

# Pathology of Respiratory System “Practical”

Editing File

**Black:** original content.

**Red:** Important.

**Green:** AlRikabi's Notes.

**Grey:** Explanation.

**Blue:** Only found in boys slides.

**Pink:** Only found in girls slides.



# Objectives

- Acquire the basic knowledge of the histopathological features of lobar pneumonia, bronchopneumonia, emphysema, pulmonary embolus and pulmonary infarction.
- Identify the gross appearance of bronchial asthma, bronchiectasis, bronchopneumonia, lobar pneumonia, bronchogenic carcinoma, squamous cell carcinoma and metastatic carcinoma of the lung

## Contents

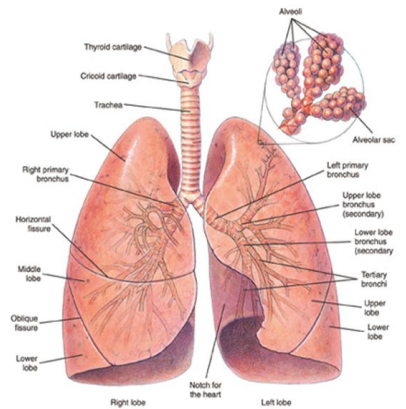
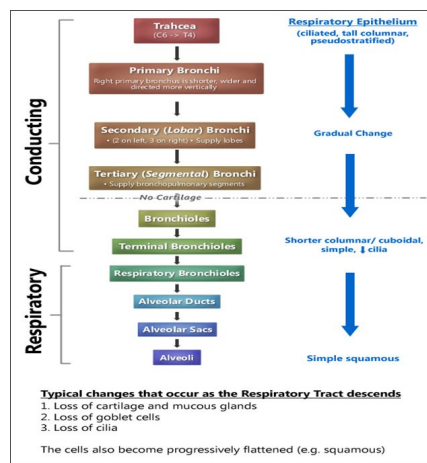
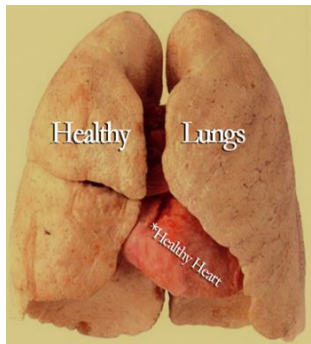
### First practical

- Allergic Alveolitis
- Bronchial asthma
- Bronchiectasis
- Chronic Bronchitis
- Emphysema
- Lobar Pneumonia
- Bronchopneumonia
- Pulmonary Embolus & Infarction

### Second practical

- Tuberculosis
- Lung carcinomas:
  - Squamous cell carcinoma
  - Adenocarcinoma
  - Large cell carcinoma
  - Small cell carcinoma
  - Metastatic tumors
  - Mesothelioma

# First Practical



Cartilage is present to the level of proximal bronchioles. Beyond terminal bronchiole gas exchange occurs. The distal airspaces are kept open by elastic tension in alveolar walls.

## Normal anatomy and histology

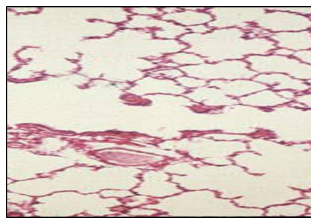
Lung&Heart

Anatomy of the lung

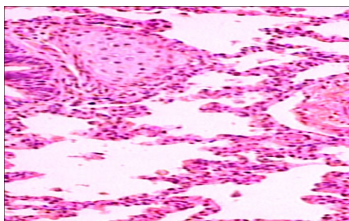
Lungs

Alveoli

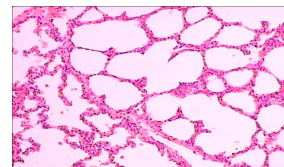
Bronchiole



Microscopic section of normal lung showing terminal bronchiole (T) , respiratory bronchiole (R), alveolar duct (AD), alveolar sac (AS), and alveoli (A).



This view shows a **BRONCHIOLE** (left) and **Blood Vessel** (right) in cross-section as well as numerous **ALVEOLI** in normal lung at 100X magnification. The bronchiole inner membrane is composed of pseudostratified columnar epithelial tissue. Portions of hyaline cartilage rings can also be seen outside of the bronchiole.



**Normal Alveoli:** These oval-shaped alveoli expand with air during inspiration, have very thin epithelial walls and are surrounded by capillaries creating the respiratory membrane where gas exchange occurs between air and blood

## Classification of Respiratory Diseases

- Inflammatory lung diseases:**  
(Asthma, cystic fibrosis, & COPD)
- Restrictive lung diseases:**  
(**Allergic Alveolitis**)
- Obstructive lung diseases :**  
(**Bronchial Asthma, Bronchiectasis, & (COPD- Ch. Bronchitis & Emphysema )**)
- Respiratory tract infections:**  
-Upper resp. tract infection (sinusitis, tonsillitis, otitis media, pharyngitis & laryngitis)  
-Lower resp. tract infection (**Pneumonia & Bronchopneumonia , T.B.**)
- Malignant tumors(SquamousCC, adenocarcinoma, Large CC & Small CC)**
- Benign tumors** (Pulmonary hamartoma, pulmonary sequestration)
- Pleural cavity diseases** ( eg. Mesothelioma, effusion )
- Pulmonary vascular diseases** (Embolism, edema & hypertension)
- Neonatal diseases** (pulmonary hyperplasia.)

## Restrictive Lung Disease

### Fibrosing

Usual interstitial pneumonia (idiopathic pulmonary fibrosis)  
Nonspecific interstitial pneumonia  
Cryptogenic organizing pneumonia  
Associated with collagen vascular disease  
Pneumoconiosis  
Associated with therapies (drugs, radiation)

### Granulomatous

Sarcoidosis  
Hypersensitivity pneumonia

### Eosinophilic

Loeffler syndrome  
Drug allergy-related  
Idiopathic chronic eosinophilic pneumonia

### Smoking-Related

Desquamative interstitial pneumonia  
Respiratory bronchiolitis



End-stage: diffuse interstitial pulmonary fibrosis (Honeycomb lung).



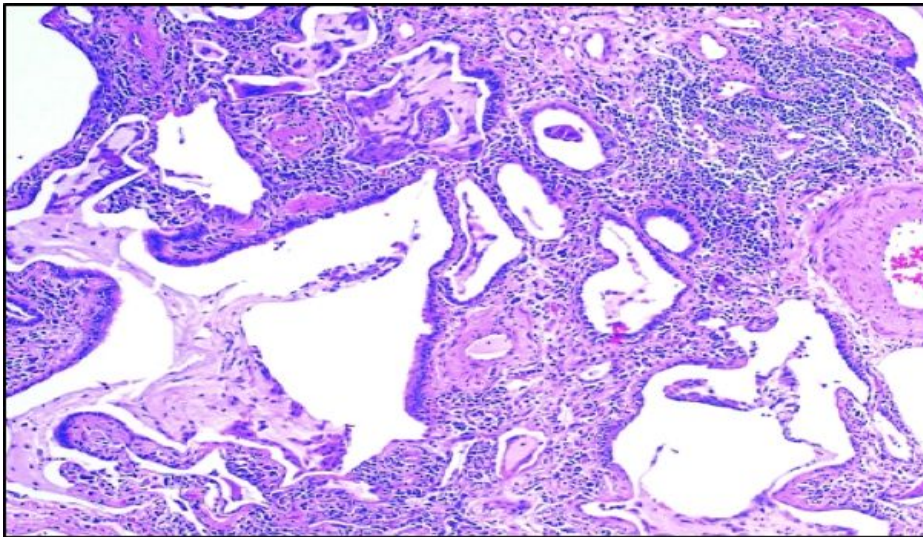
# RESTRICTIVE LUNG DISEASES

## ALLERGIC ALVEOLITIS



Restrictive Lung Disease  
(Honeycomb lung) – Cut section

- Extensive fibrosis.
- organizing diffuse alveolar damage.
- Cystic spaces

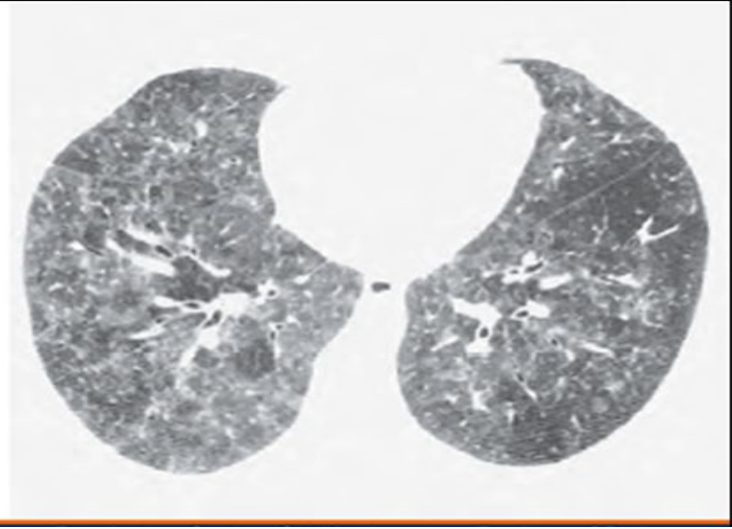
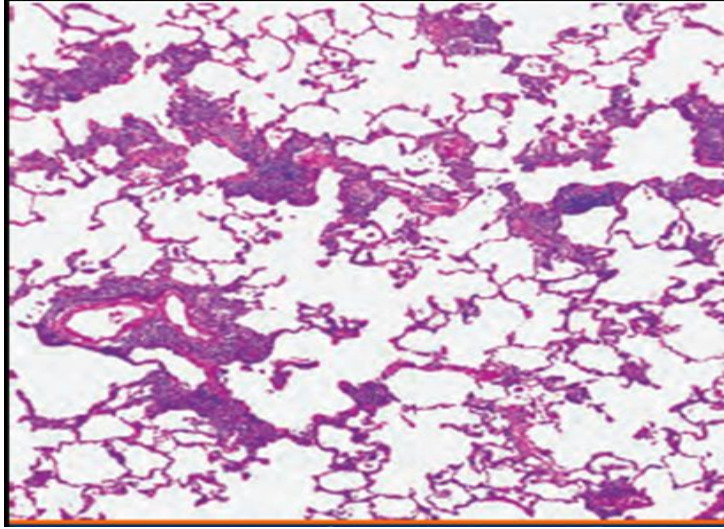


Restrictive Lung Disease (Honeycomb lung) – LPF

- Pulmonary fibrosis
- Extensive interstitial collagen deposition
- Minimal lymphocytic inflammatory infiltrate.
- Residual airspace dilation.

# RESTRICTIVE LUNG DISEASES

## ALLERGIC ALVEOLITIS

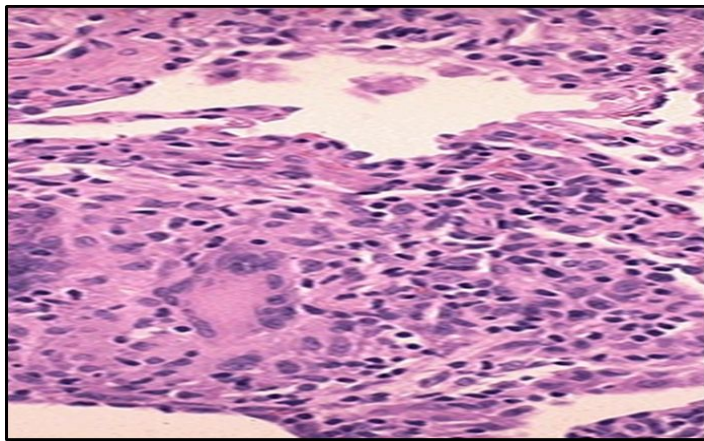


### Hypersensitivity Pneumonitis– Histopathology & Radiogram

This case of extrinsic allergic alveolitis shows

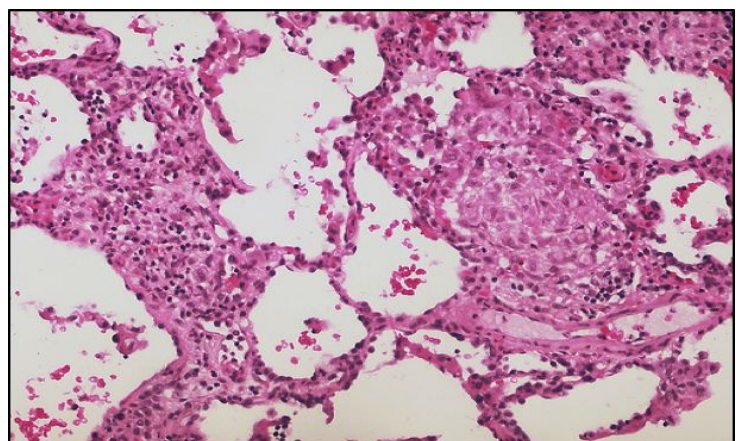
- interstitial inflammation along alveolar ducts (bronchiolocentric distribution or peribronchiolar).
- The inflammation is:
  - Diffuse
  - lacks nodularity

manifests radiologically as a ground-glass pattern.



### Hypersensitivity Pneumonitis (HP)

- Interstitial bronchiolocentric pneumonitis (Extrinsic allergic alveolitis) with:
  - Lymphocytes
  - plasma cells
  - foamy macrophages in:
    - alveolar space
    - terminal airways .
- Interstitial fibrosis,
- obliterative bronchiolitis
- intra-alveolar exudate .
- Nodules of organizing fibroblasts & histiocytes
- Interstitial noncaseating granulomas
- other inflammatory cells.



### Hypersensitivity Pneumonitis (HP)

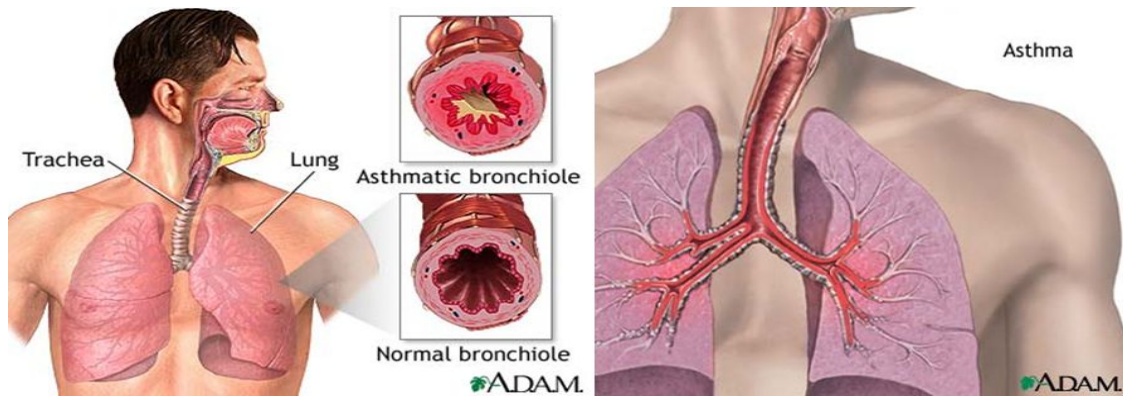
- Interstitial fibrosis,
- lymphocyte infiltration in the alveolar wall
- Non-caseating granuloma.
- collagen fibers hyperplasia (mainly), especially in the bronchioles due to
  - their respective muscle fibers
  - endothelial cell proliferation & thickening



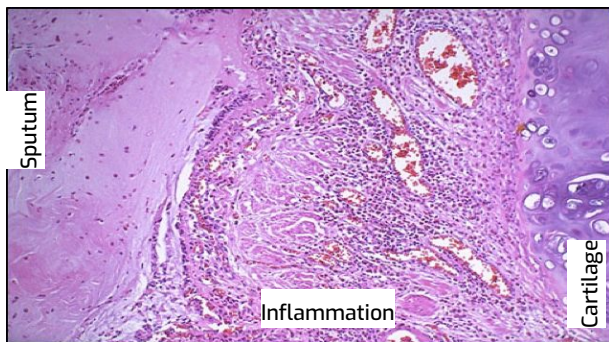
# CHRONIC OBSTRUCTIVE LUNG DISEASES

## 1- Bronchial asthma

### BRONCHIAL ASTHMA - Anatomy



- Bronchial Asthma: Inflammation of the airways causes airflow into and out of the lungs to be restricted.
- The muscles of the bronchial tree become tight and the lining of the air passages swells, reducing airflow and producing the characteristic wheezing sound



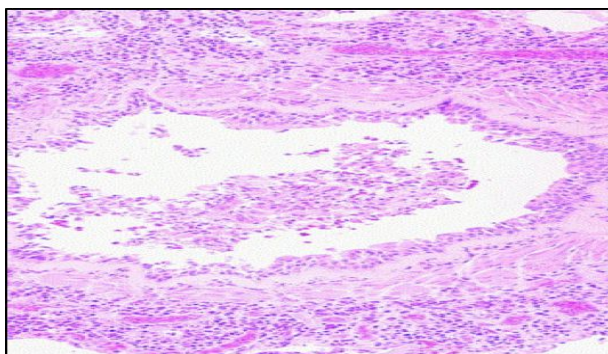
Between the bronchial cartilage at the right and the bronchial lumen:

- filled with mucus
- submucosa widened by smooth muscle hypertrophy
- edema,
- inflammation (mainly eosinophils).

These are changes of bronchial asthma.

The **peripheral eosinophil** count or the **sputum eosinophils** can increase during an asthmatic attack.

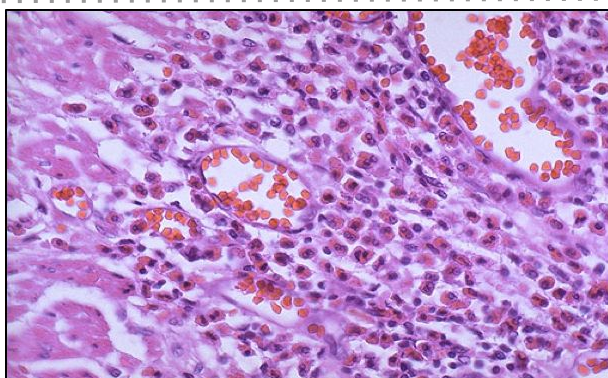
### BRONCHIAL ASTHMA - LPF



Bronchus from a fatal case of bronchial asthma in a 4-year-old child showing:

- Plugging of the lumen,
- Intense inflammatory infiltrate (With eosinophils)
- Vascular congestion.

### BRONCHIAL ASTHMA - LPF



Changes of bronchial asthma:

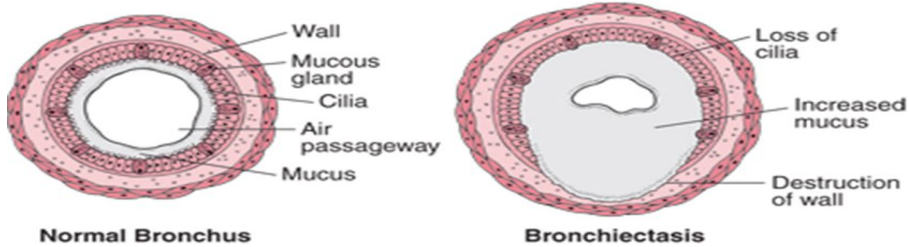
- numerous eosinophils (prominent from their **bright red cytoplasmic granules** in this case of bronchial asthma).

### BRONCHIAL ASTHMA - HPF

# CHRONIC OBSTRUCTIVE LUNG DISEASES

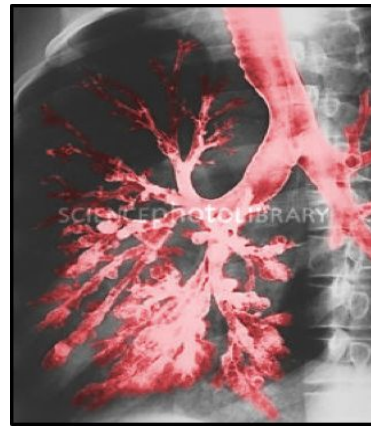
## 2- BRONCHIECTASIS

### Diagram of Normal & Bronchiectatic Bronchus



In Bronchiectasis:

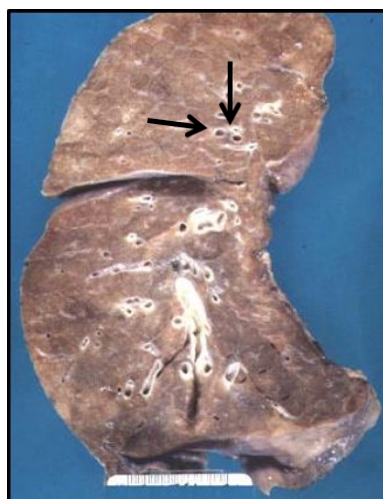
- mucus production increases
- cilia are destroyed or damaged,
- areas of the bronchial wall become chronically inflamed and are destroyed .



### Bronchiectasis – Gross pathology & Colored X-ray

- Permanent dilation of bronchi and bronchioles.
- Markedly distended peripheral bronchi.

**caused by:** destruction of muscle and elastic tissue resulting from or associated with chronic necrotizing infection



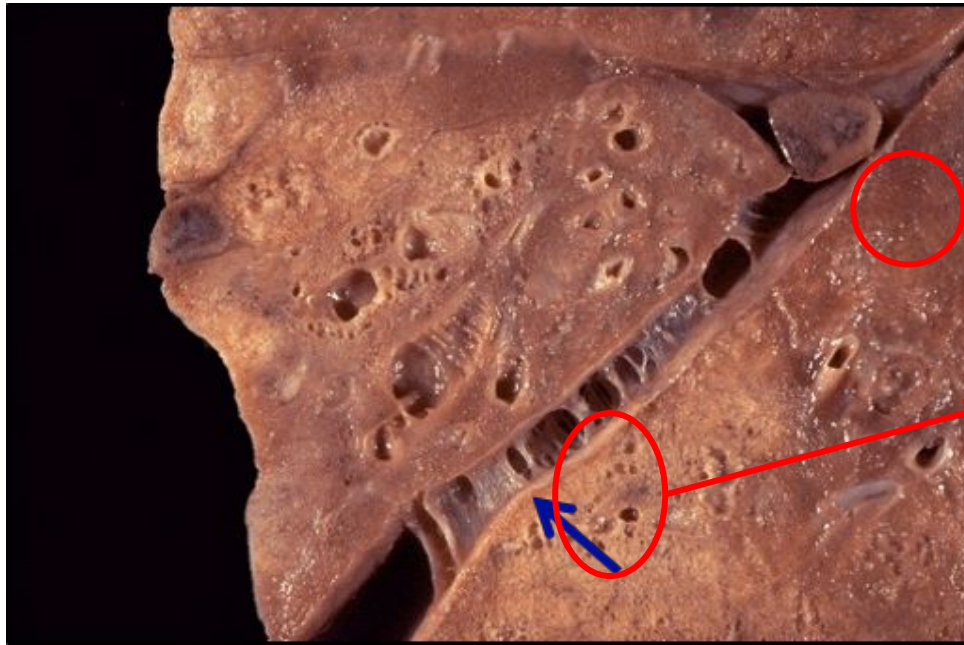
### Bronchiectasis – Gross pathology

- Bronchiectasis occurs when there is **obstruction** or **infection** with **inflammation** and **destruction of bronchi** so that there is permanent dilation.



# CHRONIC OBSTRUCTIVE LUNG DISEASES

## 2- BRONCHIECTASIS (cont.)

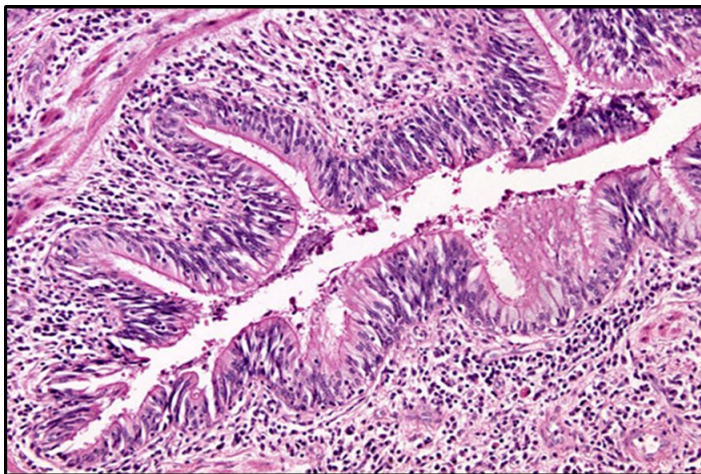


### Bronchiectasis – Gross pathology

The repeated episodes of inflammation can result in:

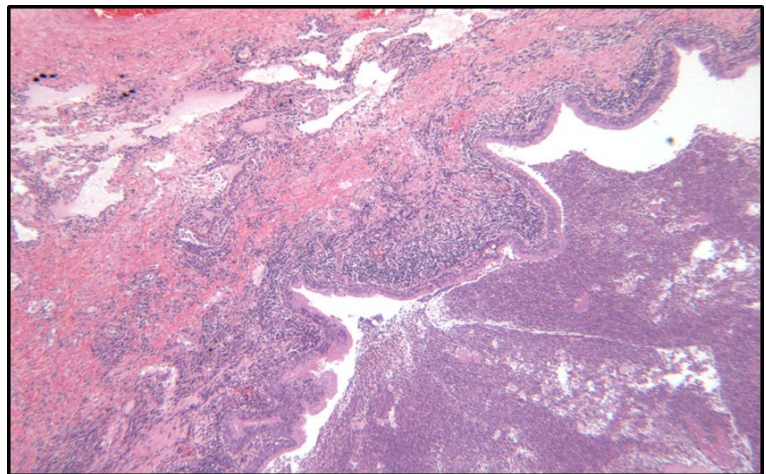
- Scarring
- fibrous adhesions between the lobes.
- Inflammation in the septa.

(Fibrous pleural adhesions are common in persons who have had past episodes of inflammation of the lung that involve the pleura).



### Bronchiectasis – HPF

- Chronic inflammation
- variable inflammation
- fibrosis of alveoli
- ulceration of bronchial wall
- ossification of bronchial cartilage
- thickened pleura.



### Bronchiectasis – LPF

Section of a dilated bronchus with:

- florid acute on chronic inflammation of the bronchial wall
- surrounding interstitial fibrosis.



# CHRONIC OBSTRUCTIVE LUNG DISEASES

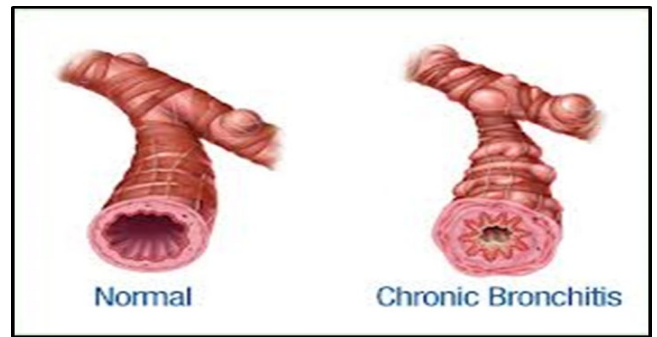
**Chronic Obstructive Pulmonary Diseases (COPD)**

also known as

Chronic Obstructive Lung Disease (COLD),  
Chronic Obstructive Airway Disease (COAD),  
Chronic Obstructive Respiratory Disease (CORD)

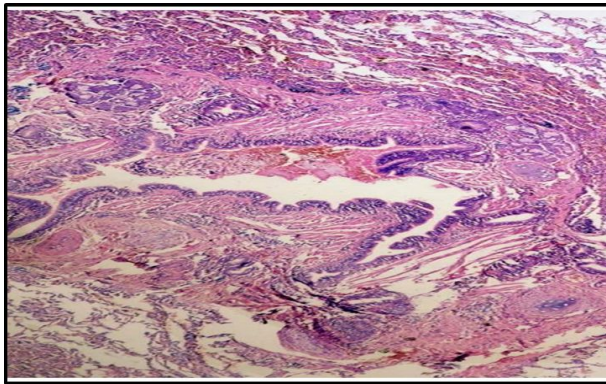
Include:

**3. Chronic Bronchitis**  
**4. Emphysema,**  
a pair of commonly co-existing diseases of the lungs in which the airways narrow over time.



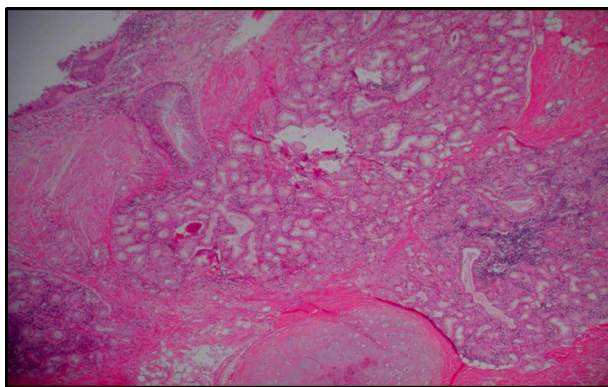
Normal vs Chronic bronchitis

## 3- Chronic Bronchitis



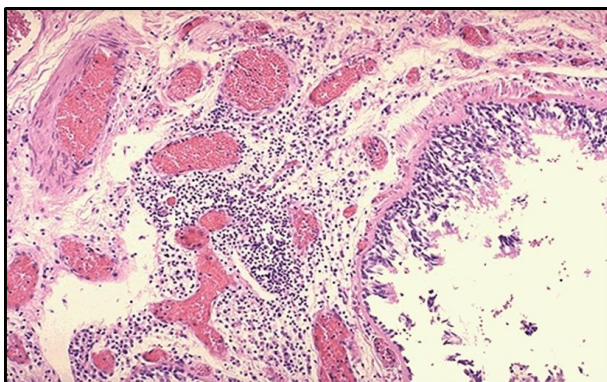
Chronic Bronchitis - LPF

- Inflammatory infiltrate in bronchial walls is composed of:
  - Lymphocytes
  - Plasma cells.
- In the lumen:
  - desquamated epithelial cells (**catarrhal inflammation**) .
- In mucosa (often occurs):
  - metaplasia of cylindrical ciliated epithelium into multilayered squamous epithelium.
- Goblet cells & the sero-mucous glands in the submucosal layer are:
  - Hyperplastic
- Muscularis mucosae:
  - hypertrophic.



Chronic Bronchitis - LPF

- **Early:**
    - hypersecretion of mucus in large airways
    - hypertrophy of submucosal glands in tracheobronchial tree .
  - **Later:**
    - increase in goblet cells in small airways
- contributes to excessive mucus production and airway obstruction .



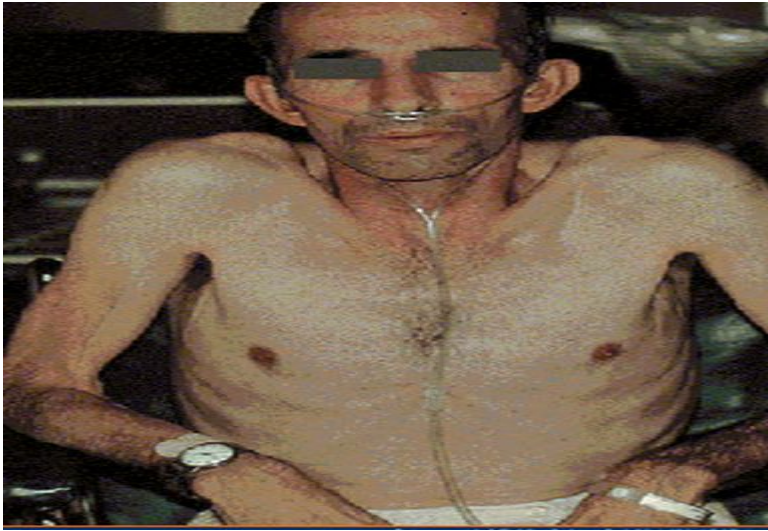
Chronic Bronchitis - HPF

- Chronic inflammatory infiltrates (range from absent to prominent).
- Increased percentage of bronchial wall occupied by submucosal mucous glands (**as measured by Reid index**); this directly correlates with:
  - sputum production
  - variable dysplasia
  - squamous metaplasia
  - bronchiolitis obliterans.



# CHRONIC OBSTRUCTIVE LUNG DISEASES

## 4- EMPHYSEMA

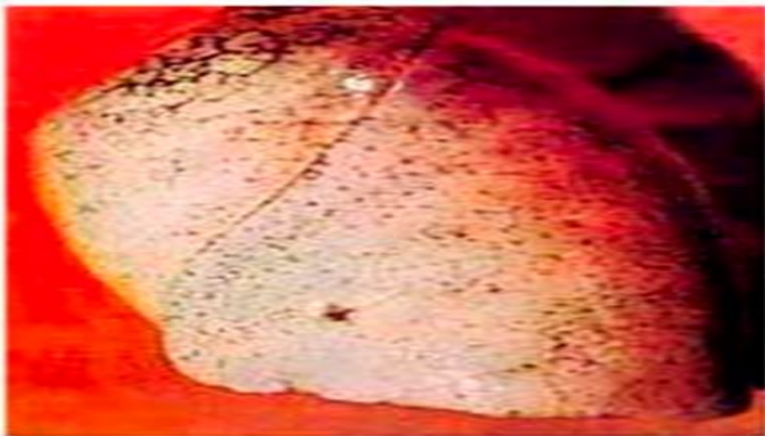


### Clinical Features

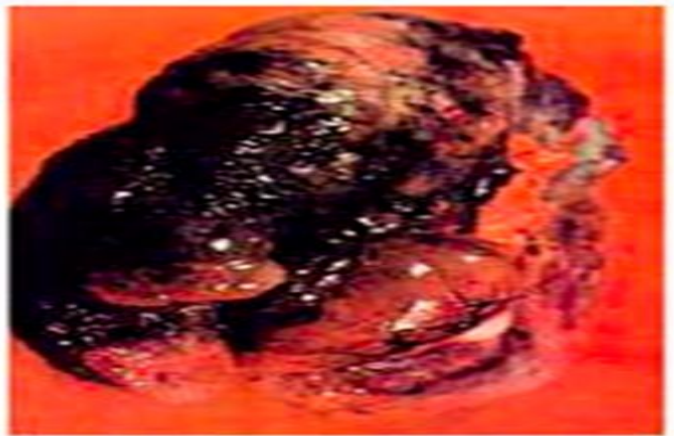
- Emphysema patient (so called -pink puffers).
- dyspnea
- no significant hypoxemia.
- Tend to be:
  - Thin
  - Have **hyperinflated lung** fields at total lung capacity
  - Free of signs of right heart failure.

### Complications:

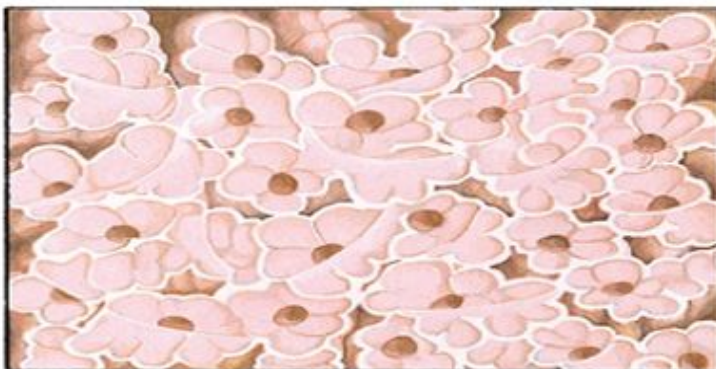
- Pulmonary hypertension.
- Cor pulmonale.
- Respiratory failure.
- Pneumothorax.



Normal Lung

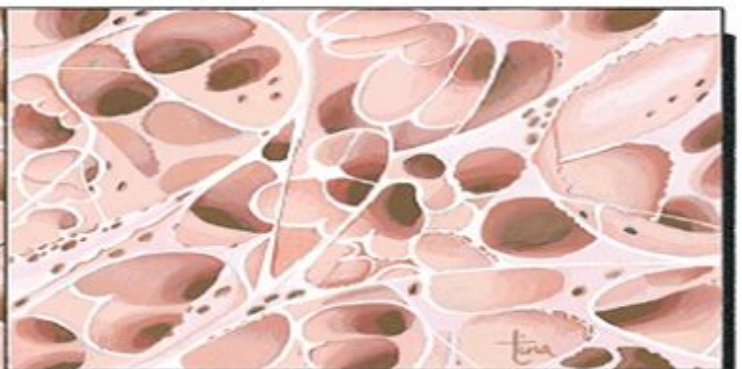


Emphysema



A

Normal Lung



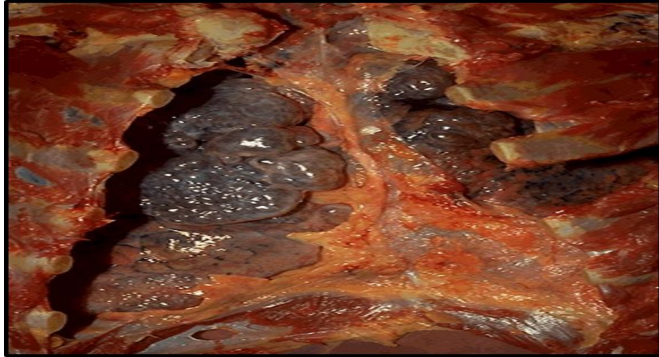
B

Emphysema



# CHRONIC OBSTRUCTIVE LUNG DISEASES

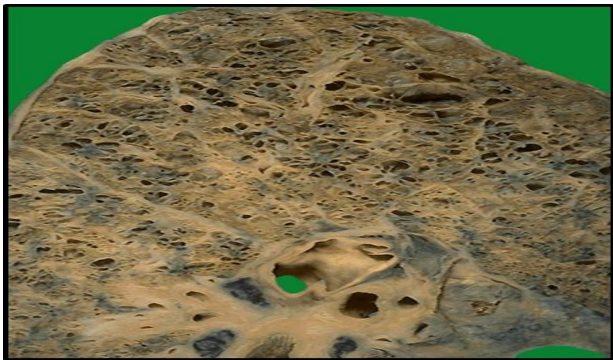
## 4- EMPHYSEMA (cont.)



The chest cavity is opened at autopsy to reveal: **numerous large bullae (In the upper lobes of both lungs)** on the surface of the lungs in a patient dying with emphysema.

(Bullae: large dilated air spaces that bulge out from beneath the pleura.)

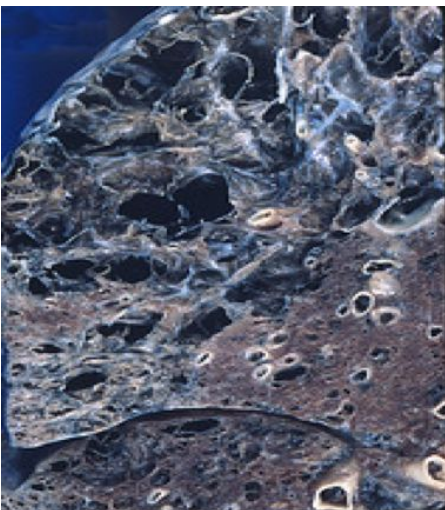
### Emphysema – Gross Anatomy



- Dilated air spaces in emphysematous lung. (Although there tends to be some scarring with time because of superimposed infections, **the emphysematous process is one of loss of lung parenchyma, not fibrosis.**)

How to differentiate between Emphysema and bronchiectasis practically?  
Emphysema will be close to the pleura.  
Bronchiectasis will be far from the pleura.

### Emphysema – Gross pathology



### Bullous Emphysema – Gross pathology

- A bulla (defined as: an emphysematous space larger than 1 cm).



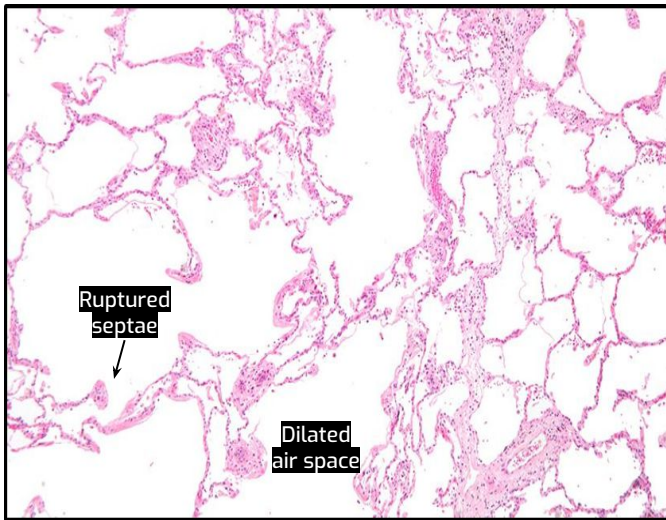
### Centrilobular Emphysema – Gross pathology

Centrilobular emphysema : Fixed, cut surface of a lung shows:

- multiple cavities
- heavy black carbon deposits lining the cavities (characteristic of smoking).

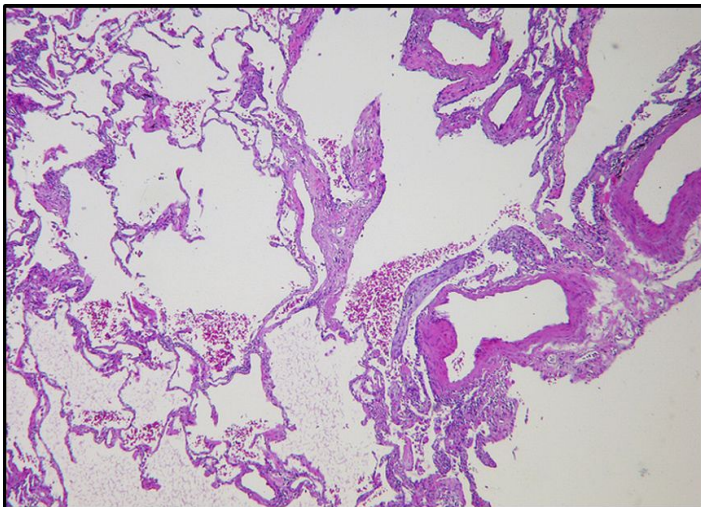
# CHRONIC OBSTRUCTIVE LUNG DISEASES

## 4- EMPHYSEMA (cont.)



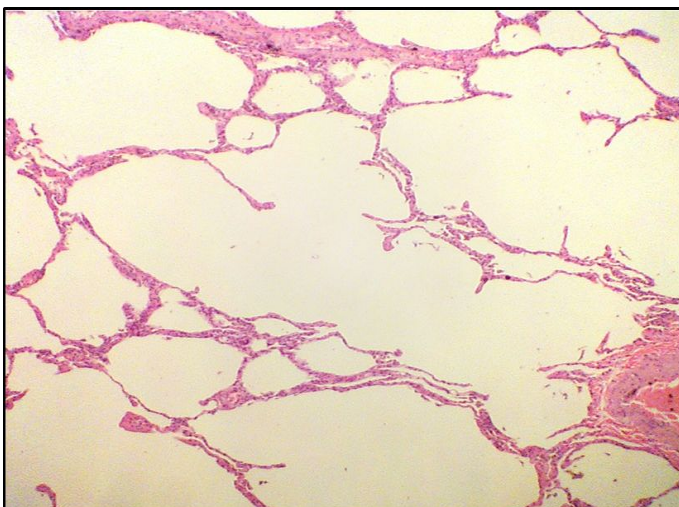
- Enlarged airspaces/alveolar spaces.
- Destruction of some alveolar septi.

**Panacinar Emphysema – LPF**



- Ruptured alveolar septae
- spurs (projections of the ruptured septa air spaces).

**Panacinar Emphysema – LPF**



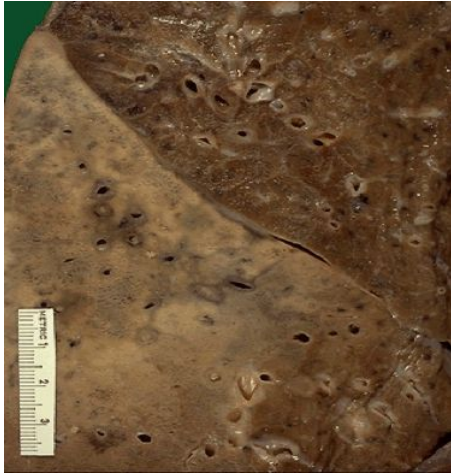
- Destruction of tissue
- emphysematous spaces with little surface area.
- few capillaries.
- large air spaces.
- Large vessel at lower left.

**Panacinar Emphysema - HPF**



# LOWER RESPIRATORY TRACT INFECTIONS

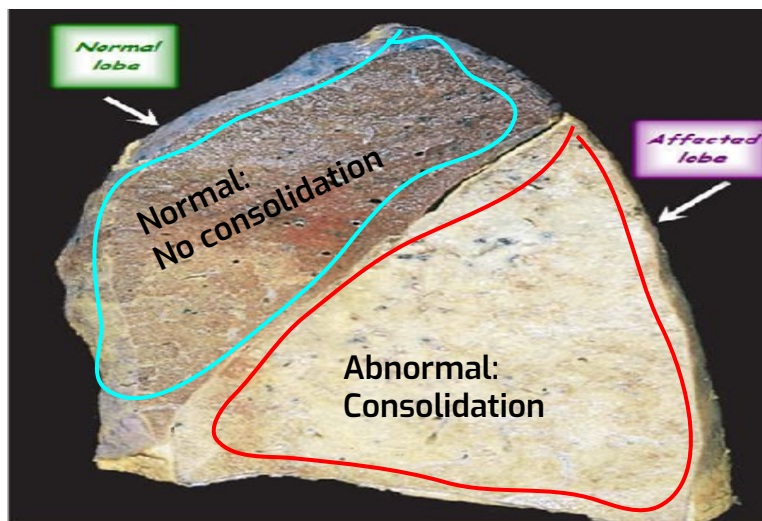
## 1- Lobar Pneumonia



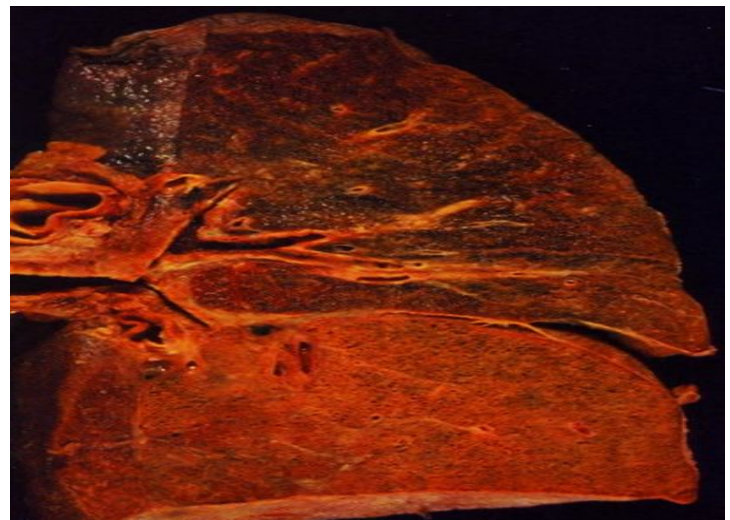
A closer view of the lobar pneumonia demonstrates:

- Distinct difference between the upper lobe and the consolidated lower lobe.

### Lobar Pneumonia - Gross pathology



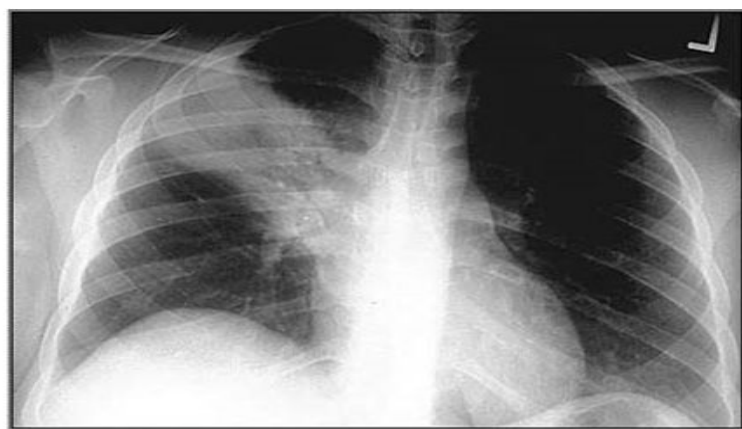
### Lobar Pneumonia - Gross pathology



### Lobar Pneumonia - Gross pathology



### Lobar Pneumonia of the right Lower lobe



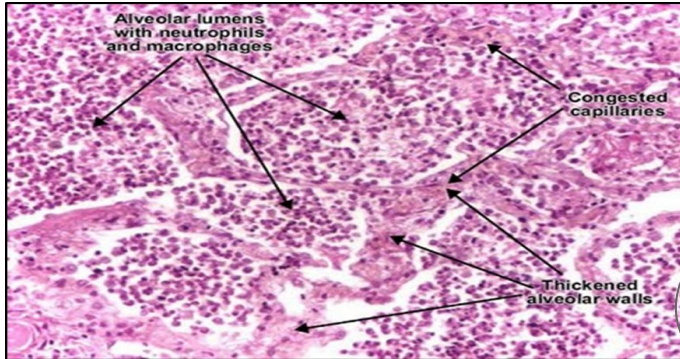
### Lobar Pneumonia of the right middle lobe

- Localised focus of consolidation (seen in both X-ray films taken from 2 different patients).



# LOWER RESPIRATORY TRACT INFECTIONS

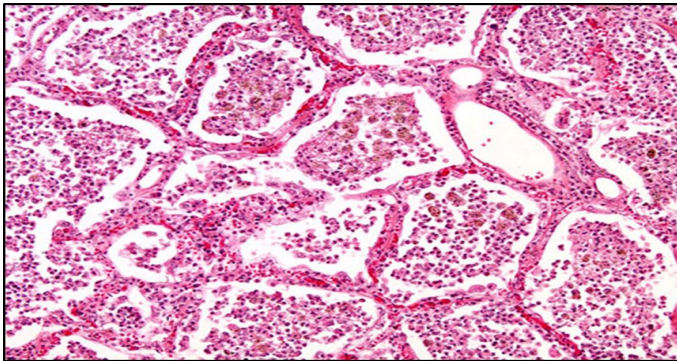
## 1- Lobar Pneumonia (cont.)



1. **Congestion** → (first 2 days)
2. **Red hepatisation** → (2nd to 4th day)  
(fibrinous alveolitis)
3. **Grey hepatisation** → (4th to 8th day)  
(leukocytic alveolitis)
4. **Resolution** → (after 8th day)

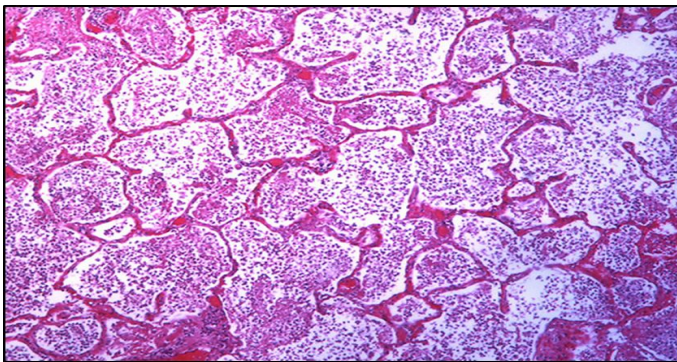
### Lobar Pneumonia - Histopathology

There will be inflammatory cells (Neutrophils and macrophages)



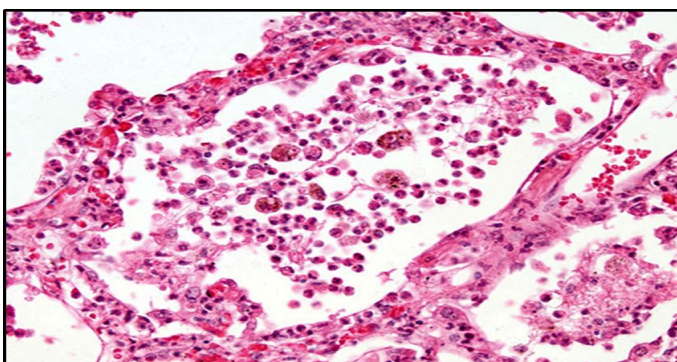
Lobar Pneumonia - LPF

- All the alveoli are filled with:
  - fibrinous exudate
  - fibrin threads
  - polymorphs
  - macrophages
  - RBCs.
- alveolar walls:
  - congested
- Pleura:
  - fibrinous exudate.



Lobar Pneumonia - LPF

- the alveoli are filled with:
- fibrinous exudate
  - fibrin threads
  - polymorphs
  - macrophages
  - RBCs.



Lobar Pneumonia - HPF

- the alveoli are filled with:
  - fibrinous exudate
  - fibrin threads
  - polymorphs
  - macrophages
  - RBCs.
- Alveolar wall:
  - Thickened

# LOWER RESPIRATORY TRACT INFECTIONS

## 2- Bronchopneumonia



Bronchopneumonia – Gross pathology

→ In Lobular Pneumonia the **consolidated areas very closely match the pattern of lung lobules** (hence the term "lobular" pneumonia).

→ Bronchopneumonia is classically a "hospital acquired" pneumonia seen in persons already ill from another diseases e.g.:

- DM
- old age
- immune deficiency process.



Bronchopneumonia – Cut section

- This bronchopneumonia is more subtle, but there are areas of:
  - lighter tan consolidation.
- The hilum is seen at the lower left with:
  - radiating pulmonary
  - arteries and bronchi



Bronchopneumonia – X-Ray

This radiograph demonstrates:

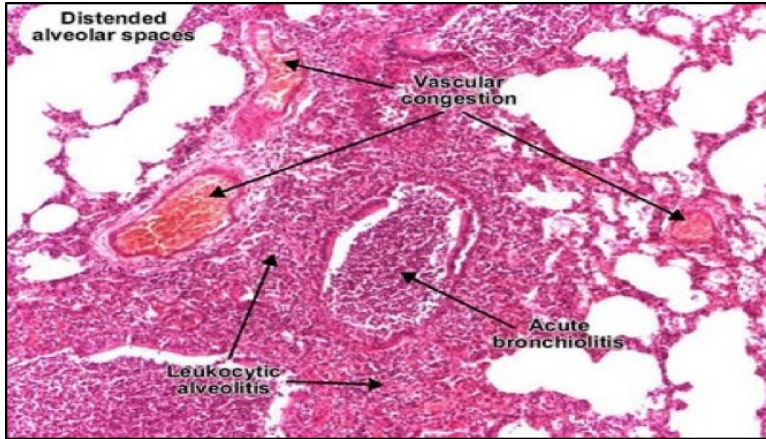
- patchy infiltrates

consistent with a bronchopneumonia from a bacterial infection.



# LOWER RESPIRATORY TRACT INFECTIONS

## 2- Bronchopneumonia (cont.)

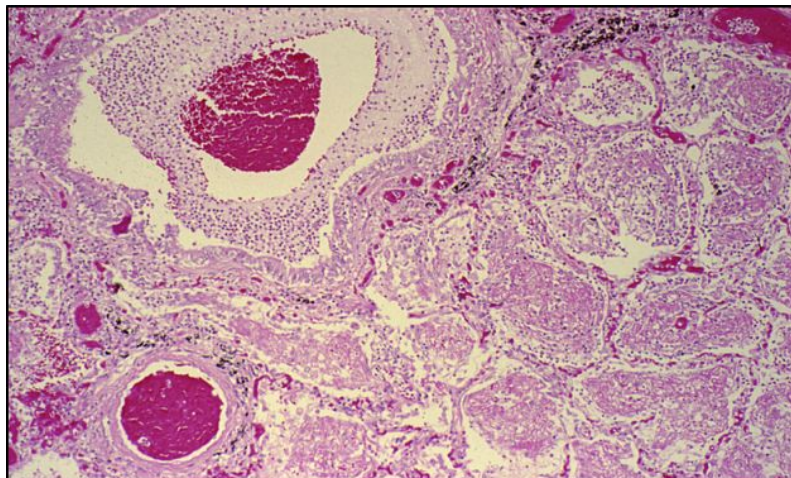


- Bronchopneumonia (Lobular pneumonia) is an **acute exudative inflammation** of the lungs characterised by:
  - foci of consolidation
  - normal parenchyma (surrounding the consolidation)
- Usually, bronchopneumonia affects one or more lobes and is bilateral.

Histological findings:

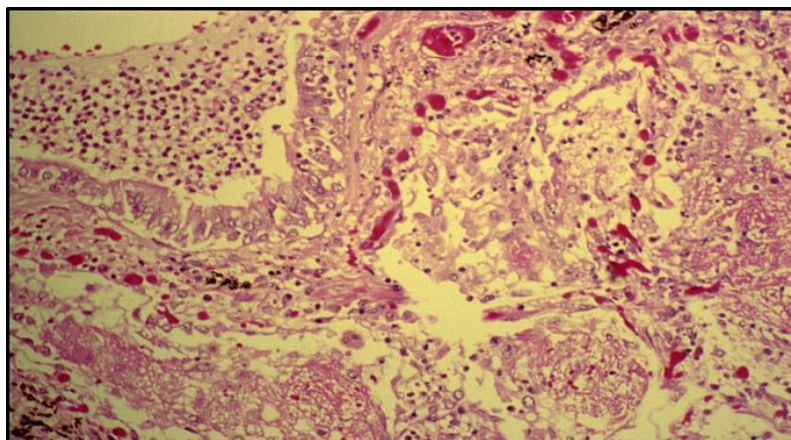
- Vestibular congestion
- Acute bronchitis
- Leukocyte alveolitis

### Bronchopneumonia – Histopathology



- Section of the lung shows:
  - foci of inflammatory consolidation surrounding bronchioles.
- Bronchioles are filled with:
  - inflammatory purulent exudate
  - show ulceration of mucosa
  - focal inflammation
  - necrosis of walls .
- Surrounding lung parenchyma shows:
  - Congestion
  - edema

### Bronchopneumonia – LPF



At high magnification

- alveolar exudate (mainly **neutrophils** is seen).
- The surrounding alveolar walls have:
  - Dilated capillaries and filled with **RBC's**.

This exudate gives rise to:

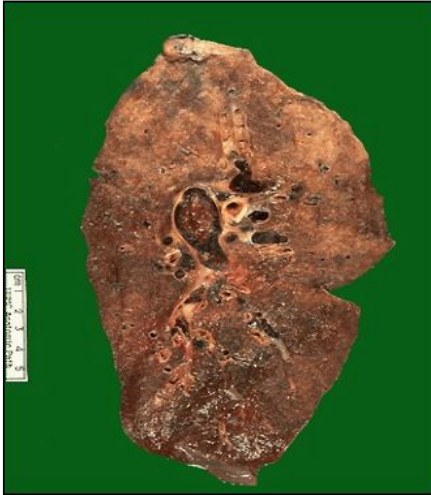
- productive cough
- purulent yellow sputum

Such an exudative process is typical for bacterial infection.

seen with bacterial pneumonias

### Bronchopneumonia – MPF

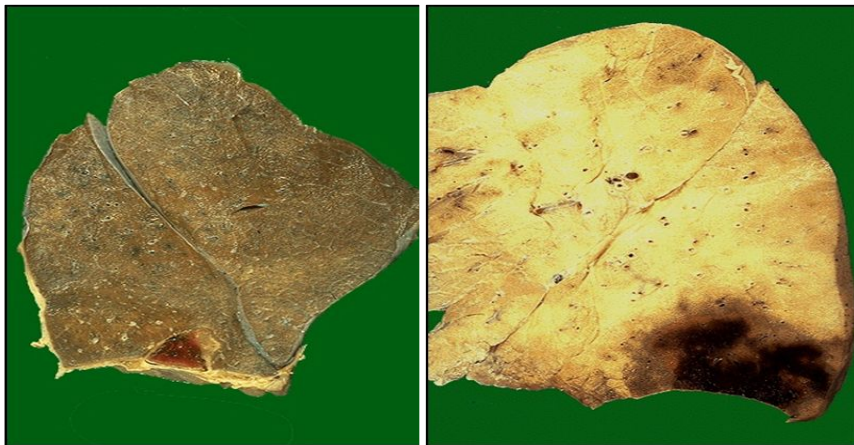
# PULMONARY EMBOLUS AND INFARCTION



- **large pulmonary thromboembolism** in the pulmonary artery to the left lung.

Such thromboemboli typically originate in the leg veins or pelvic veins of persons who are immobilized.

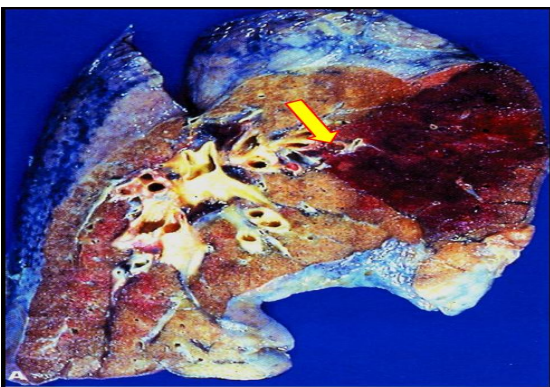
## Thromboembolism in the Lung – Gross



Large thromboemboli can cause death.

- **Medium sized thromboemboli** (blocking a pulmonary artery to a lobule or set of lobules) can produce the lesion seen here
  - **Wedge-shaped** hemorrhagic pulmonary infarction which based on the pleura.

## Thromboembolism in the Lung – Gross



### Pulmonary embolism and infarction in the Lung

- A Longitudinal transection of a lung showing:
- a wedge shaped peripheral hemorrhagic infarction .
  - A thrombus (in a major branch of pulmonary artery (arrow head).



Wedge-shape

### Pulmonary Embolus with infarction CT scan

White arrows shows:

- pulmonary embolism
- lung infarction.



# PULMONARY EMBOLUS AND INFARCTION

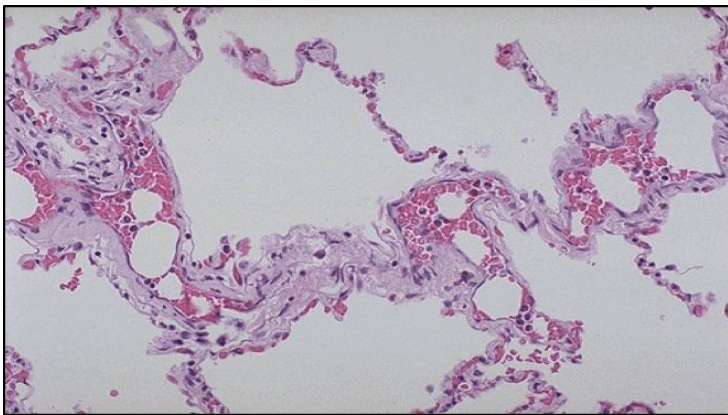


Pulmonary artery thromboembolus - LPPF

Microscopic appearance of:

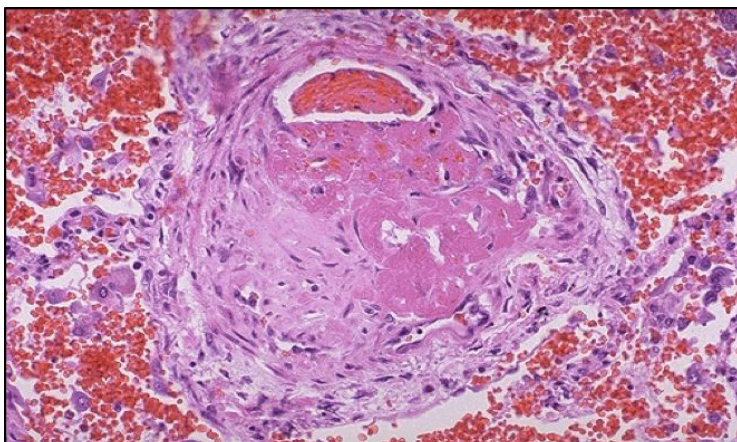
- Pulmonary thromboembolus (in a large pulmonary artery).
- "**lines of Zahn**": are interdigitating areas of pale pink and red (characteristic for a thrombus).

Their presence implies thrombosis at a site of rapid blood flow that happened before death



Fat Embolism in the Lung - HPF

- Fat emboli (The rounded holes that appear in the vascular spaces here in the lung).
- **Fat embolization syndrome:** occurs most often following trauma with fracture of long bones that releases fat globules into the circulation which are trapped in pulmonary capillaries



Small pulmonary artery thromboembolus - HPF

- A small peripheral pulmonary artery thromboembolus.

If these small PE (Pulmonary embolism) are showered into the pulmonary circulation at once or over a period of time will lead to pulmonary hypertension.

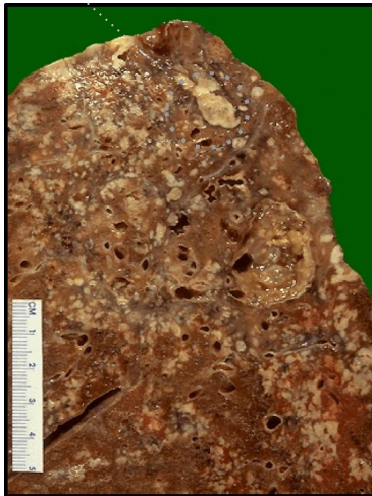
# Second Practical

# Tuberculosis

- Tuberculosis is a chronic inflammation caused by *M.tuberculosis*.
- Characterized as Histological by:
  - Central caseous necrosis
  - Epithelioid cells.
  - Multinucleated giant cells.
  - Granuloma
  - Ghon's complex.
- Complications of TB include:
  - Amyloidosis
  - Tuberculous pneumonia
  - Miliary tuberculosis
  - Tuberculous meningitis
  - Addison disease

## Pulmonary TB – Caseous Necrosis – Gross

Caseous necrosis

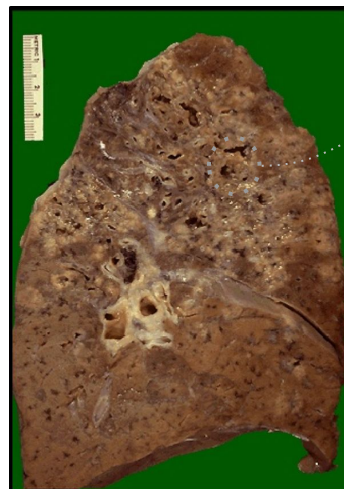


### secondary (reactivation) tuberculosis.

Gross appearance shows:

- Granuloma
- Areas of caseous necrosis.

(This pattern of multiple caseating granulomas primarily in the upper lobes is most characteristic of secondary (reactivation) tuberculosis.)



Cavity formation is more common in the upper lobes

### secondary (reactivation) tuberculosis.

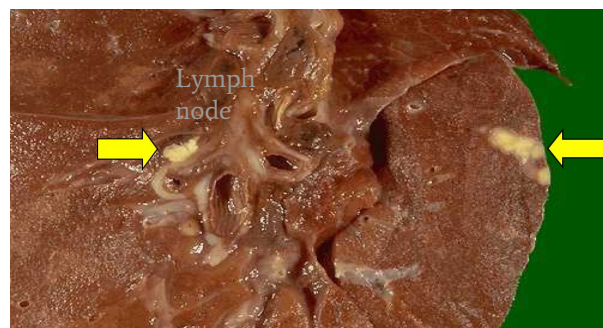
- Extensive caseation
- Granulomas involving A large bronchus
- Soft necrotic center that drain out and leave behind a cavity.

(→ Cavitation is typical for large granulomas with TB.)

(→ Cavitation is more common in the upper lobes)

## Pulmonary TB – Ghon's complex – Gross

The ghon complex:  
Ghon's focus +  
hilar lymph node  
involvement.



Ghon  
lesion

### Primary Tuberculosis

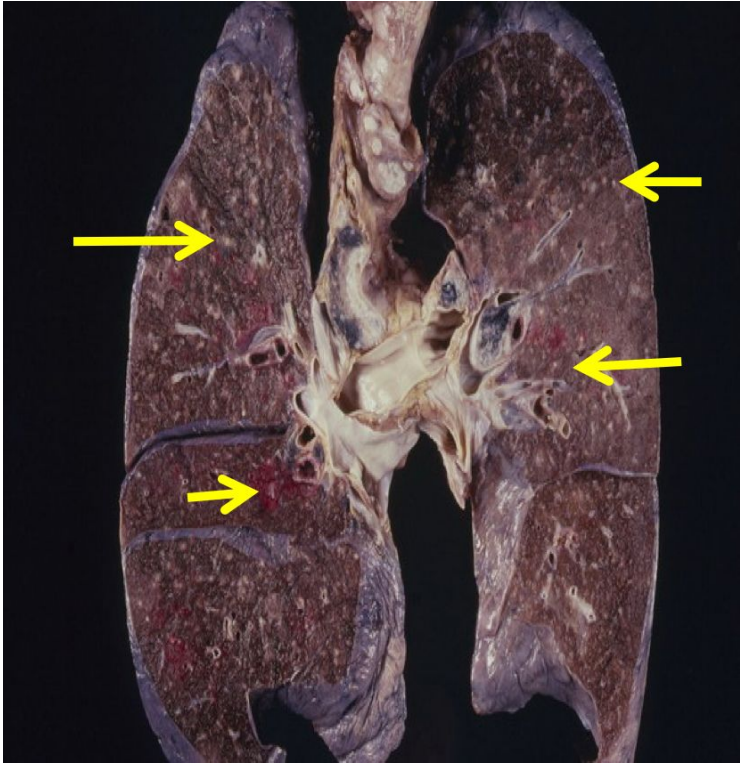
(→ Primary tuberculosis is the pattern seen with initial infection with tuberculosis in children.)

(→ Reactivation, or secondary tuberculosis, is more seen in adults.)



# Tuberculosis Cont'

## Miliary TB of the lung



- Miliary TB can occur when:
  - 1-TB lung lesions erode pulmonary veins.
  - 2-Extrapulmonary TB lesions erode systemic veins.
- This results in hematogenous dissemination of tubercle bacilli producing myriads of 1-2 mm. lesions throughout the body in susceptible hosts.
- Miliary spread limited to the lungs can occur following erosion of pulmonary arteries by TB lung lesions.

## Miliary TB of the lung- X-Ray



This chest x-ray shows a patient with miliary TB

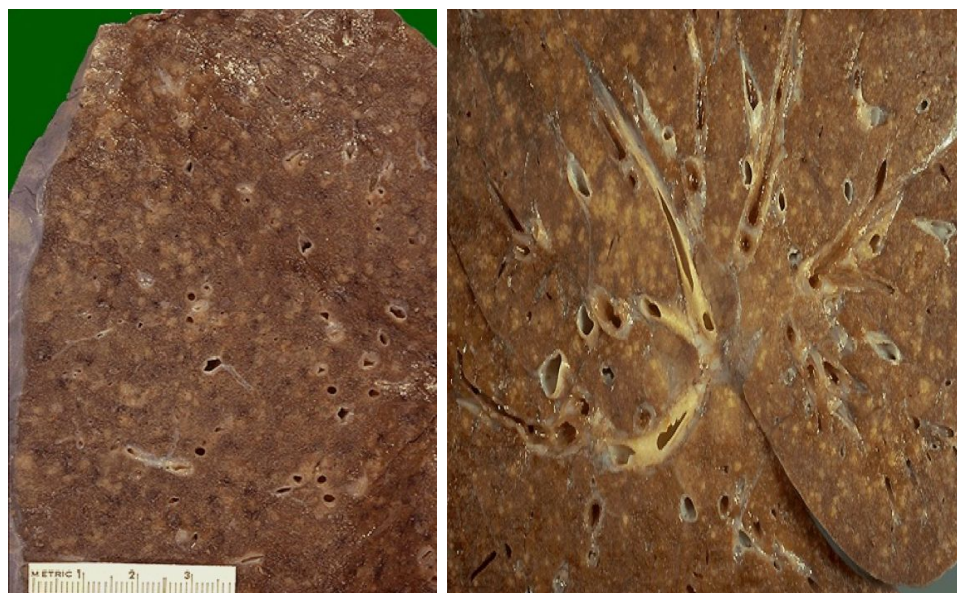
Miliary TB is most prominent in:

- Liver
- Bone marrow
- Spleen
- Adrenals
- Meninges
- Kidney
- Fallopian tube
- Epididymis

Miliary TB complications:

- Amyloidosis
- TB meningitis
- TB spleen
- TB of Fallopian tube
- TB epididymis

## Miliary TB of the lung- Cut section



- This is a "miliary" pattern of granulomas because there are a multitude of small tan granulomas, about 2 to 4 mm in size scattered throughout the lung parenchyma.



# Tuberculosis Cont'

Granulomas are composed of

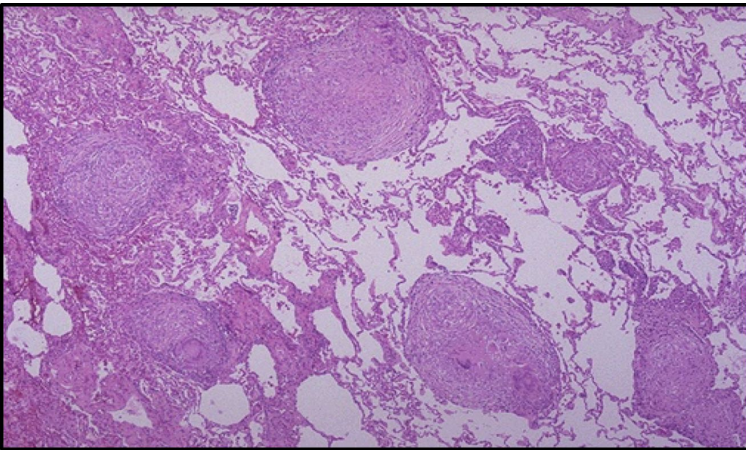
Transformed macrophages called epithelioid cells along with lymphocyte

Occasional PMN's

Plasma cells

Fibroblast

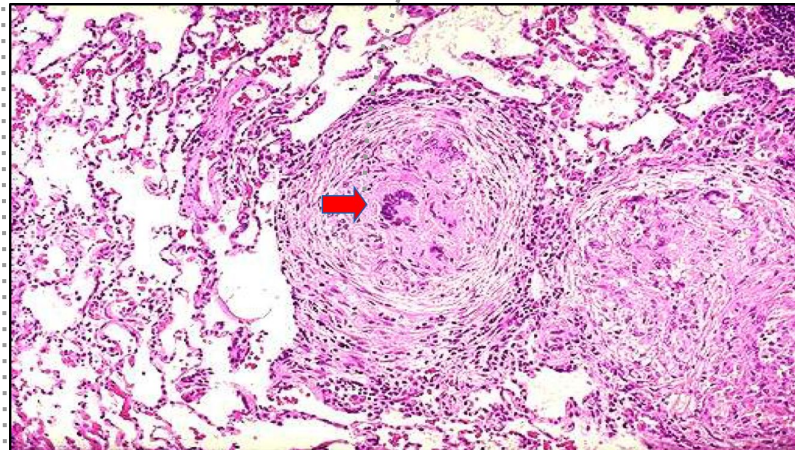
This granuloma contains several langhan's giant cells



**Tuberculosis Granulomas- LPF**

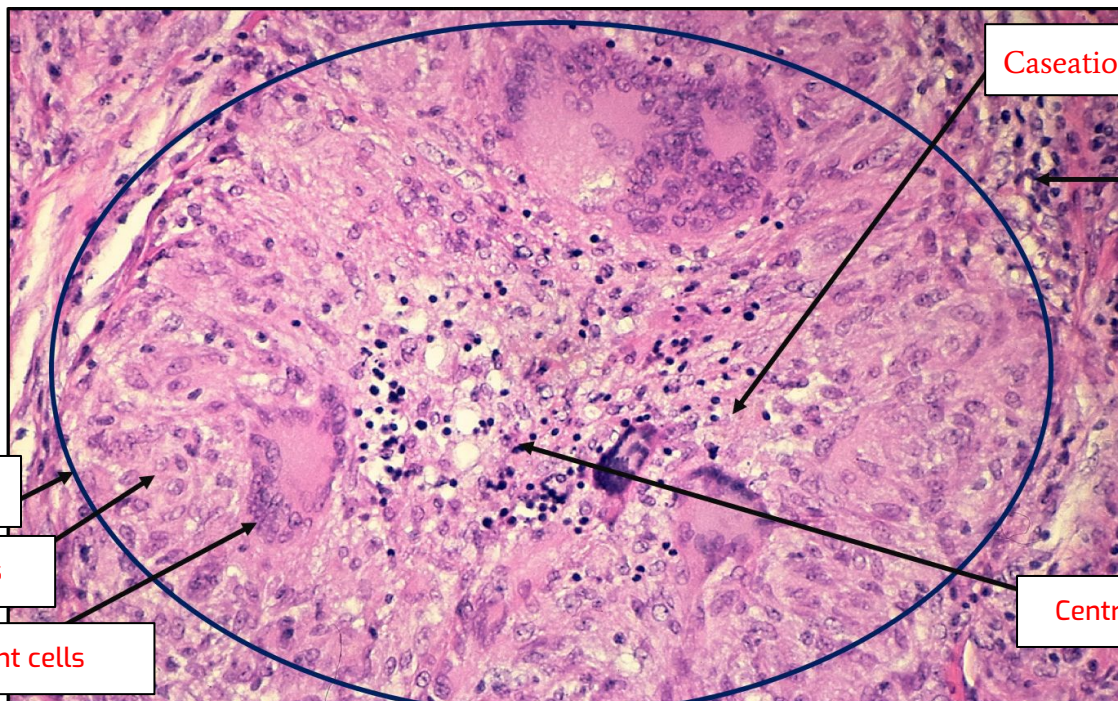
This micrograph reveals:

- multiple granulomas.



**Tuberculosis Granulomas- HPF**

- Well-defined granulomas with rounded outlines.

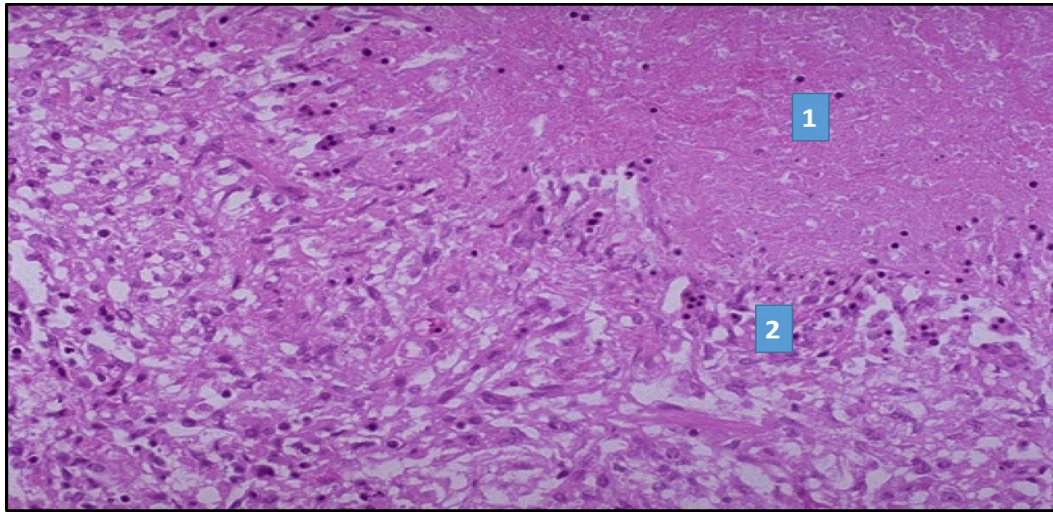


**Pulmonary TB - granuloma with central early necrosis**

( → pyknotic nuclei of epithelioid cells in the center (apoptotic bodies) are a precursor of necrosis with focal caseation necrosis.)



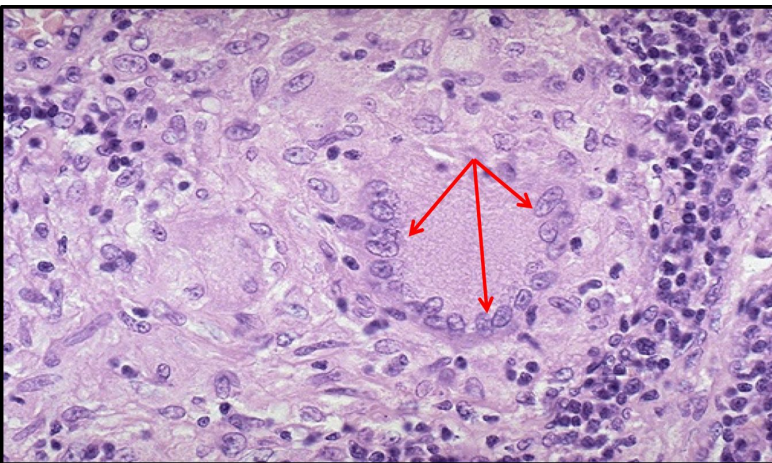
# Tuberculosis Cont'



## Tuberculosis Granulomas- HPF

(→The edge of a Granuloma is shown here at high magnification)

- [1] - necrotic elements of the granuloma
  - infectious organisms.
  - ring of inflammatory component
- [2] - Epithelioid cells
  - Lymphocyte
  - Fibroblasts.

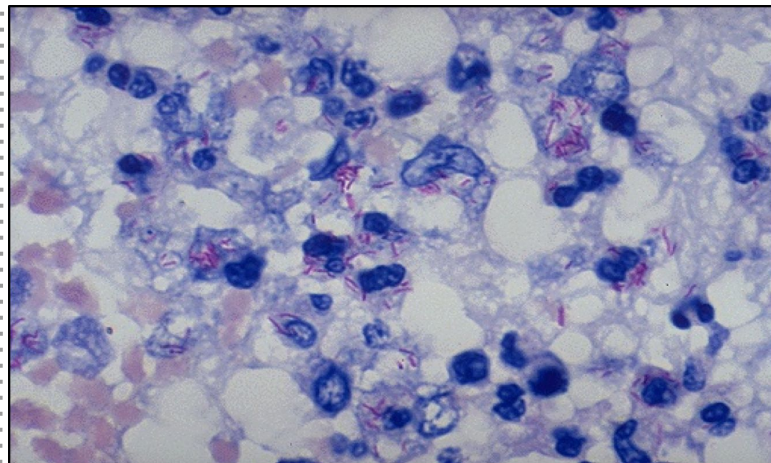


## Epithelioid & Giant cell Granulomas in Tuberculosis

At high magnification: the **granuloma** containing:

- **Elongated epithelioid macrophages** with:
  - 1-long, pale nuclei
  - 2-pink cytoplasm.
- **Giant cells** (organization of macrophages into committees)

(The typical giant cell for infectious granulomas is called a **Langhan's giant cell**: has the nuclei lined up along one edge of the cell)

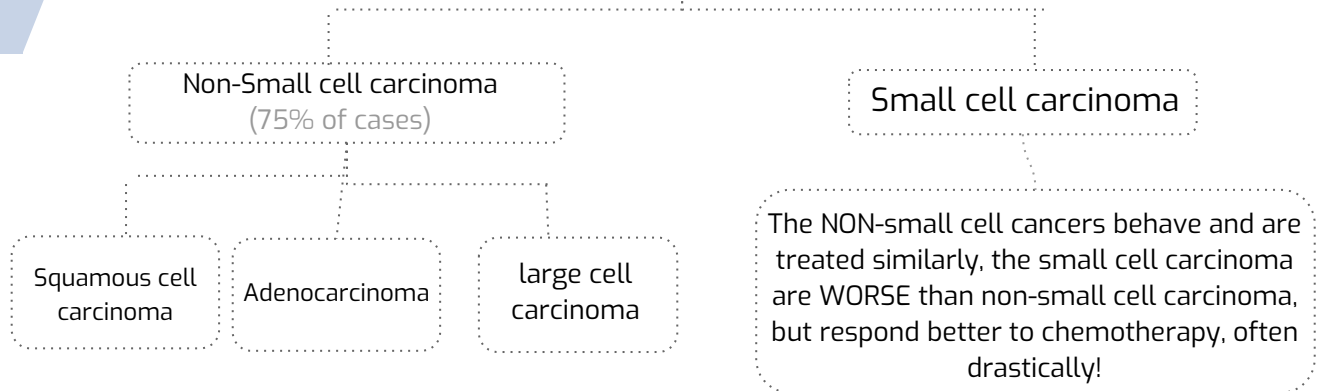


## Acid Fast bacilli of Mycobacterium TB in the lung

(AFB stain= ziehl neelsen stain) is done to find:

- **the mycobacteria TB stained as red rods.**

# Lung carcinoma



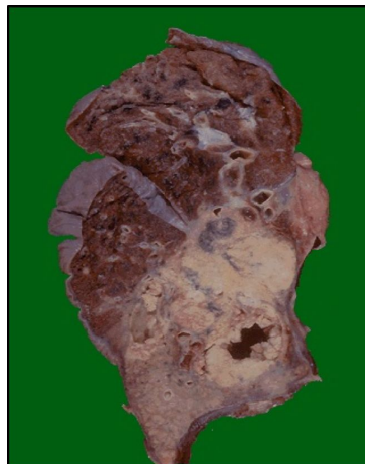
## 1- SQUAMOUS CELL CARCINOMA:

- Most commonly found in men and correlated with **smoking**.
- Pathology: more differentiated, more cytoplasm, keratin whorls.
- Transforms to carcinoma in situ.
- Grading is based on the amount of keratin & cytoplasm.

## Squamous cell carcinoma of the lung- Gross



- squamous cell carcinoma **arising centrally** in the lung (as most squamous cell carcinoma do).  
1- obstruction to the main bronchus.  
2- very firm and has a Pale, white to tan cut Surface

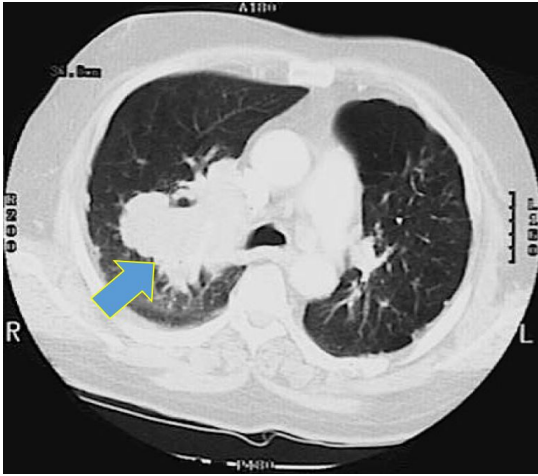


squamous cell carcinoma:  
central cavitation  
(probably because the tumor outgrew its blood supply)



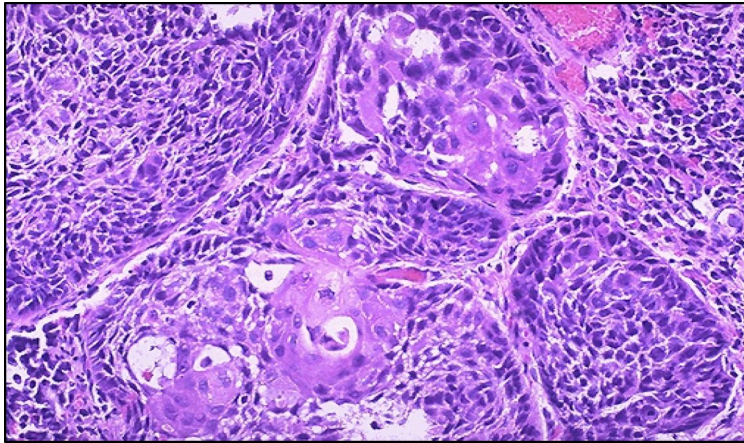
# Lung carcinoma

## 1- SQUAMOUS CELL CARCINOMA (Cont.)



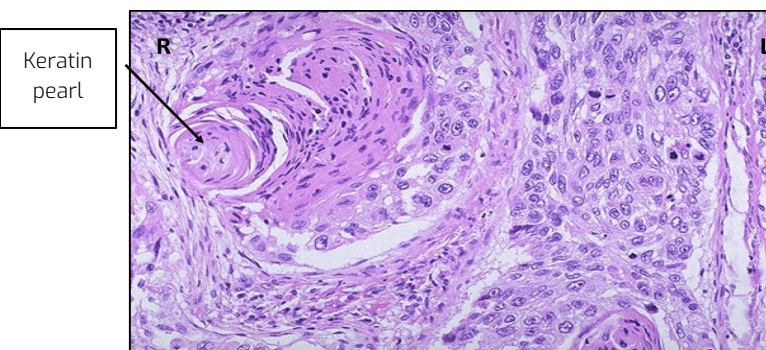
Squamous cell carcinoma of the lung- CT SCAN

- A large squamous cell carcinoma of the **right upper lobe**
- It extends around the right main bronchus
- It invades into the mediastinum and
- It involves hilar lymph nodes



Squamous cell carcinoma of the lung- HPF

- Microscopic appearance of squamous cell carcinoma showing nests of polygonal cells with:
  - 1- pink cytoplasm.
  - 2- distinct cell borders.
  - 3- hyperchromatic and angular nuclei.
- Well differentiated on the middle
- Poorly differentiated on the left



Squamous cell carcinoma of the lung- HPF

- 1- upper right:
  - Squamous eddy with a keratin pearl.
- 2- At the left:
  - less differentiation.
  - dark mitotic figures are seen.
  - Mitosis

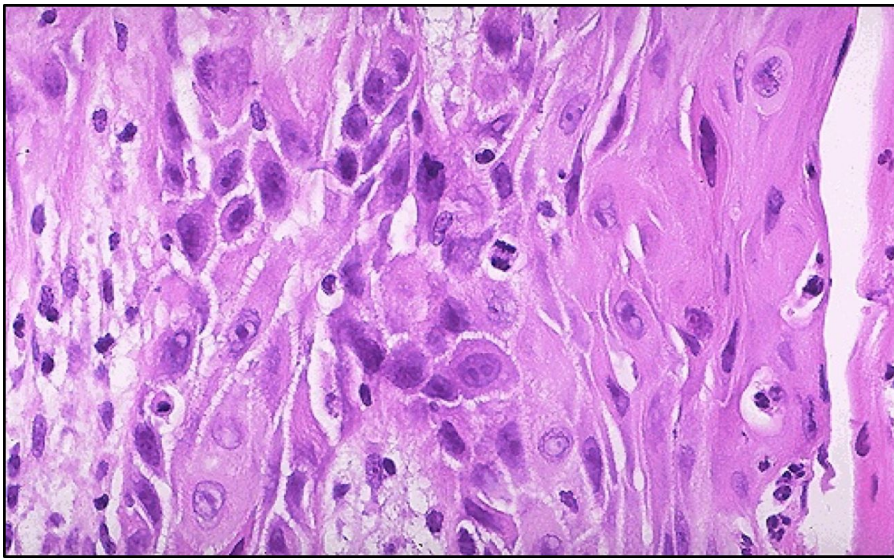
# Lung carcinoma

## 1- SQUAMOUS CELL CARCINOMA (Cont.)



- Neoplastic squamous cells showing:
  - 1- pleomorphism
  - 2- hyperchromatism
  - 3- individual cell keratinization
  - 4- mitoses
- areas of necrosis
- Well differentiated

Squamous cell carcinoma of the lung - HPF



- Characteristics:
  - 1- pink cytoplasm
  - 2- distinct cell borders
  - 3- intercellular bridges

Squamous cell carcinoma of the lung- HPF



# Lung carcinoma

## 2. ADENOCARCINOMA OF THE LUNG

### Adenocarcinoma of the lung

- The most common type of lung cancer, making up 30-40% of all cases (more common in women).
- Glandular differentiation by tumor cells
- 80% of tumor cells produce mucin.
- Not as strongly associated with a smoking history as compared to Squamous or Small Cell Carcinomas.
- Usually located in the periphery of the lungs
- Adenocarcinoma in situ - called bronchoalveolar carcinoma.
- Early and distant metastases.
- Genetic mutations: EGFR (Epithelial Growth Factor Receptor) gene mutation and Alk (Alkaline Phosphatase enzyme) gene mutation



Adenocarcinoma of the lung - Gross

- peripheral adenocarcinoma of the lung.

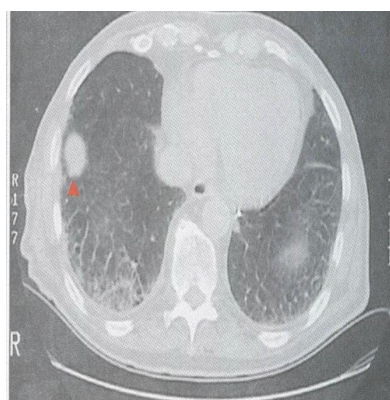
→ Adenocarcinomas and large cell anaplastic carcinomas tend to occur more peripherally in lung.

→ Adenocarcinoma is the one cell type of primary lung tumor that occurs more often in non-smokers and in smokers who have quit.

### X-Ray



### CT scan



Chest x-ray of elderly non-smoker woman showing:

- A peripheral adenocarcinoma of the lung.

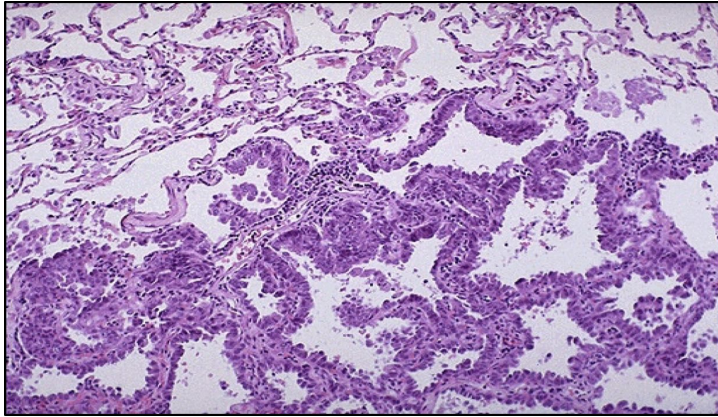
CT scans:

- Peripheral right lung nodular mass

Adenocarcinoma of the lung

# Lung carcinoma

## 2. ADENOCARCINOMA OF THE LUNG (Cont)

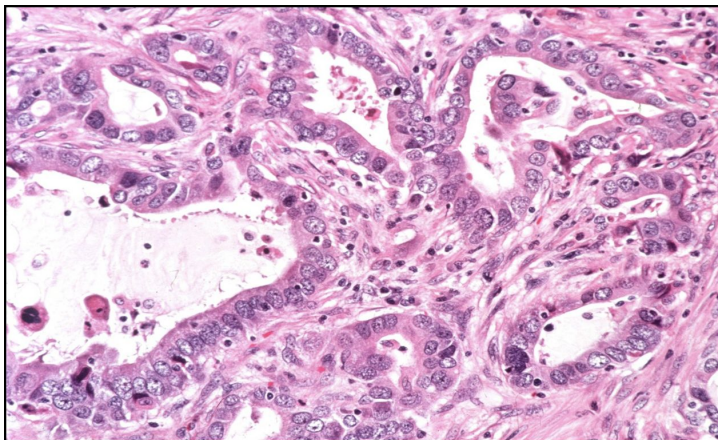


Adenocarcinoma of the lung  
- LPF

→ **Adenocarcinoma in Situ** (Previously named Bronchioalveolar Carcinoma).

Composed of:

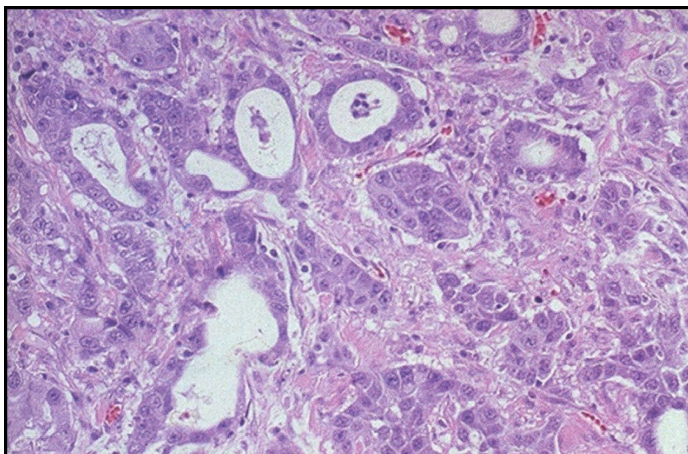
- columnar cells (proliferating along the framework of the alveolar septae).
- Well-differentiated cells.



Adenocarcinoma of the lung  
- HPF

Section of the tumor shows:

- Moderately differentiated **malignant glands** lined by:
  - Pleomorphic malignant cells
  - Hyperchromatic malignant cells
  - conspicuous nucleoli in the malignant cells.
  - **Irregular nuclei**
  - **Prominent nucleoli**
- Desmoplastic fibroinflammatory tissue
- Mitotic figures



Adenocarcinoma of the lung  
- HPF

- Differentiated **malignant glands** lined by:
  - Pleomorphic malignant cells
  - Hyperchromatic malignant cells
  - conspicuous nucleoli in the malignant cells.



# Lung carcinoma

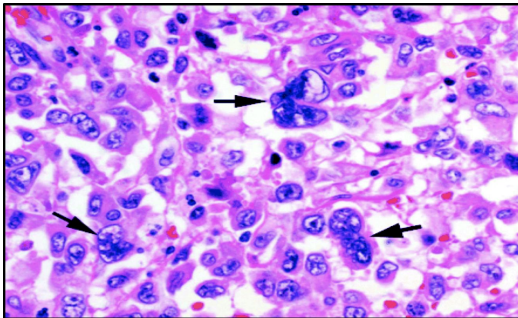
## 3. LARGE CELL CARCINOMA OF THE LUNG

### Large cell carcinoma of the lung

- Can be neuroendocrine carcinoma. Probably represents undifferentiated SCC and adenocarcinomas.
- Large nuclei with prominent nucleoli.
- Variation in size and shape.
- Nuclei usually do not touch due to more cytoplasm.
- Moderate amount of cytoplasm.
- Early and distant metastases, sometimes cavitating.



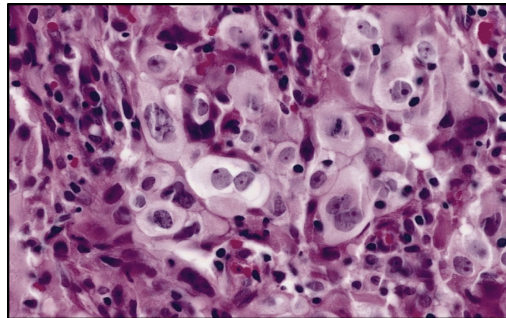
Undifferentiated large cell carcinoma of the lung - Gross



Large cell carcinoma of the lung - HPF  
(H and E, x200)

Pleomorphic carcinoma of lung:

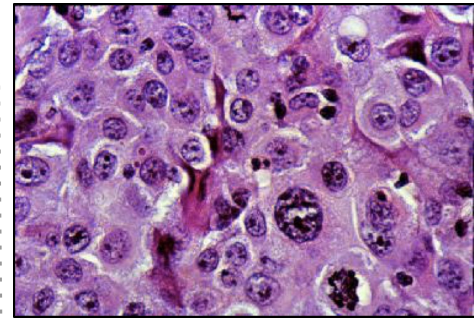
- (large cell and giant cell subtype.
- composition of:
  - large cell carcinoma
  - pleomorphic multinucleated giant cells (arrows).



Large cell carcinoma of the lung - HPF

section from lower respiratory tract shows:

- neoplastic cells
- abundant pale eosinophilic cytoplasm
- surrounding infiltrate of inflammatory cells.



Large cell carcinoma of the lung - HPF

section shows:

- neoplastic cells
- abundant pale eosinophilic cytoplasm
- pleomorphic multinucleated giant cells.

# Lung carcinoma

## 4. SMALL CELL CARCINOMA OF THE LUNG

### Small cell carcinoma of the lung

- Highly Malignant Tumor.
- Cells are small, with scant cytoplasm, ill-defined borders, finely granular chromatin (salt & pepper pattern) and absent or inconspicuous nucleoli.
- High mitotic count
- often extensive necrosis.
- Typically not graded as all SCLC are considered High Grade.
- Very strong relationship with smoking.
- Often lead to paraneoplastic syndromes.

## Small cell carcinoma of the lung “oat cell” - Gross



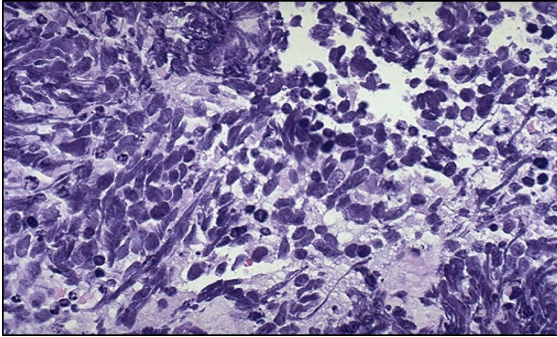
- Arising centrally in this lung.
- spreading extensively.
- The cut surface of this tumor has:
  - Soft
  - Lobulated
  - white to tan appearance.
- Caused obstruction of the main bronchus to left lung.
- The distal lung is collapsed (due to obstruction.)



- Spread of oat cell carcinoma along the bronchi.
- speckled black rounded areas (lymph nodes with metastatic carcinoma).

# Lung carcinoma

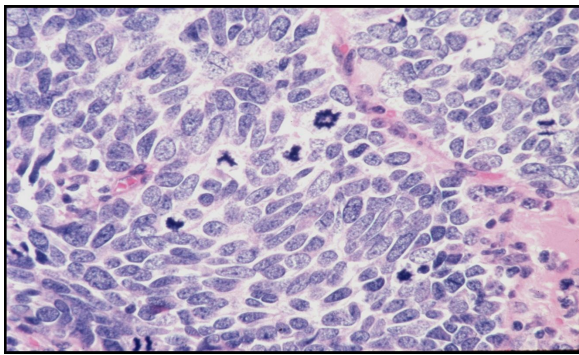
## 4. SMALL CELL CARCINOMA OF THE LUNG (Cont.)'



Small cell carcinoma of the lung "oat cell" - HPF

The microscopic pattern of a small anaplastic (oat cell) carcinoma:

- small dark blue cells
- minimal cytoplasm (are packed together in sheets.)

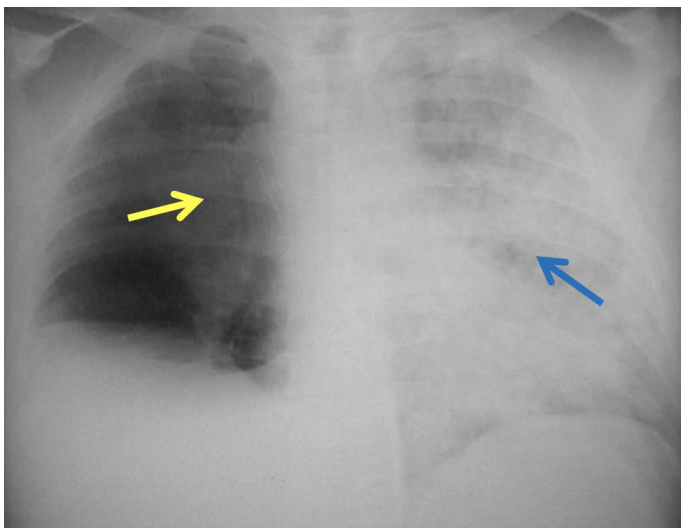


Small cell carcinoma of the lung "oat cell" - HPF

Section of the tumor shows:

- Clusters of malignant cells which are:
  - Small
  - Round, oval, or spindle shaped
  - Prominent nuclear molding
- finely granular nuclear chromatin (**salt and pepper pattern**)
- high mitotic count
- Focal necrosis.

Not Hyperchromatic



Small cell carcinoma of the lung "oat cell" - X-Ray

This chest radiograph demonstrates a **mass lesion in the right upper lobe (oat/small cell carcinoma)**

- Right main bronchus obstruction
- Atelectasis on the right (evidenced by a raised right hemidiaphragm)
- **Diffuse pneumonia** on the left

(caused by The patient aspirated gastric contents, since aspirated material could not pass the obstruction on the right).



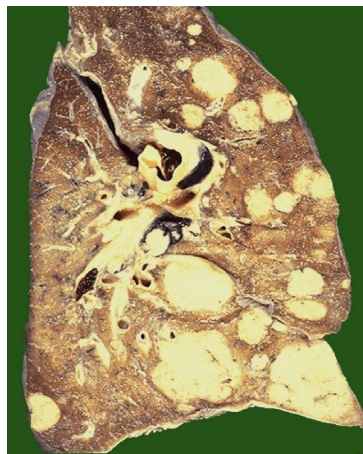
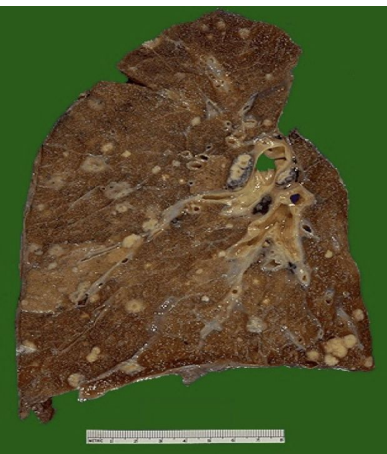
# Lung carcinoma

## 5. METASTATIC TUMORS OF THE LUNG

### Metastatic Tumors

- **LUNG** is the **MOST COMMON** site for all metastatic tumors, regardless of the site of origin.
- It is the site of **FIRST CHOICE** for metastatic sarcomas for purely anatomic reasons.

### Metastatic tumors of the lung - Gross



- **Multiple variably sized masses** (in all lung fields.)
- Tan-white nodules

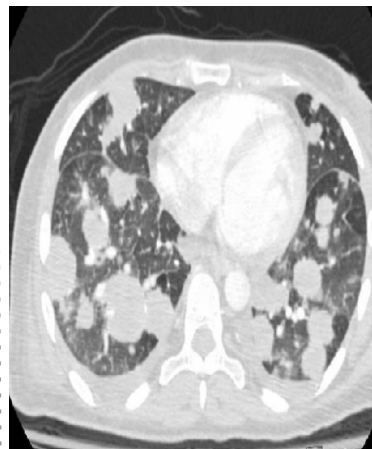
characteristic for metastatic carcinoma.

- larger but still:
- variably-sized nodules of metastatic carcinoma in lung.

→ Metastases to the lungs are **more common** than primary lung neoplasms.

### Metastatic tumors of the lung

CT scan



X-Ray



- Cannonball Metastases.
- Metastatic lesions of varying sizes (Large, hematogenously spread in the lungs)

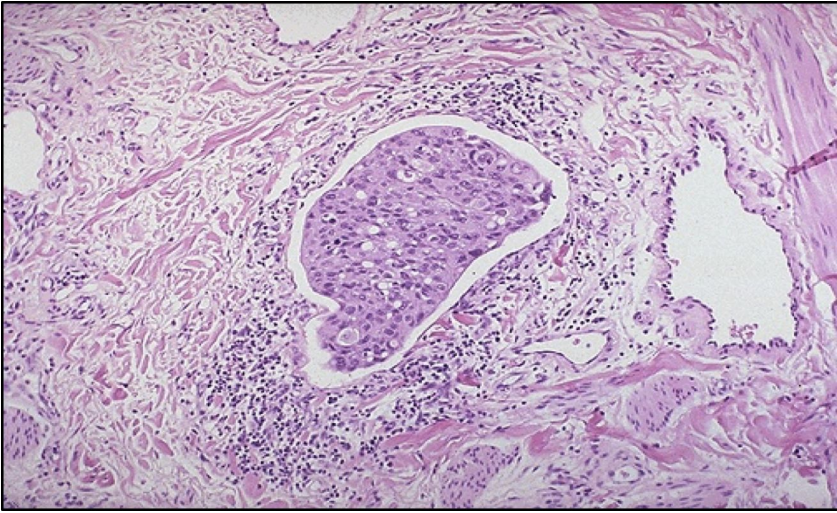
→ Most often from:

- Colon
- Breast
- Renal
- thyroid primaries.

- multiple cannonball opacities (in both lung fields.)

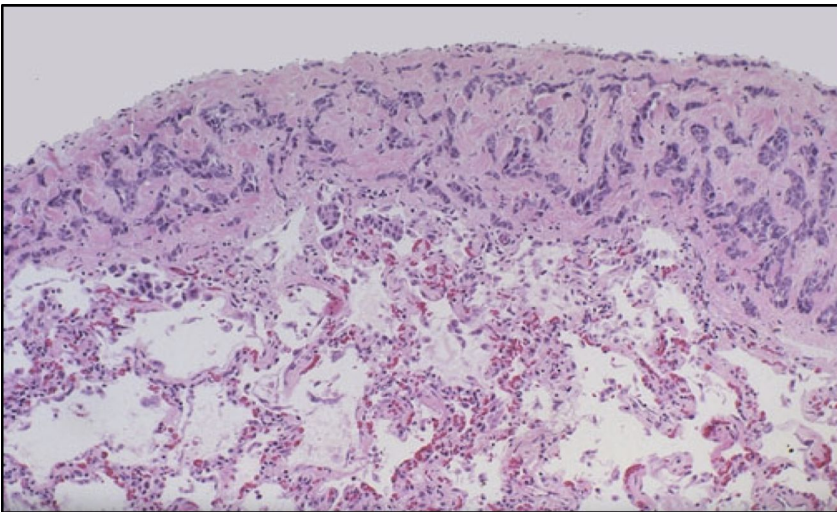
# Lung carcinoma

## 5. METASTATIC TUMORS OF THE LUNG (Cont.)



- A nest of metastatic infiltrating ductal carcinoma (breast)
- Dilated lymphatic channel (where the nest is) in the lung.  
(Carcinomas often **metastasize via lymphatic.**)

### Metastatic tumor of the lung - LPF



Coming from breast

- A focus of metastatic carcinoma on the pleural surface of the lung.

Diagnosis: **pleural fluid cytology** and often reveal the malignant cells

Complications: Such pleural metastases may lead to:

- pleural effusions (Ex: hemorrhagic effusions)

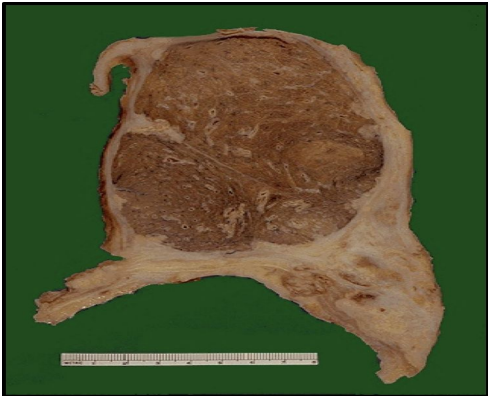
### Metastatic tumor of the lung - LPF



# Lung carcinoma

## 6. MESOTHELIOMA OF THE LUNG

-Definition: Malignant tumors of the mesothelial cells lining the pleura.  
-Immunohistochemistry is used to differentiate between mesothelioma and adenocarcinoma

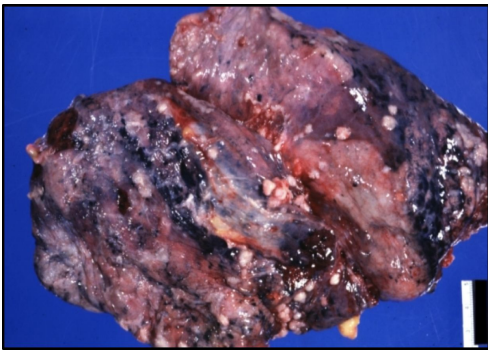


- Dense white encircling tumor mass (arising from the visceral pleura) is a mesothelioma.

These are big bulky tumors that can fill the chest cavity.

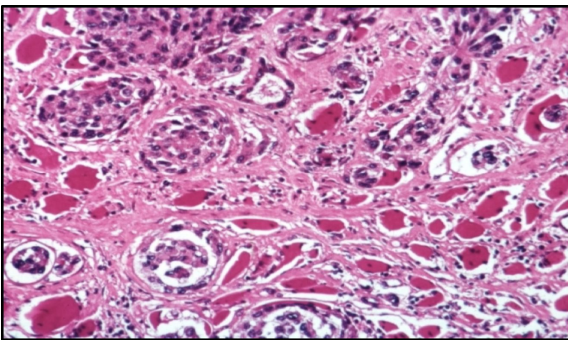
risk factor of mesothelioma is **asbestos exposure**.

### Mesothelioma of the lung - Gross



RESPIRATORY: Pleura: Mesothelioma: Gross natural color external view of the lung with nodules of tumor on pleura.

### Mesothelioma of the lung - Gross

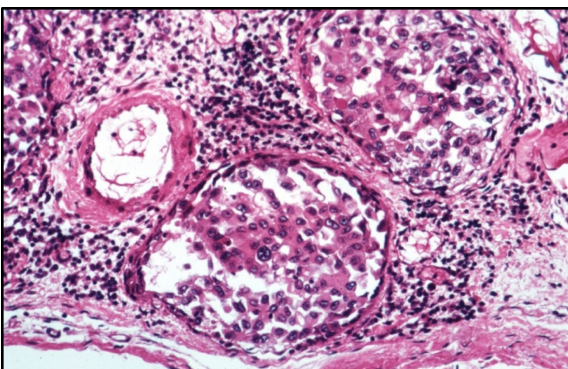


High power microscopy shows:

- Gland-like configurations formed by:
  - spindle cells or plump rounded cells (characteristically seen in mesothelioma).

→ Very difficult to diagnose cytologically.

### Mesothelioma of the lung - MPF



Mesothelioma:

- gland-like configurations formed by:
  - Micro epithelial pattern plump rounded cells

### Mesothelioma of the lung - HPF

This lecture was done by ★

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- Faisal Almuheid
- Mohammad Aljumah
- Mohammed Alhumud
- Alwaleed Alsaleh

# Thank you

