isn't possible** Because the tumor already metastasis to the lymph node ➔ So we use chemotherapy +/- radiation, Oncology non surgical management. ★ CT is used for staging in SCLC.

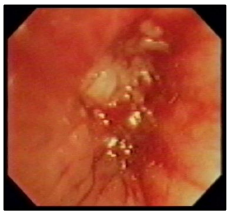
Clinical Features

- Asymptomatic
- Symptomatic
  - Lung (causing repetitive chest infections, cough, hemoptysis) cough, dyspnea, hemoptysis, consolidation, repetitive chest infection, opacity or nodules in CXR
  - Surrounding structures:
    - Recurrent laryngeal nerve (causing paralysis of the vocal cords → **hoarseness**)
    - Esophagus (causing **dysphagia**)
    - C8, T1 nerve (causing **severe pain in the brachial plexus**)
    - Sympathetic (causing **horner's syndrome:** ptosis, miosis lack of hydration in the effected side, and anhidrosis)
    - Pleura (causing severe pleuritic chest pain, plural effusion, hemothorax)
    - Superior Vena Cava **(causing SVC obstruction syndrome** Caused by two reason : 1- metastatic non-bronchogenic cancer to the lymph node around SVC 2-lymphoma**)**
  - Distal (paraneoplastic syndrome) results in hypersecretions of:
    - Parathyroid Like Hormone
    - Antidiuretic Like Hormone usually with adenocarcinoma, squamous cell, small cell carcinoma
    - Adrenocorticotropic Like Hormone
    - Hypertrophic pulmonary osteoarthropathy "HPO" (severe joint and bone pain, due to hormonal secretion which won't respond to medications, so the only solution is surgical removal)

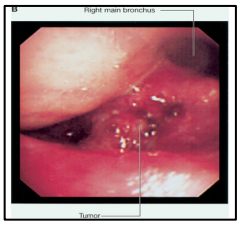
A. Primary lung carcinoma

Investigations

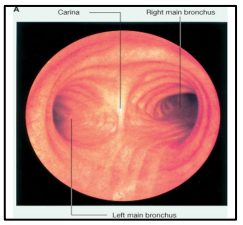
- CXR
- Bronchoscopy
- Transthoracic needle aspiration FNA, true cut biopsy (interventional radiology)
- CT scan with IV contrast → **GOLDEN STANDARD** + staging the tumor
- MRI (in case of soft tissue invasion) in special condition if we suspect invasion to vertebra, major vessels, spinal canal, brachial artery)
- It can be asymptomatic and diagnosed by chance , or symptomatic at late stage



Lung cancer - upper lobe



Tumor



Bronchoscope

Staging

- TNM staging system

You're not required to study it

NEW INTERNATIONAL REVISED STAGE GROUPING

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

Management

- **Depends on:**
  - Stage
  - Cell type
  - Patient physical fitness

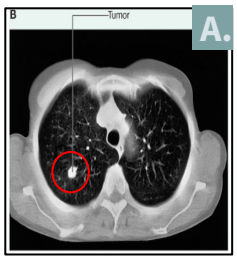
NSCLC (Non-Small Cell Lung Carcinoma)

- **In early stages:**
  - Surgical
- **In advanced stages:**
  - Radiotherapy
  - Chemotherapy

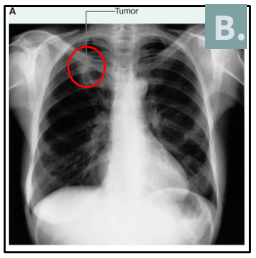
SCLC (Small Cell Lung Carcinoma)

Remember that it has very poor prognosis

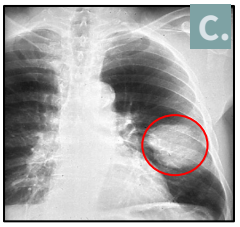
- Chemotherapy
- Radiotherapy

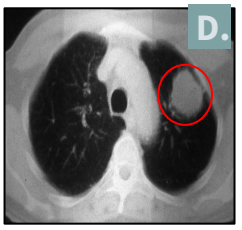


Picture A: very early stage curable adenocarcinoma



Picture B: the patient has opacity which was confirmed by CT





Picture C: 60 years old heavy smoker, with chest pain, Hemoptysis, large tumor was found in the lower zone.
picture D: showed a large mass in the left upper lobe, and after biopsy it turned out to be small cell carcinoma.

B. Secondary lung carcinoma (metastatic)

Types

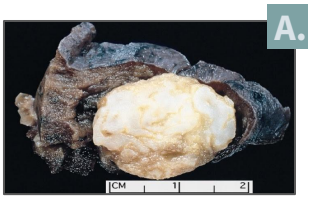
- Solitary lung nodule (less than 3cm in size):
  - Primary lung carcinoma
  - Tuberculous granuloma
  - Mixed tumor
  - Secondary lung carcinoma
  - Miscellaneous e.g. disk pneumonia

Comparison

Hamartoma (most common benign)- carcinoid (benign Vs malignant):

- Age
- Sex
- X-Ray
  - Size
  - Time
  - Calcification

● All in all, The histopathology report is the confirmatory tool to differentiate.

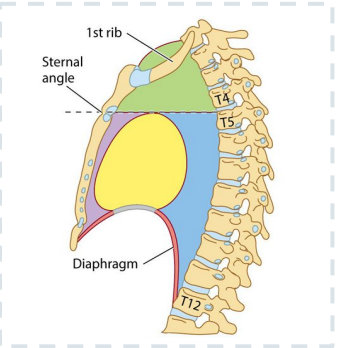


Picture A: Hamartoma, benign tumor with calcification

Mediastinum Anatomy:

Boundaries

The space in the thoracic cavity between the lungs, it's divided into superior and inferior compartments by the thoracic plane at the level of the sternal angle, and the intervertebral disc of T4–T5, the inferior space is further divided into: anterior (behind the sternum), middle (around the heart and the major vessels) and posterior (in front the thoracic vertebra).

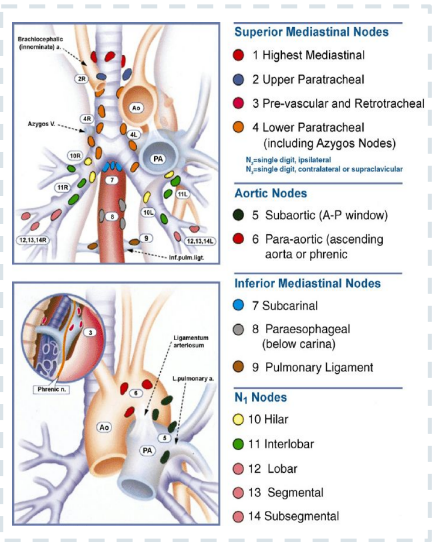


Divisions

- Traditional
- Clinical

Access

- Mediastinoscopy
- Mediastinotomy



- Pulmonary metastasis is a common presentation and may be the only site of metastasis.
- Resection of metastatic lesions may be part of a treatment protocol.
- What is Virchow's node? It is an enlarged left supraclavicular node. It occurs on the left as this is where the cisterna chyli (dilated lymph sac at the end of the thoracic duct) empties into the subclavian vein. Virchow's node is suggestive of metastatic lung or gastrointestinal malignancy.

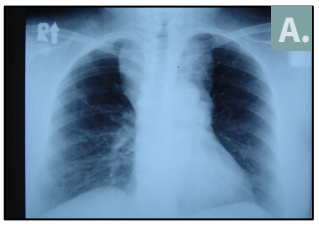
★ Mediastinal Mass Lesions [1]

Middle Mediastinum
(Cyst: bronchogenic cyst & pericardial cyst , esophageal cyst)

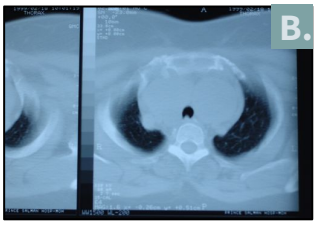
Anterior Mediastinum (5 T's)

Posterior Mediastinum
(Neurogenic tumors "originating from around the vertebrae"), Enterogenous cysts)

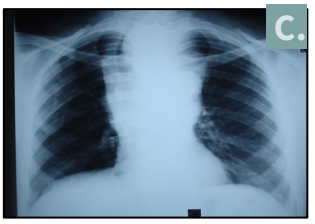
- **Thymus - thymoma**
- **Thyroid - ectopic thyroid masses (goiter)**
- **Teratoma**
- **T cell lymphoma**
- **TB lymphadenitis**



Picture A: large superior mediastinum.

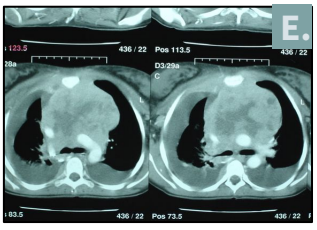


picture B: large mass behind the sternum 'retrosternal goitre'.

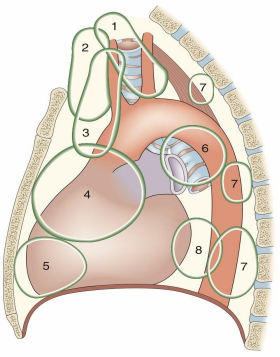


Picture C: the trachea is compressed, there is a retrosternal goiter shifting the trachea to the right (away from pathology).

picture D: superior and anterior mediastinum enlarged.



picture E: there is a large mass in superior and anterior mediastinum compressing SVC → obstruction.
The patient has advanced stage lymphoma, the mass is invading the ascending aorta, trachea, carania, and right main bronchus (so the patient can't sleep in supine position), in addition to pleural effusion.



1 Goitre
2 Lymph node tumours, primary and metastases
3 Thymoma
4 Dermoid/teratoma
5 Pleuropericardial cyst
6 Bronchogenic cyst
7 Neurogenic tumour
8 Enterogenous cyst

1. 90-95% of superior and anterior mediastinum masses are existing in these 5T's .
   - Benign and malignant masses may arise in the mediastinum. Some clue to the likely diagnosis is provided by the location of the lesion within the mediastinum. Where the diagnosis is in doubt, tissue may be obtained by CT-guided needle biopsy. If this is either not feasible or is unsuccessful, a surgical biopsy can be obtained using mediastinotomy, mediastinoscopy or videothoracoscopy. Patients may be asymptomatic or having vague symptoms. Surgical resection is generally undertaken via a median sternotomy for anterior lesions or a thoracotomy for mid and posterior lesions.

Thymoma

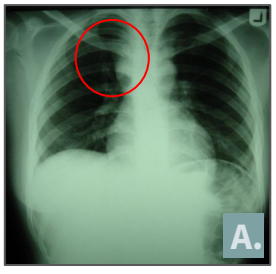
Epidemiology	• The commonest tumor of anterior mediastinum • Peak 40-60y • M:F (1:1)

Clinical Feature	• Asymptomatic
	• Symptomatic:
	  ○ Mass effect.
	  ○ Systemic effect: **Myasthenia gravis** is the commonest 40-50%.

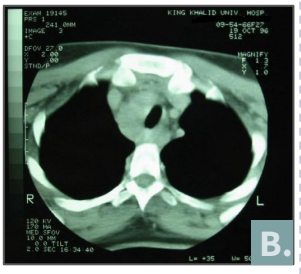
Pathology	• Classification:
	  ○ Epithelial
	  ○ Lymphocytic
	  ○ Lymphoepithelial
	  ○ Spindle cell
	• Benign vs. malignant
	• Stages:
	  ○ I → localized not invading the capsule
	  ○ II → invading the capsule
	  ○ III → outside the capsule (surrounding structure)
	  ○ IV → outside the surrounding structure to the lplura , lung (distance metastasis)

Investigation	• CXR / CT / Biopsy
	• Selected cases:
	  ○ Bronchoscopy
	  ○ Esophagoscopy
	  ○ Angiogram

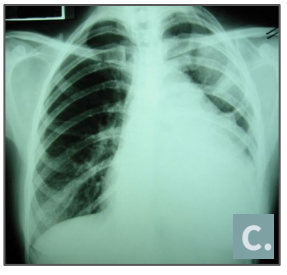
Treatment	• Benign: complete excision
	• Malignant: complete excision if possible, if there's residual masses then treated with chemo +/- radiotherapy
	  ○ If non-resectable or incomplete resection:
	  – Post-op radiotherapy.



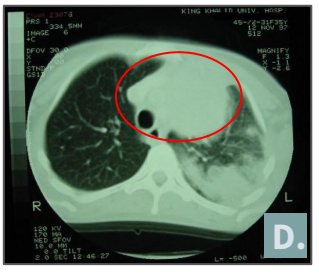
Picture A: superior mediastinal mass.



picture B CT of big mediastinal mass of thymoma.



Picture C Advanced case of thymoma extended to lungs and pleura (has to be removed along with the lung and metastasis).



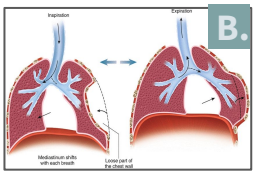
picture D Big mass of thymus (anterior mediastinal thymoma) and Left lung is full of metastasis. stage IV.

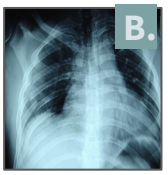
Trauma:

1. Road Traffic Accidents
2. Fractured ribs: - Simple Complicated
3. Haemothorax
4. Pneumothorax
5. Flail Chest
6. Lung Contusion & ARDS

Fractured ribs & Flail Chest

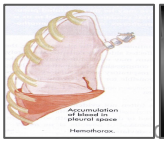
- **Picture A:** a patient of multiple fractures showing hemothorax opacity, lung contusion [1] and surgical emphysema.
- **Picture B:** Flail chest (fracture in two or more consecutive ribs, causing paradoxical movement [3] of that region of the chest). Need to be on ventilators .
- In **Picture C:** multiple fractures.

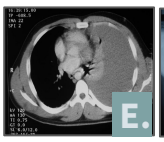


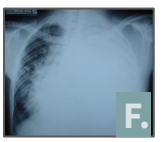


Hemothorax

- Hemothorax: accumulation of blood in pleural cavity, managed by chest tube drainage, some cases need open thoracotomy to treat the origin of bleeding (intercostal arteries, lung parenchyma, mediastinum…)
- **Picture D:** Hemothorax which is usually a complication of trauma, gunshot, causes of pulmonary opacity.
- **Picture E:** Collapsed left lung showing opacity due to hemothorax.
- **Picture F:** Massive hemothorax compressing the trachea and carina pushing them to the other side.

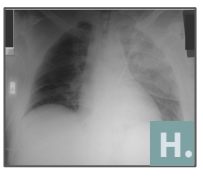


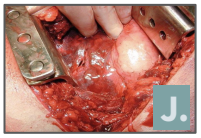




Lung contusion & ARDS

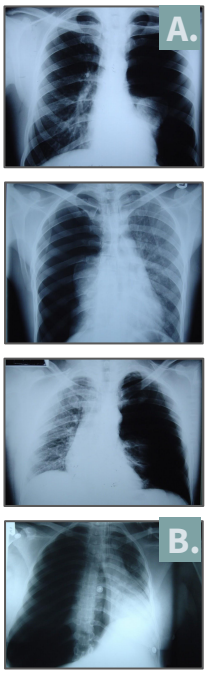
- **Picture G - H:** X ray showing lung contusion (bleeding within the lungs)
- **Picture I:** Advanced lung contusion opacity usually develops after 2-3 h up to 24 hrs
- **Picture J:** Primary treatment of lung contusion is supportive therapy including intubation, ventilation and antibiotics (unless there was an indication like hemorrhagic shock, then we treat it surgically to stop the hemorrhage).
- When giving lung contusion patient IV fluid make sure that :
  -The patient has no bleeding in other internal organ.
  -Give conservative amount of fluid/crystalloids,
  to avoid its accumulation outside the lung through intravascular structures.
- **Acute respiratory distress syndrome (ARDS)[2]** is characterized by impaired oxygenation, diffuse lung opacification on chest X-ray and an increasing 'stiffness' of the lungs (decreased compliance).





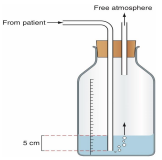
1. Lung contusion or a bruised lung, often occurs after a blow to the chest. The blunt impact can damage blood vessels, causing blood and fluid to build up in your lungs.
2. Basically it occurs when fluid builds up in the lung. The fluid keeps your lungs from filling with enough air, which means less oxygen reaches your bloodstream.
3. Paradoxical movement: the floating segment moves inward during inspiration and outward during expiration

Pneumothorax



- **Picture A:** Collapsed lung appears **radiolucent** in X-ray.
- **Picture B:** Tensions pneumothorax started to compress the the lung , mediastinum and the other lung, Both lungs are collapsed with shifted mediastinum
- **Causes:**
  - 40-50 year-old smoker causing secondary pneumothorax.
  - Spontaneous pneumothorax
  - cyst or bullae

- **Treatment:** by inserting a large-bore needle or chest tube (tube thoracostomy) between the ribs to remove the excess air.
- **Pneumothorax** occurs when air enters the potential space between the visceral and parietal pleura.
- **Initial management**: aspiration or by insertion of a chest drain connected to an underwater seal into the pleural space.
  This allows the lung to re-expand.



Types of Pneumothorax:

Traumatic Pneumothorax

Caused by either:

- **External chest wound:** resulting in open pneumothorax that's often associated with a 'sucking wound', where air moves in and out of a chest wound with respiration.
- **Internal air leak:** spontaneous leakage from a large bulla or small air sac on the lung surface.

Spontaneous pneumothorax

Primary or Secondary:

- **Primary pneumothorax:** typically occurs in young (15–35 years), tall and especially smoker individuals with essentially normal lungs apart from a few apical bullae or blebs.
- **Secondary pneumothorax:** develops in elderly patients (55–75 years) with a background of emphysema and chronic obstructive pulmonary disease.

Tension (massive) pneumothorax:[1]

Pathogenesis:

- The pulmonary leak point may have a flap valve mechanism that allows air out of but not back into the lung, causing a rapid build-up of pressure within the pleural cavity.
- This can be fatal, as the high intrapleural pressure completely flattens the ipsilateral lung while deviating the mediastinum to the opposite side, impeding venous return.

1- If the patient is clinically diagnosed with massive pneumothorax don't wait for X-ray results, you have to insert your needle (needle decompression) above the rib (to avoid vessels and nerves) immediately because the patient might die within minutes due to (severe compression on the heart and major vessels SVC , IVC + collapsing lungs + low cardiac output and input).
-It's highly life threatening!
-They present with severe symptoms of two systems respiratory and cardiovascular : tachycardia , tachypnic , unconscious , low blood pressure , dyspnea , cyanosis
-In advance stage they presented with electrical pulses activity refers to cardiac arrest in which the electrocardiogram shows a heart rhythm that should produce a pulse or heart peat , but does not.

Management:

Spontaneous pneumothorax:

- **Primary spontaneous pneumothorax:**
  →If small and patient is asymptomatic: Observation (should resolve spontaneously in 10 days) reassess with CXR.
  -Small chest tube may benefit some patients.
  → If larger and/or patient is symptomatic:
  - Administration of supplemental oxygen
  - Chest tube insertion to allow air to be released.
- **Secondary spontaneous pneumothorax:**
  - Chest tube drainage

Tension pneumothorax (Medical emergency!):

- If tension isn't relieved by decompression (via large-bore needle or chest tube) followed by thoracostomy the patient is likely to die from hemodynamic compromise.

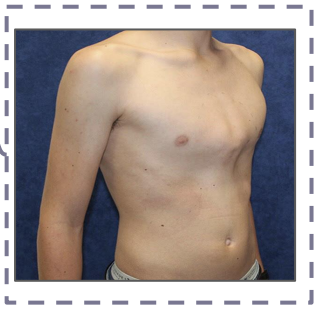
Open pneumothorax:

- Immediate treatment with an occlusive dressing taped on three sides to allow air out of the chest but not in.
- Definitive treatment is with a chest drain.

Chest wall deformities:

Pectus excavatum [1] (funnel chest)

Pectus carinatum (pigeon chest)



Pleural Cavity:

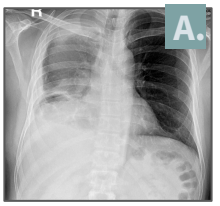
1. Spontaneous Pneumothorax
2. Pleural effusion
3. Empyema (infection)
4. Mesothelioma

1. Pectus excavatum can affect the heart and respiratory system, it's congenital and we have to rule out congenital cardiac anomalies can be corrected by nuss procedure
   - Pectus excavatum can be associated with connective tissue disorders such as Marfan's syndrome, and with unilateral breast hypoplasia. Correction is only indicated when the patient's quality of life is clearly impaired because of appearance, & it involves major surgery.

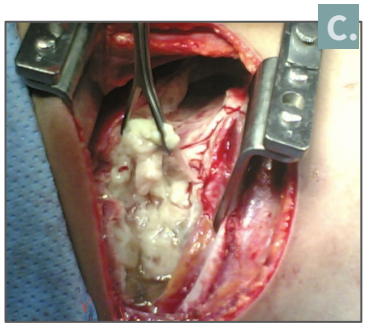
Mesothelioma

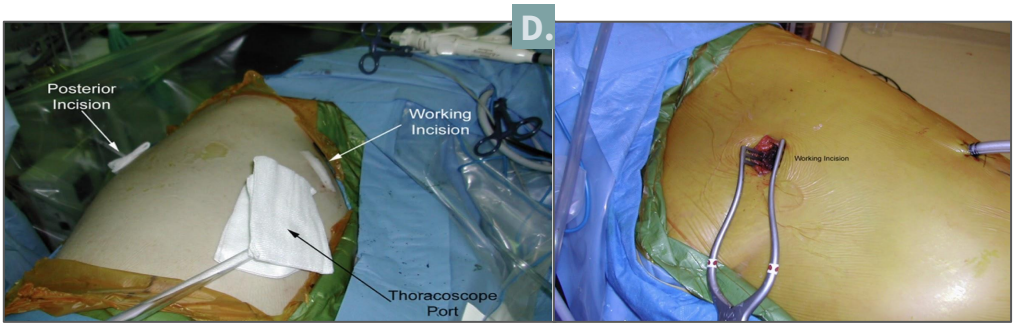
- Mesothelioma is a malignancy that involves mesothelial cells that normally line the body cavities, including the pleura.
- **Asbestos** is the principal carcinogen implicated in the pathogenesis of malignant pleural mesothelioma.
- The patient commonly presents with: shortness of breath.
- In many cases, the diagnosis is made by a percutaneous pleural biopsy but, if this is not successful, thoracoscopy or open pleural biopsy is useful.
- The main differential diagnosis is disseminated adenocarcinoma involving the pleural cavity.
- Surgical resection by excision of the parietal pleura, lung, diaphragm and pericardium (pleuropneumonectomy) is not generally reported to offer a survival benefit, except possibly in very early lesions. Radiotherapy and chemotherapy have no curative value. Therapy is, therefore, usually directed towards controlling symptoms.

Empyema & Pleural Effusion



- Pleural effusion is an abnormal collection of fluid in the pleural space while Empyema is a collection of pus within the pleural cavity and it commonly follows pneumonia due to secondary infection of a reactive parapneumonic effusion.
- Thin empyema may be resolved be intercostal drainage.
- Thick & loculated empyema requires formal surgical drainage.
- Other causes of empyema include postsurgical bronchial or oesophageal suture line leakage, lung abscesses, esophageal rupture or perforation, repeated aspiration of pleural effusion, secondary infection of a clotted haemothorax and, rarely, a sub-phrenic abscess.
- **Picture A:** Parapneumonic effusion and collapsed lung (opacity).
- **Picture B:** Collapsed right lung with empyema , failed drainage of pus due to thickened pleura (visceral and parietal) and thickened debris.
  - Patient present with chest pain , hemoptysis with cough





Picture C-D: Decortication → removing visceral/parietal pleura and debris.
Inserting chest tubes to inflate the lungs and we leave them for few more days until the lungs fills the cavity and return to its normal state.

History and Physical Examination:

Added from Johns Hopkins Textbook of Cardiothoracic Surgery & Talley

History

- History of a potential thoracic surgical patient should include presenting symptoms, previous diagnosis of cardio pulmonary disease, comorbid conditions such as diabetes mellitus, renal and liver dysfunction, current medications and allergies, tobacco use, and alcohol use. As the most frequent complications are pulmonary and cardiovascular, the history should focus on these areas.

- **Major presenting symptoms:**

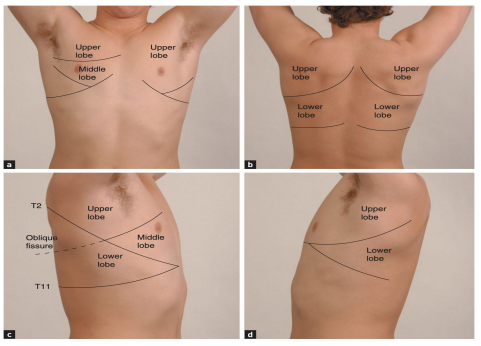
01
- Cough
- Sputum
- Haemoptysis

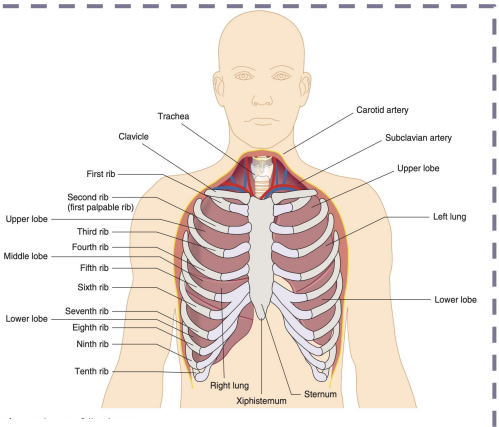
02
- Dyspnoea (acute, progressive or paroxysmal)
- Wheeze
- Chest pain

03
- Fever
- Hoarseness
- Night sweats

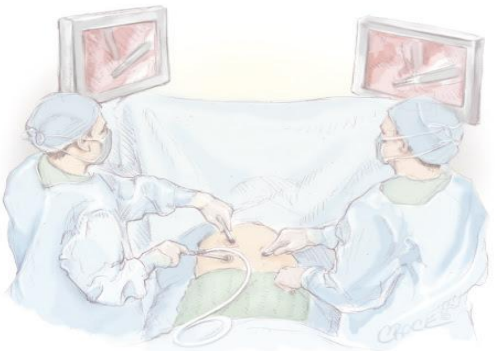
Physical Examination

- Examination begins with an assessment of overall appearance, looking especially for evidence of cachexia and generalized wasting.
- Cervical and supraclavicular lymphadenopathy can indicate metastatic disease.
- Cardiovascular examination should note murmurs (valvular disease), arrhythmias (atrial fibrillation), and presence of peripheral edema (congestive heart failure).
- Pulmonary examination should note respiratory rate, use of accessory respiratory muscles, and presence of wheezing or rales.
- Abdominal examination can confirm the presence of regional tenderness, organomegaly, masses, or adenopathy.
- The extremities should be examined for equality of pulses, cyanosis, or clubbing.
- Neurologic examination should focus on motor strength and gait, both of which are important because deficits can affect postoperative mobilization and rehabilitation.





Assessment of Pulmonary Resection:



Assessment addresses two questions:

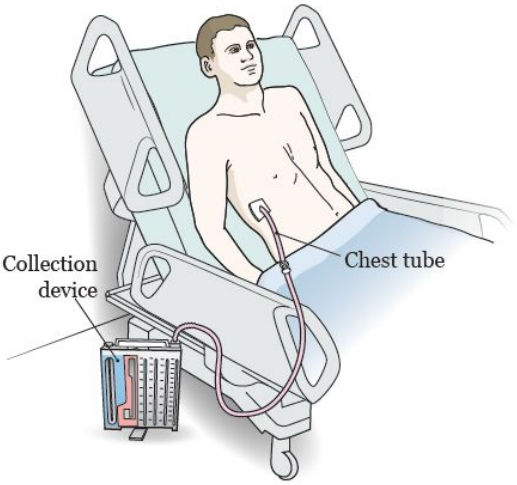
- ➔ Is the patient fit for pulmonary resection?
- ➔ Is the disease potentially curable?

So, patients with poor LV function and/ or unstable angin not suitable for pulmonary resection.If an effusion is pres this should be aspirated; if malignant cells are noted on cytology, this would preclude resection.Following assessment and surgical resection, the final pathological Tumour, Node, Metastasis (TNM) stage is helpful in indicating prognosis and determining whether a patient might benefit from adjuvant therapy, usually within the setting of a trial.

Chest tube indications:

Added from Kaplan for Surgery, 2020 edition

- The presence of symmetrical breath sounds indicate satisfactory ventilation; an absence or decrease of breath sounds may indicate a pneumothorax and/or hemothorax and necessitate chest tube placement. Pulse oximetry can be used to determine if oxygenation is satisfactory (O2 saturation >90–95%); hypoxia may be secondary to airway compromise, pulmonary contusion, or neurological injury impairing respiratory drive and necessitate intubation. Measurement of end tidal CO2 (capnography) is also very useful.



Summary

Recall

Q1: What's pulmonary sequestration? What's the treatment of each type?
Answer: Abnormal benign lung tissue with separate blood supply that DOES NOT communicate with the normal tracheobronchial airway; have systemic arterial blood supply (usually off thoracic aorta).
Treatment → Extralobar? Surgical resection. Intralobar? Lobectomy.

Q2: What is the major risk during operation for sequestration?
Answer: Anomalous blood supply from below the diaphragm (can be cut and retracted into the abdomen and result in exsanguination!); always document blood supply by A-gram or U/S with Doppler flow.

Q3: What's Pectus Excavatum?
Answer: Chest wall deformity with sternum caving inward (Think: exCAVatum = CAVE).

Q4: What's Pectus Carinatum?
Answer: Chest wall deformity with sternum outward (pectus = chest, carinatum = pigeon); much less common than pectus excavatum.

Q5: What are the two types of pleural effusions and their etiologies?
Answer:
1. Transudative → congestive heart failure, nephrotic syndrome, and cirrhosis.
2. Exudative → infection, malignancy, trauma, and pancreatitis.

Q6: What are Light's criteria, whereby if at least one of the criteria is met, the fluid is defined as exudative?
Answer:
1. Pleural fluid-to-serum protein ratio >0.5
2. Pleural fluid-to-serum LDH ratio >0.6
3. Pleural fluid LDH >2/3 upper limit of laboratory's normal serum LDH

Q7: What is the diagnostic test of choice? And what is the treatment?
Diagnosis: Thoracentesis (needle drainage) with pleural fluid studies, including cytology.
Treatment:
1. Pigtail catheter or thoracostomy (chest tube)
2. Treat underlying condition
3. Consider sclerosis if malignant pleural effusion

Q8: What is an empyema?
Answer: Infected pleural effusion; must be drained, usually with chest tube(s). Decortication (thoracotomy and removal of an infected fibrous rind from around the lung) may be necessary if tube thoracostomy drainage is incomplete

Q9: What type of lung cancer arises in nonsmokers?
Answer: Adenocarcinoma.

Q10: Cancer arises more often in which lung?
Answer: Right > left; upper lobes > lower lobes.

Q11: What are the signs/symptoms of lung cancer?
Answer: Change in a chronic cough. Hemoptysis, chest pain, dyspnea. Pleural effusion (suggests chest wall involvement). Hoarseness (recurrent laryngeal nerve involvement). Superior vena cava syndrome. Diaphragmatic paralysis (phrenic nerve involvement). Symptoms of metastasis/paraneoplastic syndrome. Finger clubbing.

Q12: What are paraneoplastic syndromes?
Answer: Syndromes that are associated with tumors but may affect distant parts of the body; they may be caused by hormones released from endocrinologically active tumors or may be of uncertain etiology.

Q13: What is the characteristic appearance of hamartoma on CXR?
Answer: "Popcorn" calcification.

Q14: What are the signs/symptoms of lung abscess? What is the associated diagnostic study?
Answer: Symptoms → Fever, productive cough, sepsis, fatigue. Diagnosis → CXR: air–fluid level.

Q15: Where are Thymoma found in the mediastinum? What percentage of patients with thymoma have myasthenia gravis?
Answer: Anterior. 30% to 45%.

Q16: Where in the mediastinum do Neurogenic Tumors occur?
Answer: Posterior, in the paravertebral gutters

439's Quiz

Q1: Old patient presented with weight loss, hemoptysis. he is heavy smoker for several years ,after screening (CXR) we found Giant abscess with thick wall, what is the next step?

A) FNA
B) Restriction
C) Antibiotics

Q2: Indication of surgical treatment for patient diagnosed with bronchiectasis.

A) Cystic type
B) Localized disease
C) Both

Q3: A 39-year-old lady is having a diagnostic laparoscopy to investigate her symptoms of right iliac fossa pain. The procedure lasts 50 minutes and following the removal of the endotracheal tube, the patient is taken to the recovery room where she develops sudden onset shortness of breath, tachycardia and hypotension. Following rapid assessment, she is found to have a tension pneumothorax which is decompressed by needle thoracocentesis. From the list below, choose the clinical sign which is not a feature of tension pneumothorax

A) Tracheal deviation away from the affected side
B) Increased expansion on the affected side
C) Decreased breath sounds on the affected side

Q4: During a ward round, you are asked to review a chest radiograph of a 45-year-old female who experienced difficulty breathing 1 day post laparoscopic cholecystectomy. You are quizzed about the contents of the mediastinum. From the list below, which structure does not form part of the contents of the mediastinum?

A) Thymus
B) Trachea
C) None of the above

Answers

Q1	B
Q2	C
Q3	B
Q4	C

Extra Questions

438's Quiz

Q1: A 42-year-old homeless man presents with a 3-week history of shortness of breath, fevers, and pleuritic chest pain. Chest x-ray (CXR) reveals a large left pleural effusion. Thoracentesis reveals thick, purulent-appearing fluid, which is found to have glucose less than 40 mg/dL and a pH of 6.5. A chest tube is placed, but the pleural effusion persists. Which of the following is the most appropriate management of this patient?
A) Placement of a second chest tube at the bedside and antibiotic therapy.
B) Thoracotomy with instillation of antibiotics into the pleural space.
C) Thoracotomy with decortication and antibiotic therapy.

Q2: A 63-year-old woman with chronic obstructive pulmonary disease (COPD) presents with a several- week history of fever, night sweats, weight loss, and cough. Her CXR is noted to have a density in the left upper lobe with a relatively thin-walled cavity. Bronchoscopy and computed tomographic (CT) scan are suggestive of a lung abscess rather than a malignant process. Which of the following is the most appropriate initial management of this patient?
A) Systemic antibiotics directed against the causative agent.
B) Left upper lobectomy.
C) Surgical drainage of the abscess.

Q3: A 71-year-old woman with a 40-year smoking history is noted to have a peripheral nodule in her left upper lobe on chest x-ray. Workup is consistent with small cell lung cancer with ipsilateral mediastinal lymph node involvement but no extrathoracic disease. What is the best treatment option for this patient?
A) Thoracotomy with left upper lobectomy and mediastinal lymph node dissection
B) Neoadjuvant chemoradiation followed by thoracotomy with left upper lobectomy.
C) Chemoradiation.

Q4: A previously healthy 20-year-old man is admitted to the hospital with acute onset of left-sided chest pain. Electrocardiographic findings are normal, but CXR shows a 40% left pneumothorax. Appropriate treatment consists of which of the following procedures?
A) Thoracotomy
B) Tube thoracostomy
C) Thoracostomy and intubation

★ Q5: A 32 years old male presented with history of mild chest pain, productive cough especially early in the morning and dyspnea for 6 weeks. He gave history of swallowing a metal object. Chest CT-scan showed cystic abnormality.
What is the most likely diagnosis?
A) Bronchiectasis
B) Thymoma
C) Pneumonia

Q6: A 72-year-old woman is brought to the emergency department because of lethargy and weakness for the past 5 days. During this period, she has had a headache that worsens when she leans forward or lies down. Her arms and face have appeared swollen over the past 2 weeks. She has smoked two packs of cigarettes daily for 40 years. Examination shows jugular venous distention. There is pitting edema in both arms. Which of the following is the most likely cause of this patient's symptoms?
A) Pulmonary embolism
B) Pulmonary tuberculosis
C) Lung cancer

★ Q7: In SCLC, which one of the following used for staging?
A) Lung aspiration
B) Bronchoscopy
C) CT

★ Q8: What is the GOLDEN STANDARD method to investigate primary lung carcinoma?
A) Chest X-ray
B) CT scan with IV contrast
C) Bronchoscopy

★ Q9: Which one of the following statements are correct regarding SCLC management?
A) No surgical indication to do any intervention
B) Surgery only
C) Chemotherapy to down stage the tumor and then the patient undergo surgery

Answers

Q1	C	Q4	B	Q7	C
Q2	A	Q5	A	Q8	B
Q3	C	Q6	C	Q9	A

Good Luck!

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