

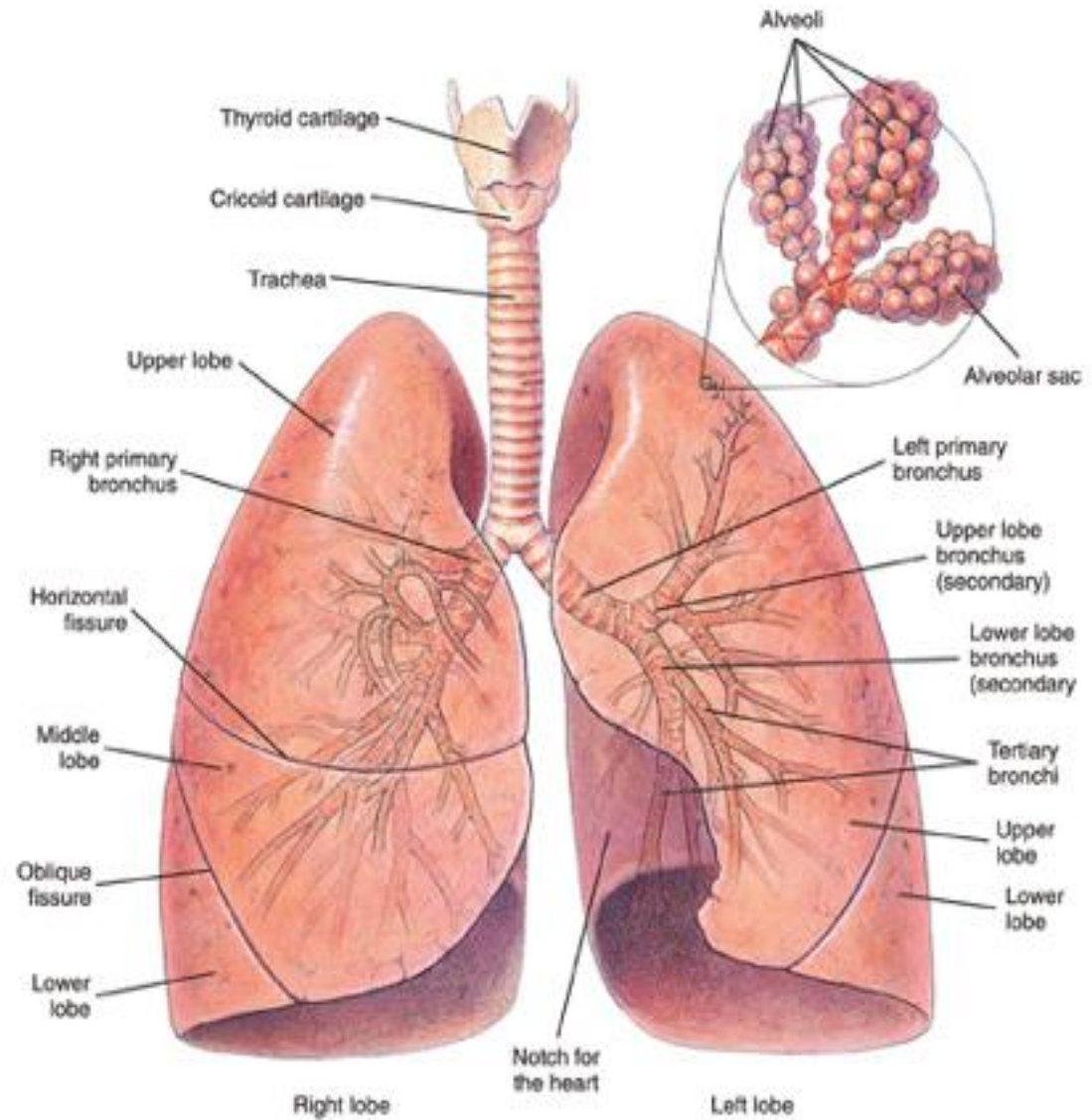
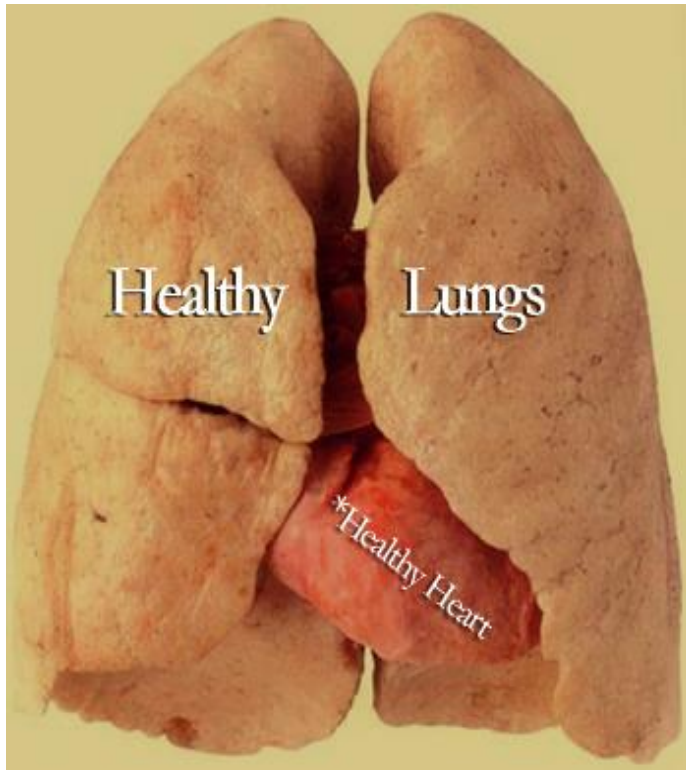
RESPIRATORY SYSTEM BLOCK

Pathology Practical 1

First Practical Session

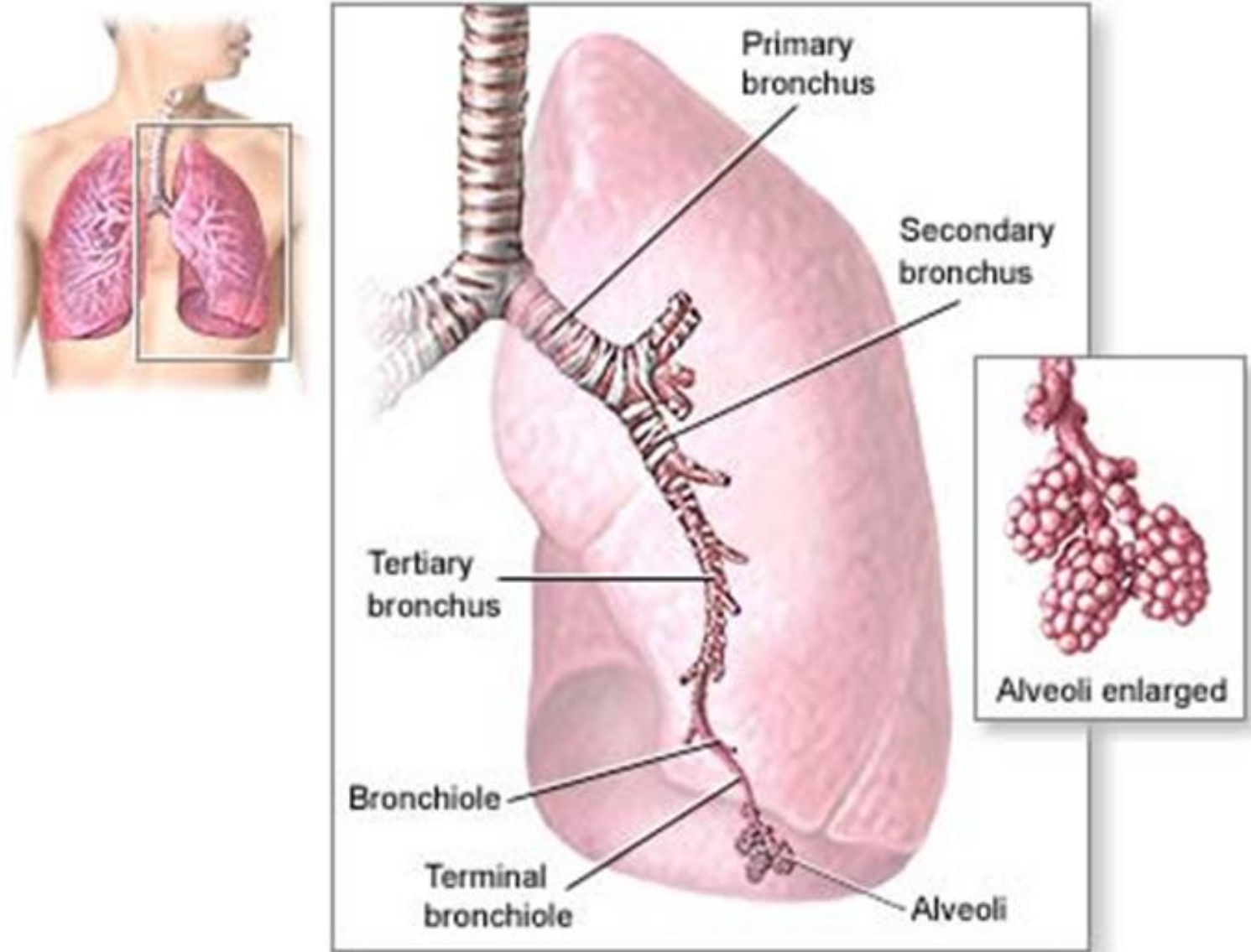
- Allergic Alveolitis •
- Bronchial asthma •
- Bronchiectasis•
- Chronic Bronchitis•
- Emphysema•
- Lobar Pneumonia•
- Bronchopneumonia•
- Pulmonary Embolus & Infarction•

Anatomy of the Respiratory System

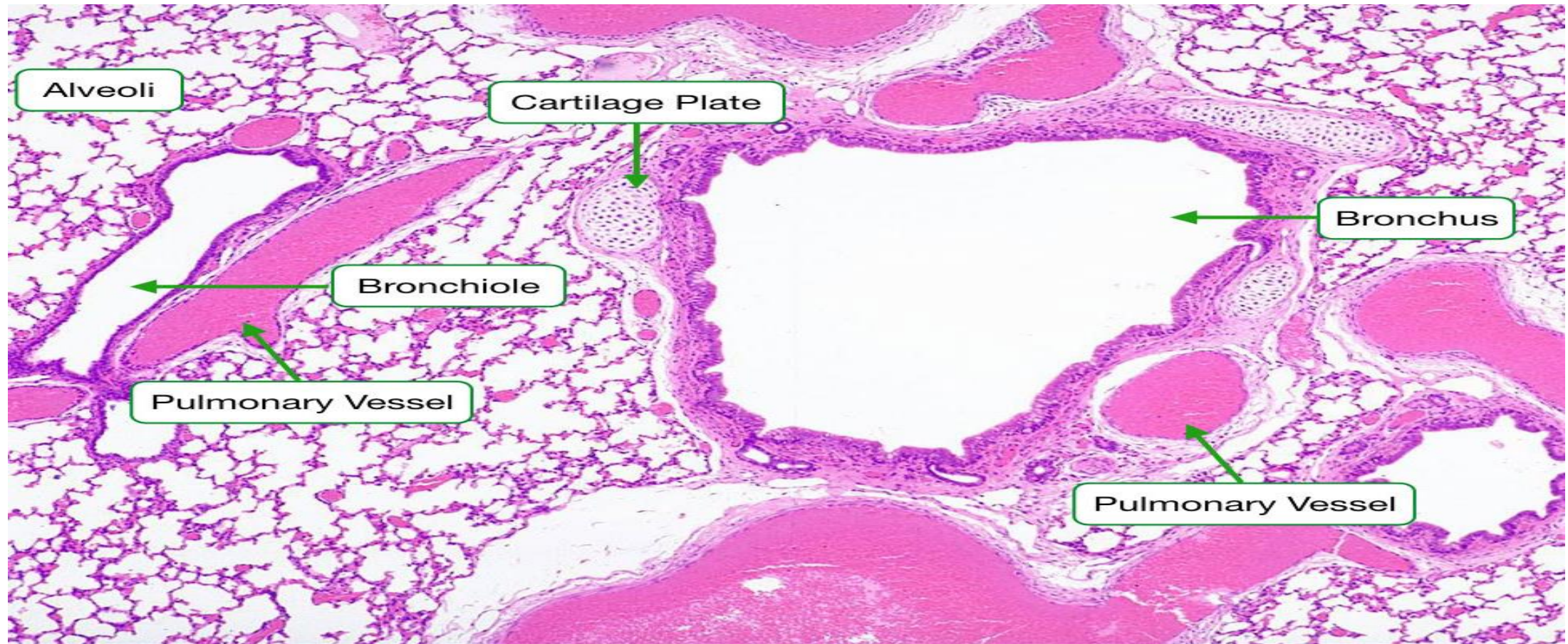


Lung Anatomy

Bronchioles are distinguished from bronchi by the lack of cartilage and submucosal glands within their wall.



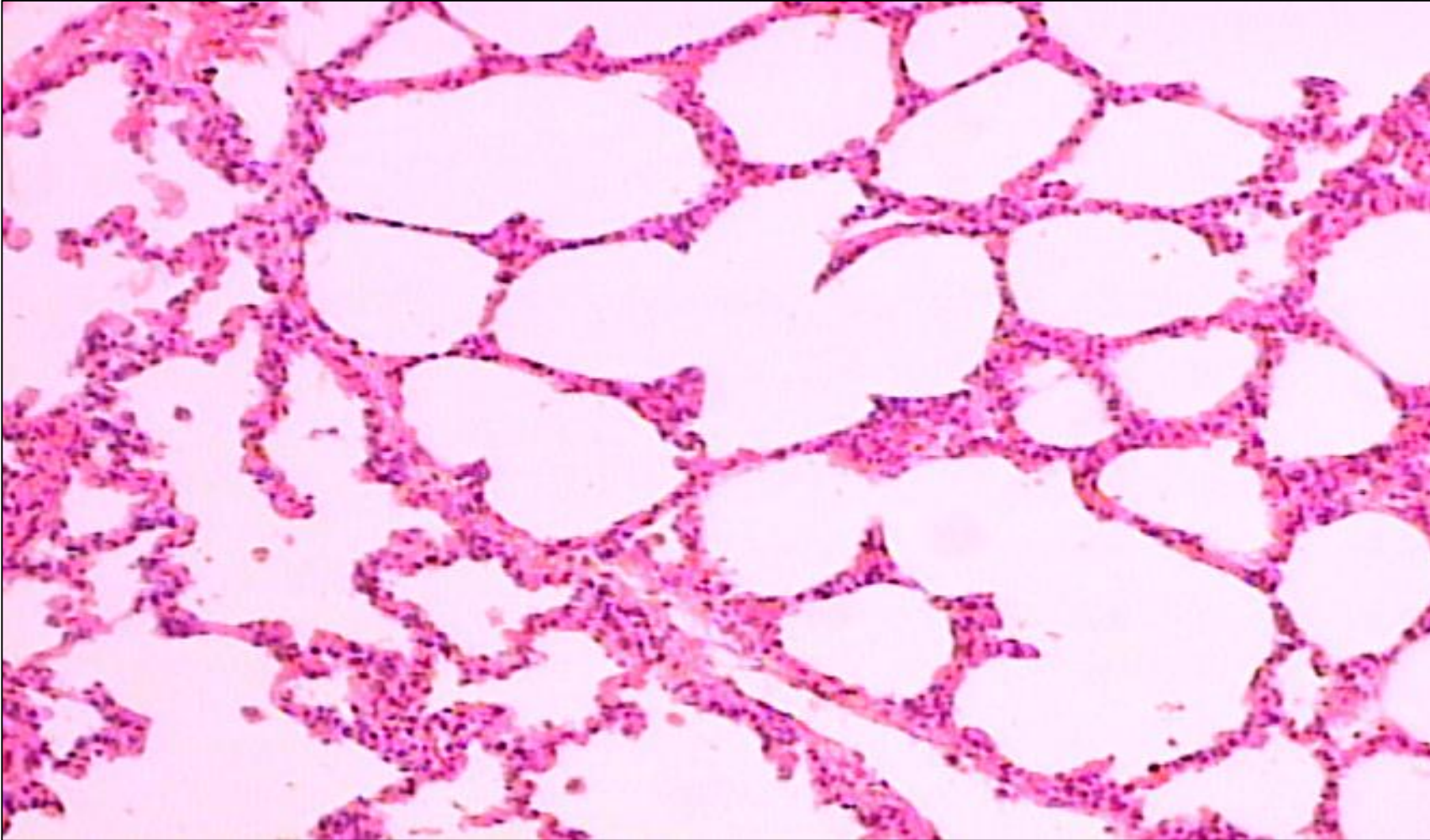
Normal Histology of the Lungs - Bronchiole



The entire respiratory tree, is lined by pseudo stratified, tall, columnar ciliated epithelium, except for the vocal cords, which are covered by stratified squamous epithelium.

*This view shows a **BRONCHIOLE** and **Blood Vessel** in cross-section as well as numerous **ALVEOLI** in normal lung at 100X magnification.*

Normal Histology of the Lungs - Alveoli



***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

Restrictive lung diseases:

Characterized by reduced expansion of lung parenchyma and decreased total lung capacity (Allergic Alveolitis)

Obstructive lung diseases or airway diseases

Characterized by an increase in resistance to airflow due to partial or complete obstruction to any level from the trachea to respiratory bronchioles (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 DISEASES

Allergic Alveolitis

Restrictive Lung Disease

Represent 15% of non-infectious diseases of lungs.

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

Acute: Acute Respiratory Distress Syndrome

Chronic : Occupational: Asbestosis, silicosis, coal worker pneumoconiosis.

Major Categories of Chronic Interstitial Lung Disease

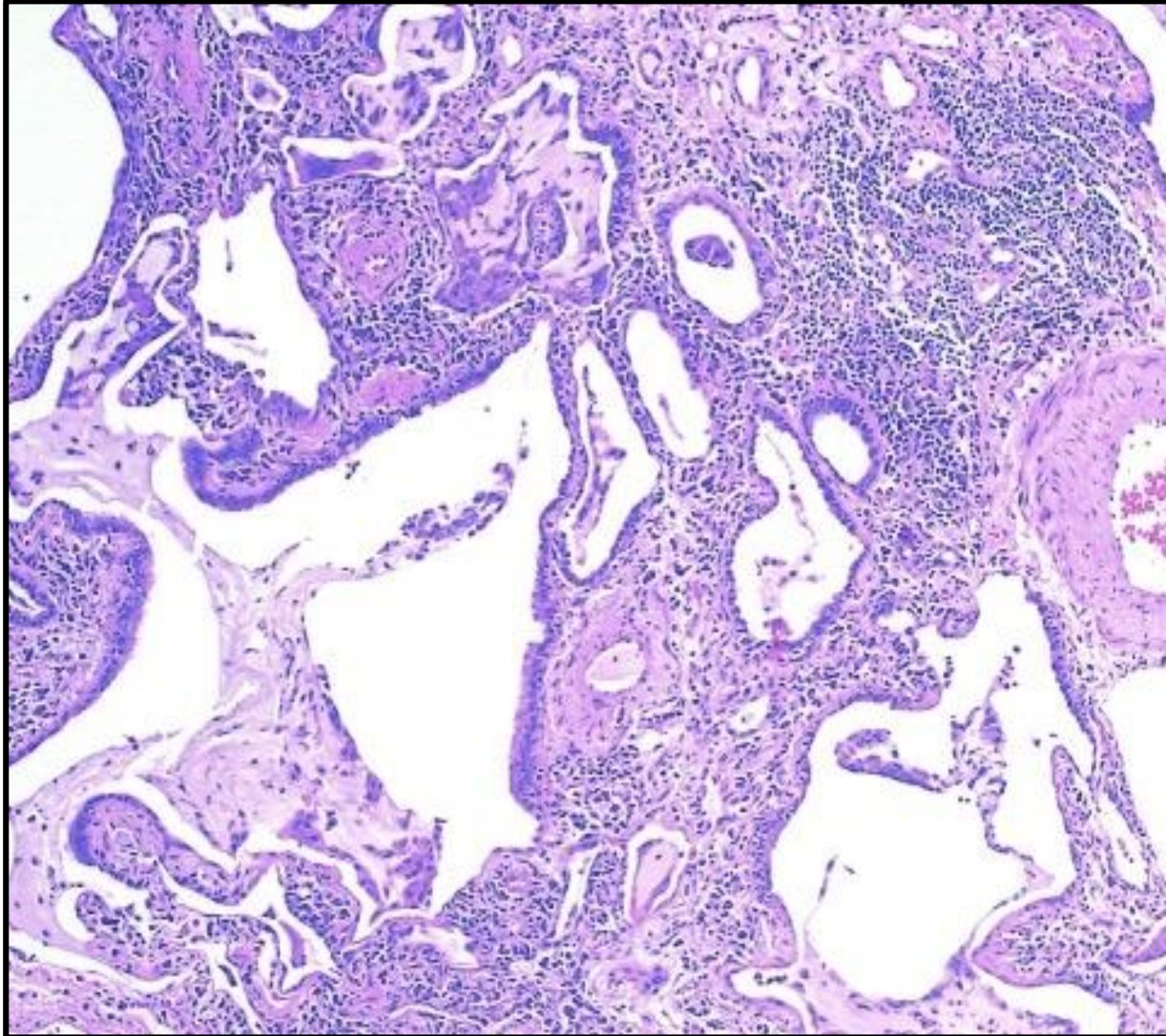
- **Fibrosing**
 - Usual interstitial pneumonia (idiopathic pulmonary fibrosis)
 - Nonspecific interstitial pneumonia
 - Cryptogenic organizing pneumonia
 - Associated with collagen vascular disease Pneumoconiosis
 - Associated with therapies (drugs, radiation)
- **Granulomatous**
 - Sarcoidosis
 - Hypersensitivity pneumonia
- **Eosinophilic**
- **Smoking Related** Desquamative interstitial pneumonia
Respiratory bronchiolitis

Restrictive Lung Disease (Honeycomb lung) – Cut section



The gross appearance, as seen here in a patient with organizing diffuse alveolar damage, known as “**Honeycomb**” lung, because of the appearance of irregular air space between bands of dense fibrous connective tissue

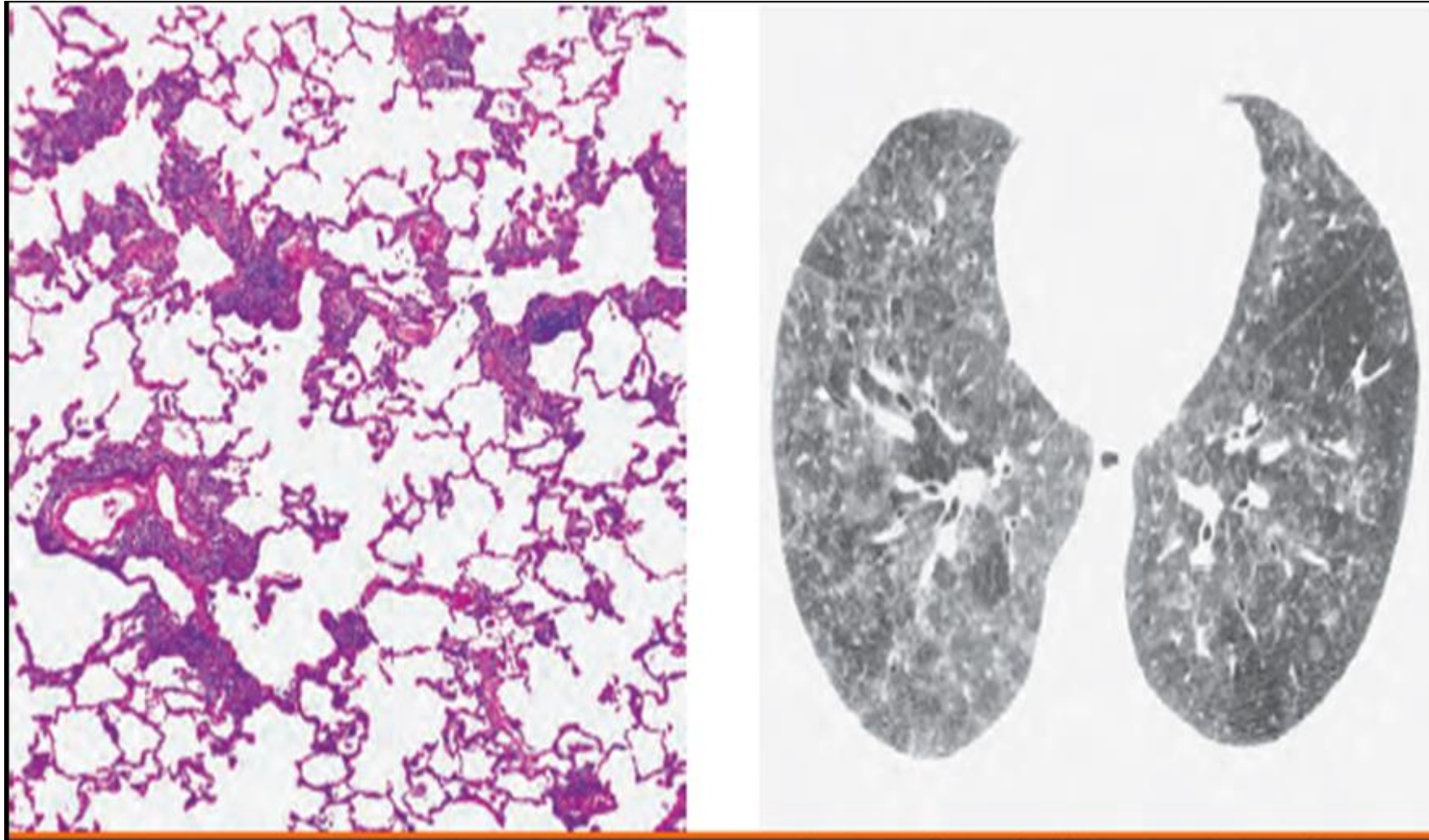
Restrictive Lung Disease (Honeycomb lung) – LPF



Restrictive Lung Disease

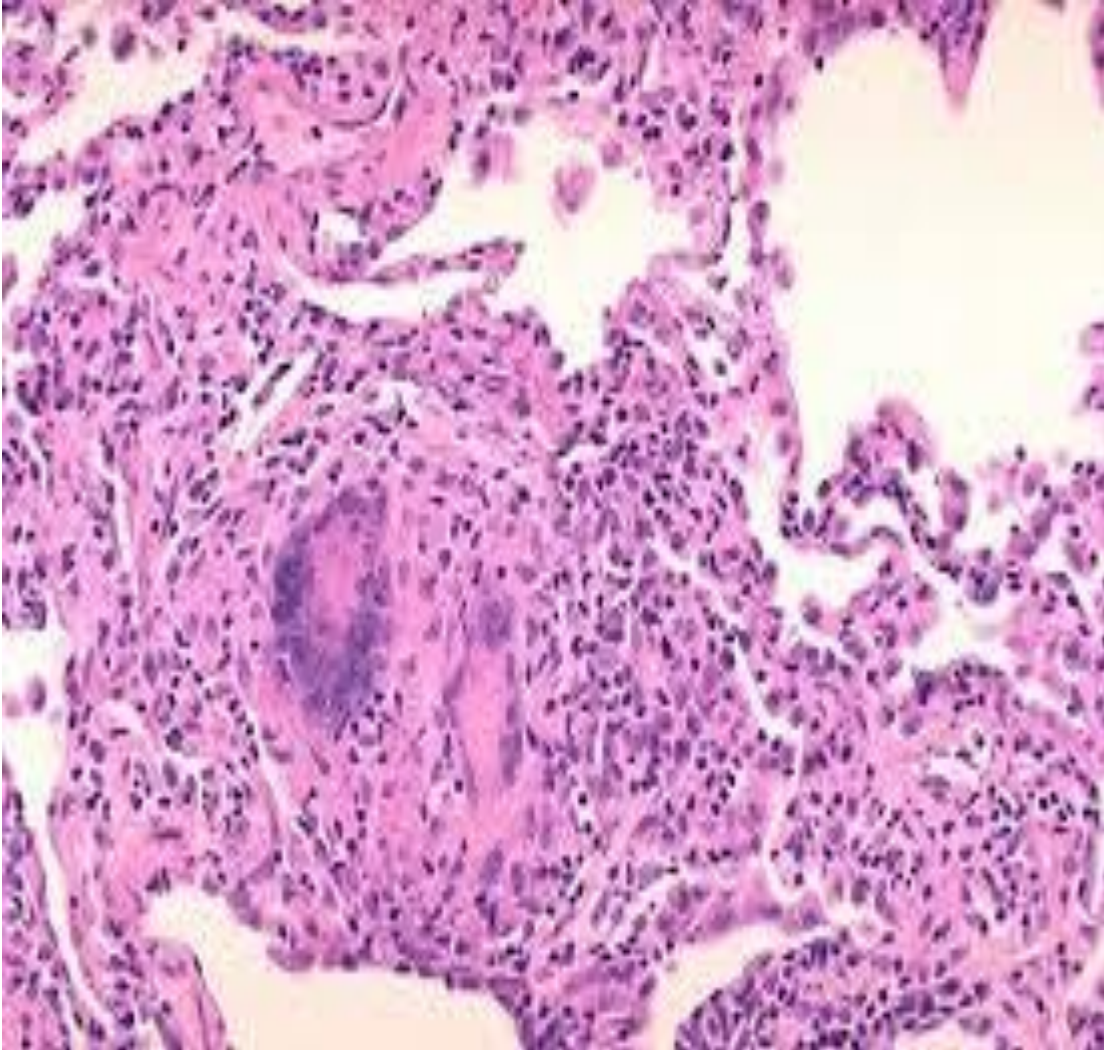
Pulmonary fibrosis with extensive interstitial collagen deposition, minimal lymphocytic inflammatory infiltrates, and residual airspace dilation.

Hypersensitivity Pneumonitis– Histopathology & Radiogram



This case of **extrinsic allergic alveolitis** shows interstitial inflammation along alveolar ducts (bronchiolocentric distribution). The inflammation is diffuse, lacks nodularity, and manifests radiologically as **a ground-glass pattern**

Hypersensitivity Pneumonitis (HP)



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

OBSTRUCTIVE LUNG DISEASES



Bronchial Asthma .1

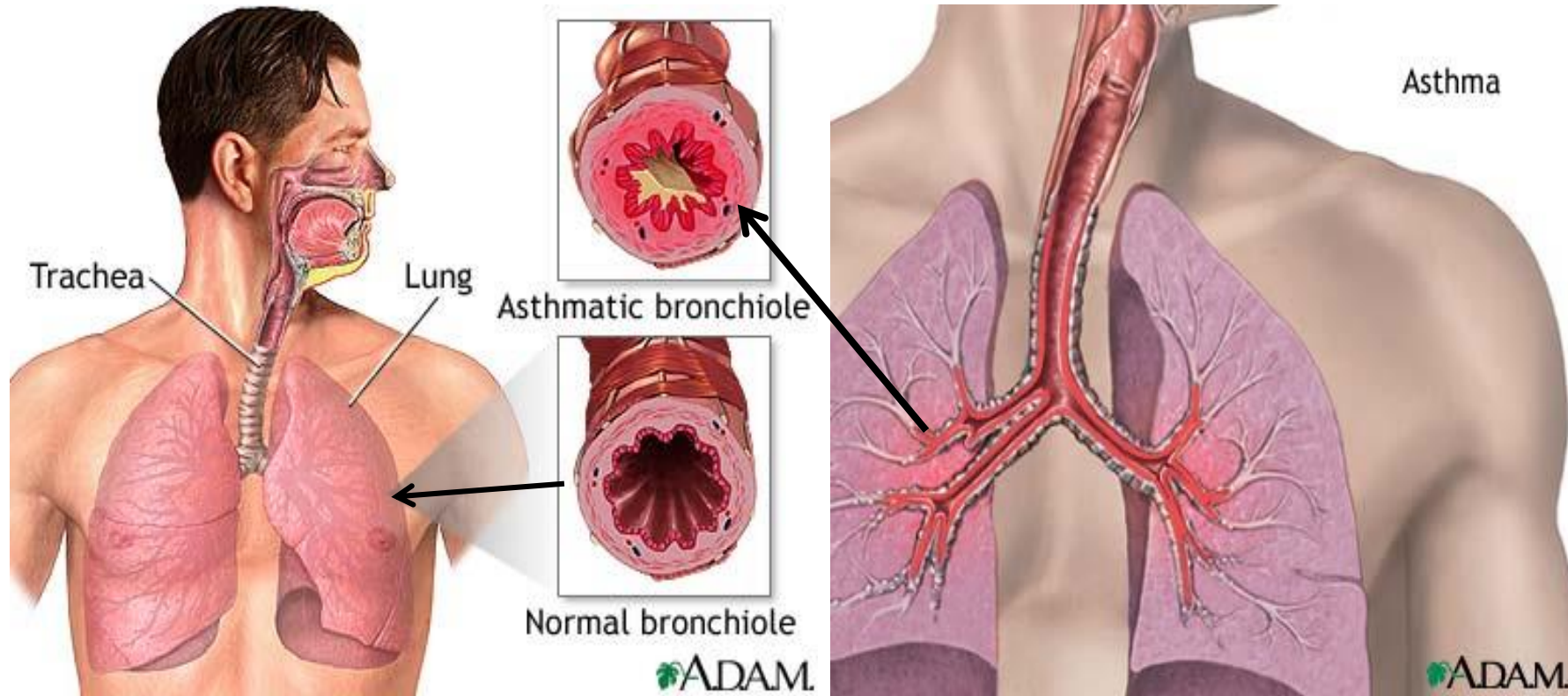
Bronchiectasis .2

COPD : .3

***(Chronic Bronchitis &
Emphysema)***

1. BRONCHIAL ASTHMA

BRONCHIAL ASTHMA - Anatomy

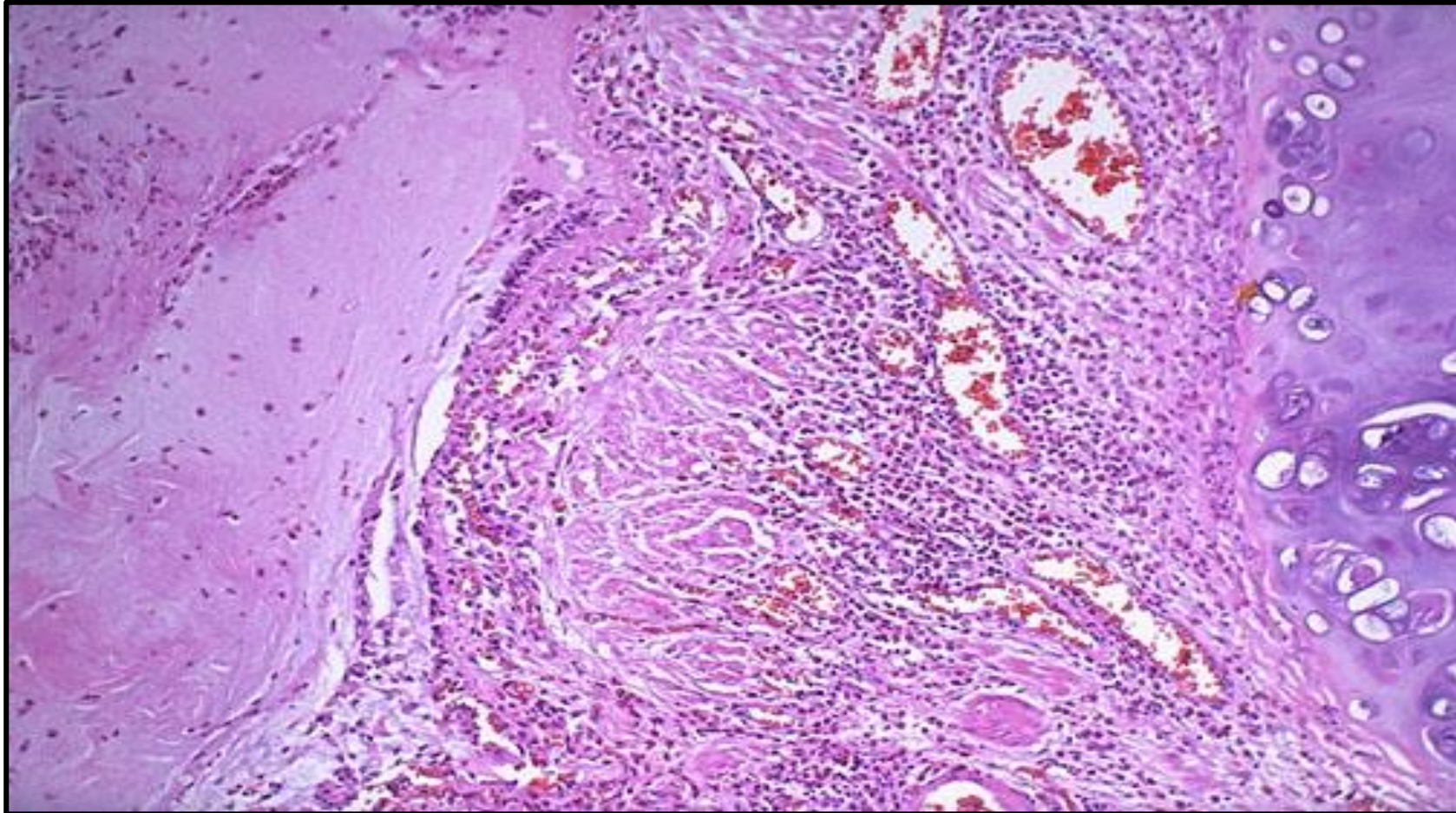


Bronchial Asthma: Inflammation of the airways causes airflow into and out of the lungs to be restricted. The muscles of the bronchial tree become tight and the lining of the air passages swells, reducing airflow.

Clinically characterized by :

Difficult breathing, cough and wheezing sound

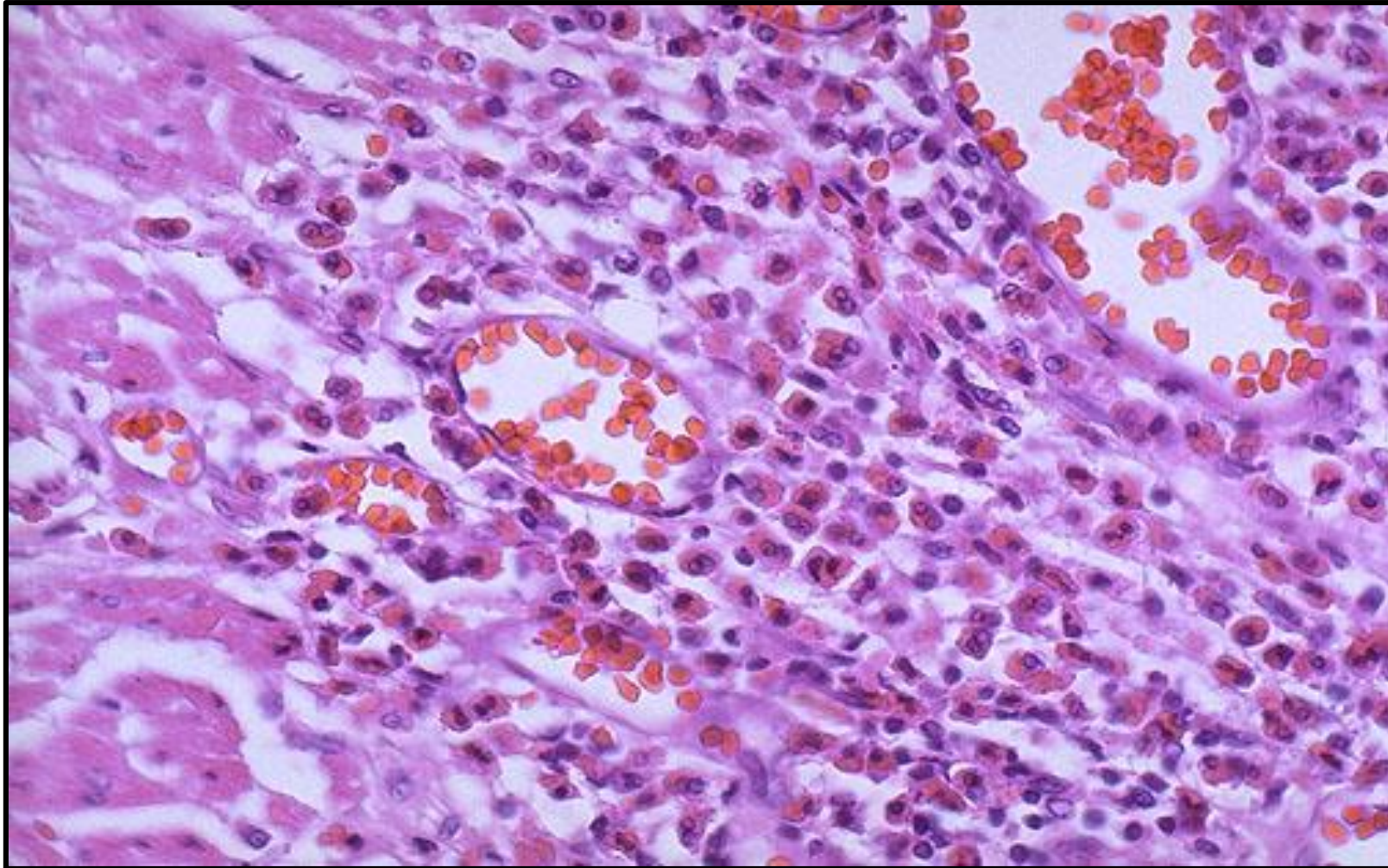
BRONCHIAL ASTHMA - LPF



Between the bronchial cartilage at the right and the bronchial lumen filled with mucus at the left is a submucosa widened by smooth muscle hypertrophy, edema, and inflammation (mainly eosinophils).

The peripheral eosinophil count or the sputum eosinophils can be increased during an asthmatic attack.

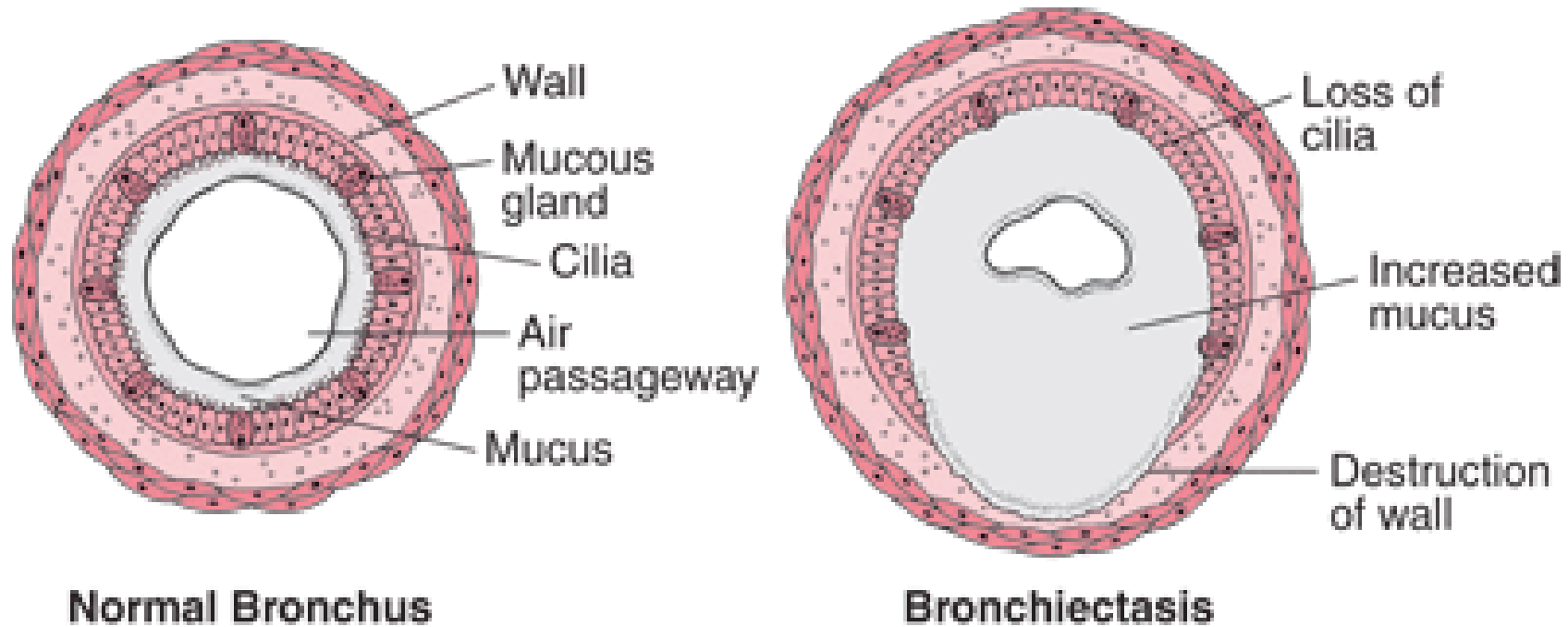
BRONCHIAL ASTHMA - HPF



Changes of bronchial asthma: the numerous eosinophils are prominent from their bright red cytoplasmic granules in this case of bronchial asthma

2. BRONCHIECTASIS

Diagram of Normal & Bronchiectatic Bronchus



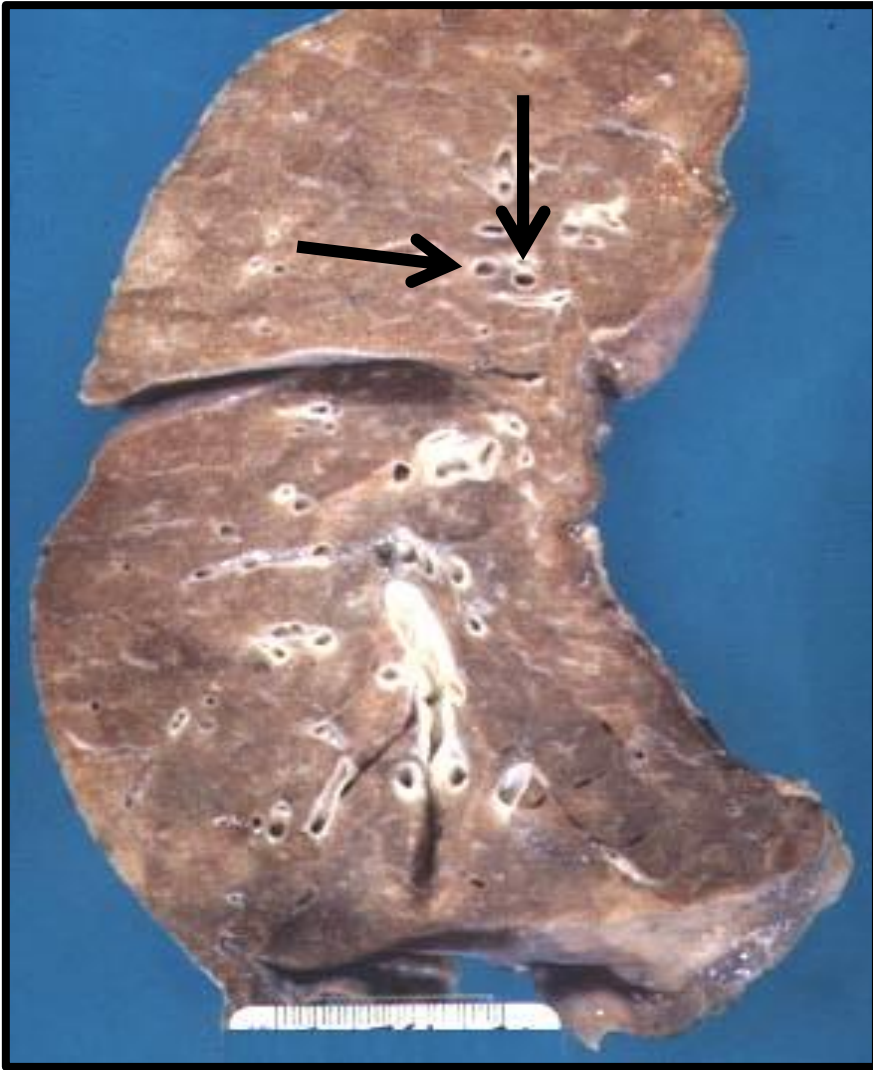
In Bronchiectasis, mucus production increases, the cilia are destroyed or damaged, and areas of the bronchial wall become chronically inflamed and are destroyed .

Bronchiectasis – Gross pathology & Colored X-ray



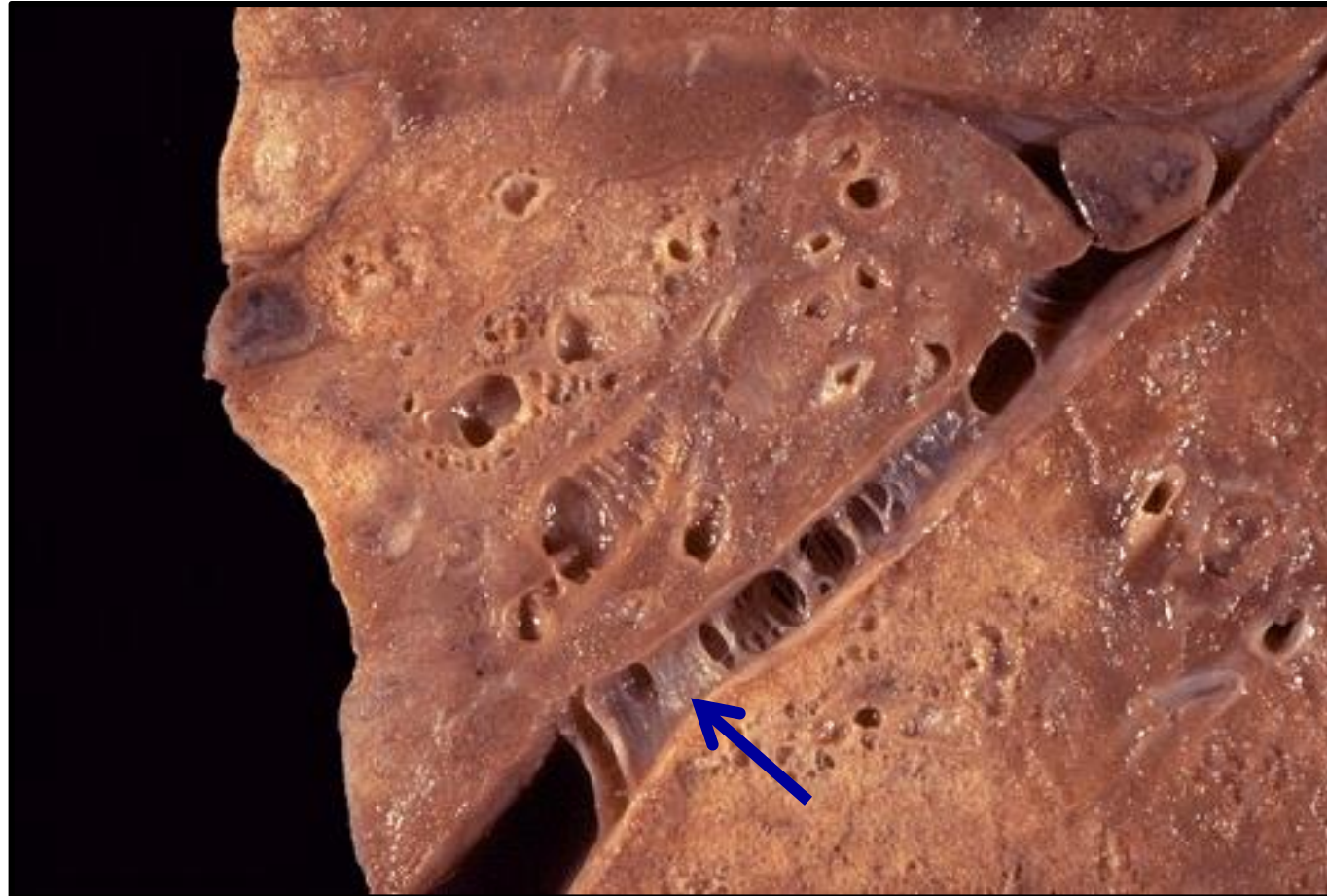
Permanent dilatation of bronchi and bronchioles caused by destruction of muscle and elastic tissue resulting from or associated with chronic necrotizing infection -Markedly distended peripheral bronchi.

Bronchiectasis – Gross pathology



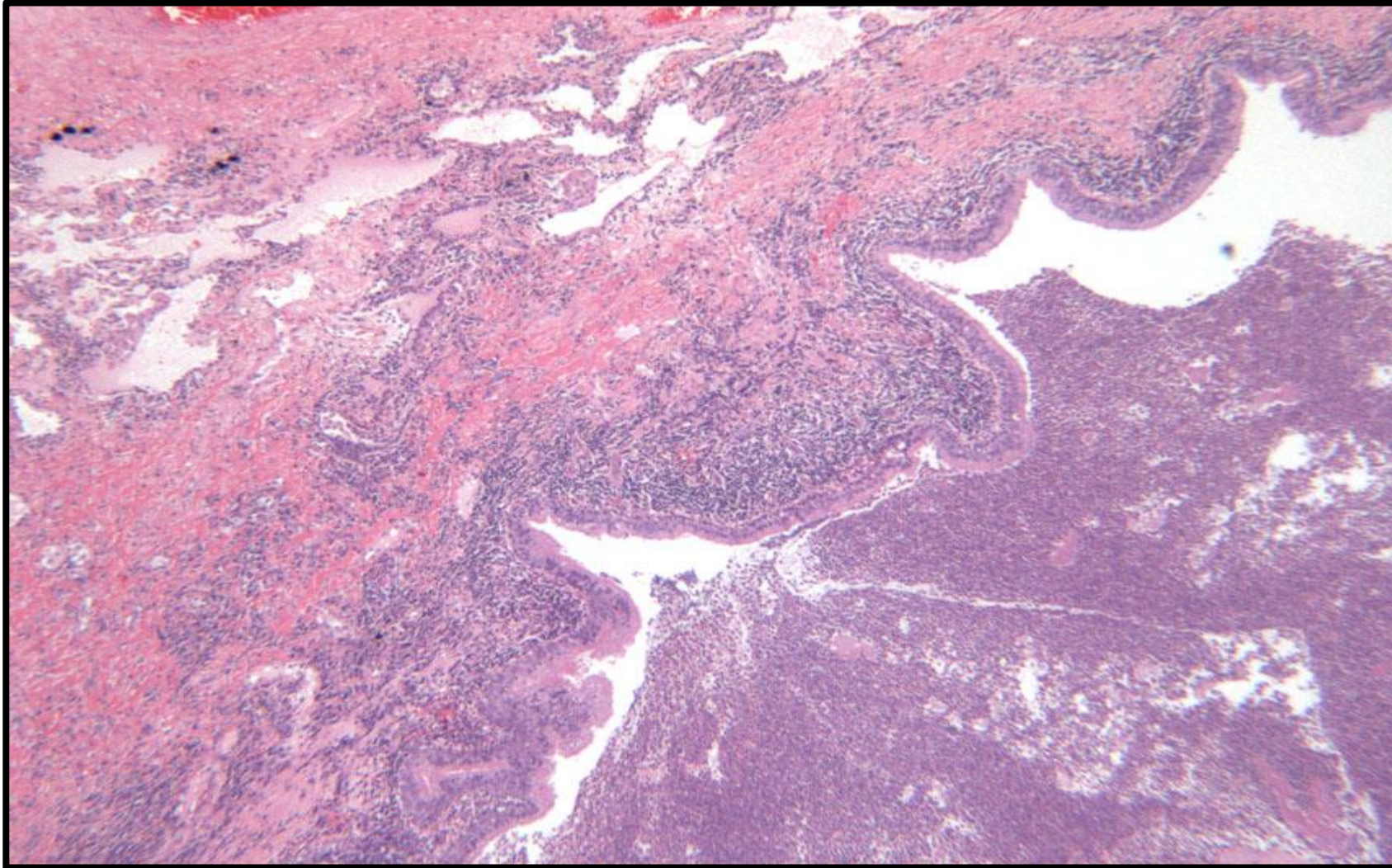
Bronchiectasis occurs when there is obstruction or infection with inflammation and destruction of bronchi so that there is permanent dilation.

Bronchiectasis – Gross pathology



Bronchiectasis is seen here. The repeated episodes of inflammation can result in scarring, which has resulted in fibrous adhesions between the lobes. Fibrous pleural adhesions are common in persons who have had past episodes of inflammation of the lung that involve the pleura.

Bronchiectasis – LPF



Section of a dilated bronchus with florid acute on chronic inflammation of the bronchial wall and surrounding interstitial fibrosis.

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,

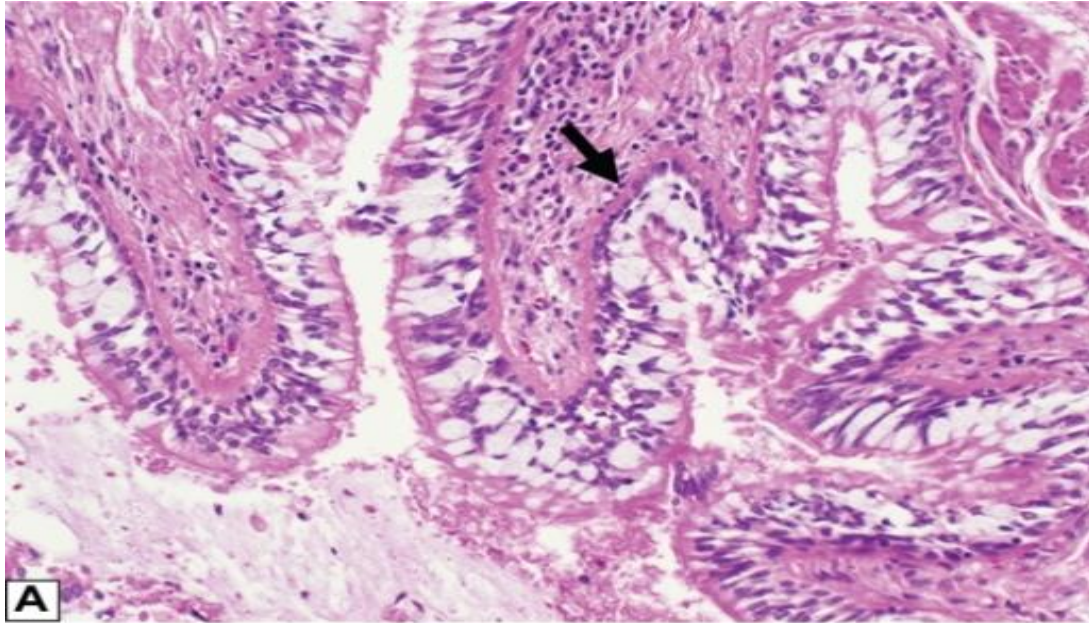
a pair of commonly co-existing diseases of the lungs in which the airways narrow over time.

3. CHRONIC BRONCHITIS

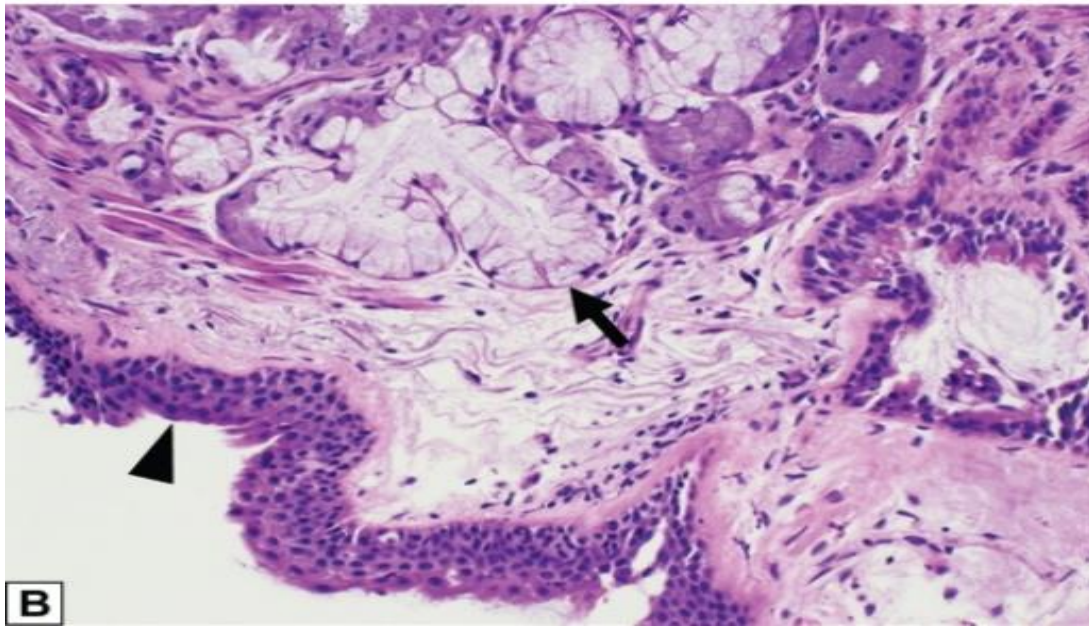
Normal vs Chronic bronchitis



Chronic Bronchitis - LPF



Early - A section of bronchiole wall with **(A)** luminal accumulation of mucous, goblet cell hyperplasia, basement membrane thickening (arrow) and scattered mononuclear inflammatory cells.

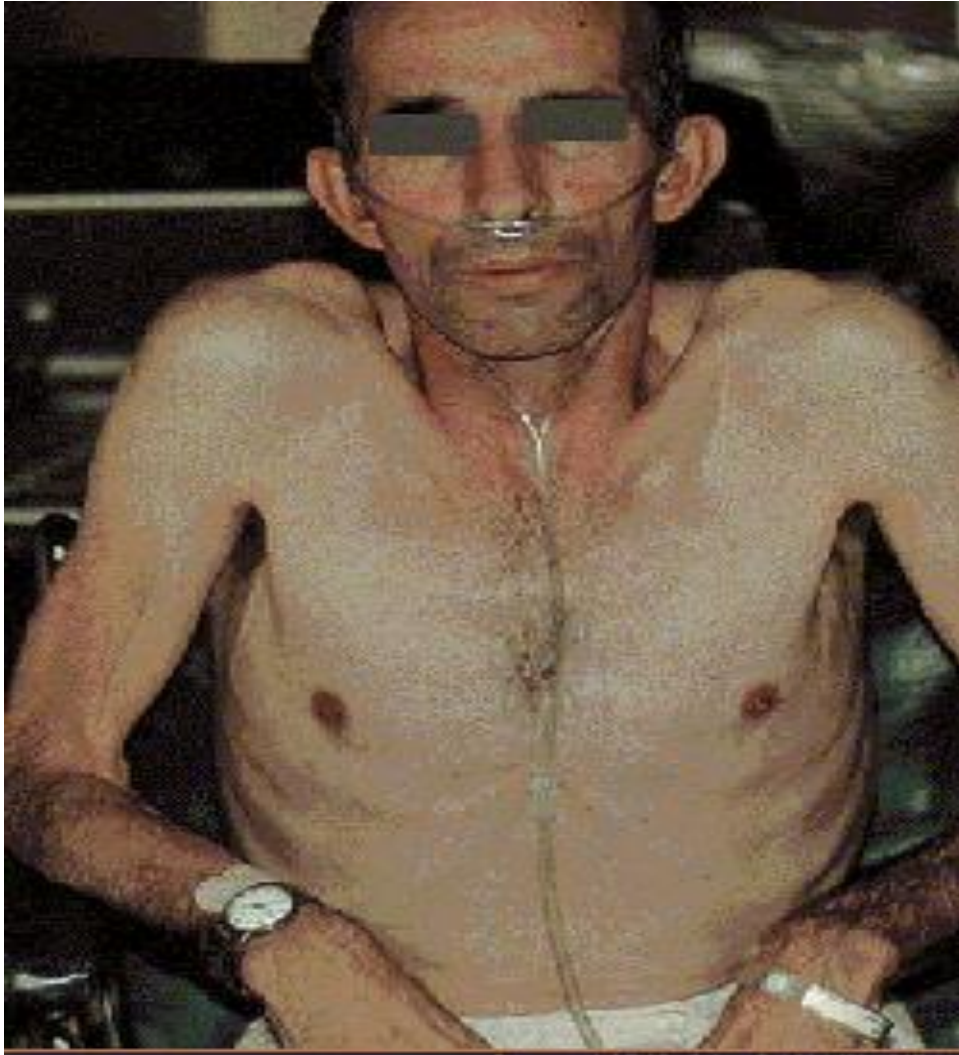


Later - A bronchial wall with squamous **(B)** metaplasia of the luminal epithelium (arrow head) and hyperplasia of the subepithelial seromucinous glands (arrow).

4. EMPHYSEMA

Characterized by irreversible enlargement of the airspaces distal to the terminal bronchiole, accompanied by destruction of their walls without fibrosis

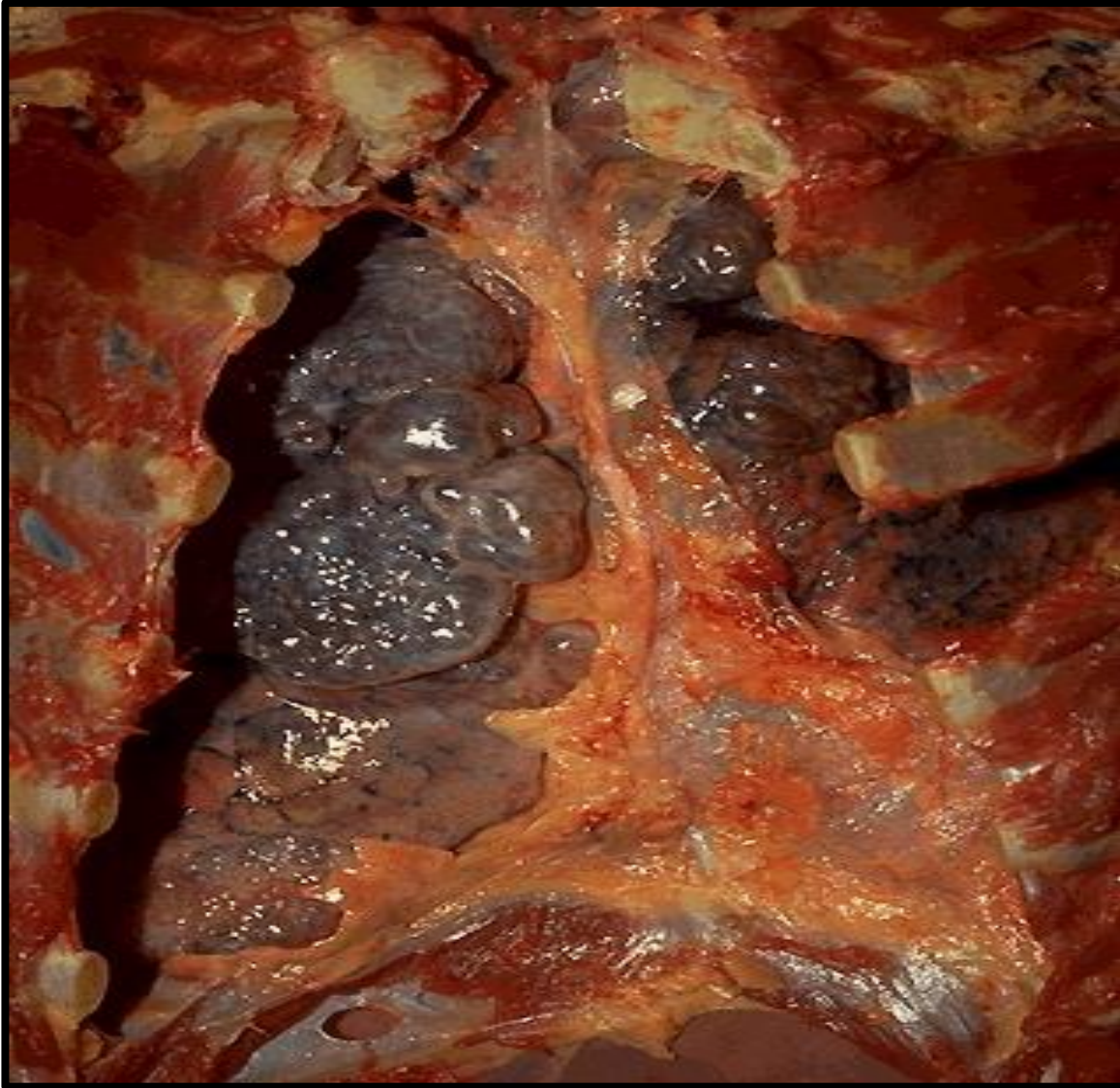
Emphysema – Clinical Features



Emphysema patient

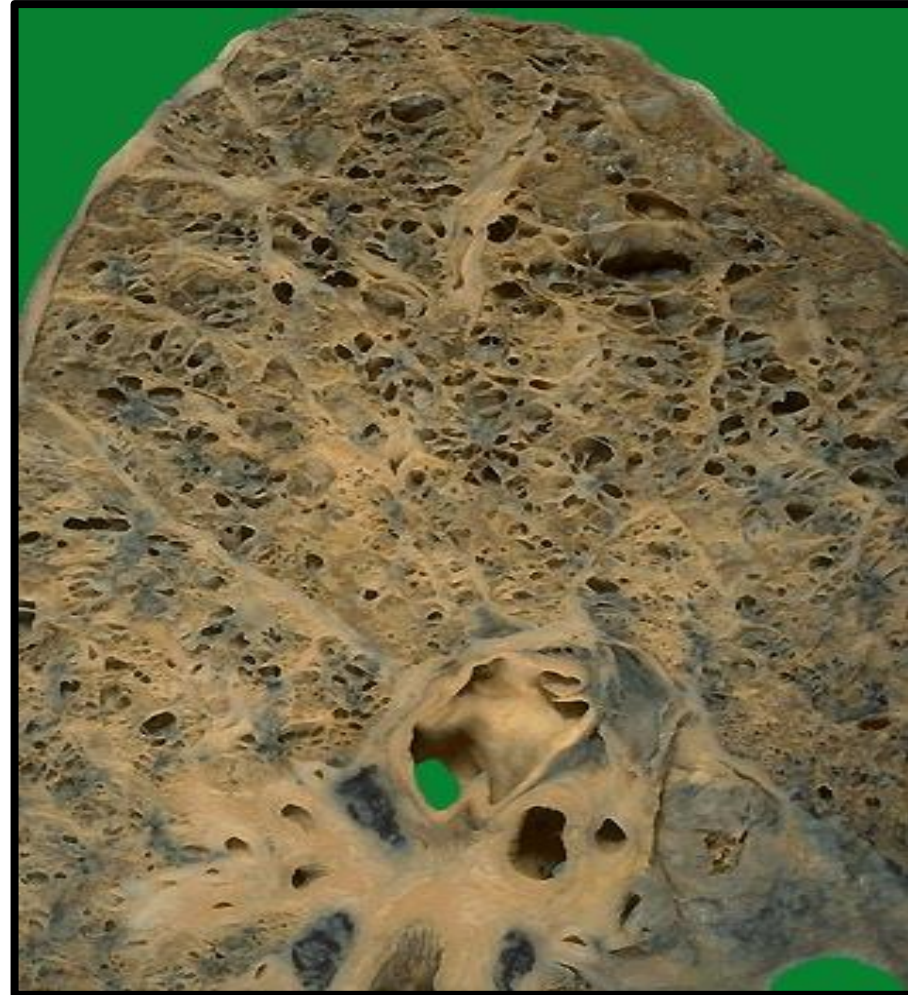
- Also known as pink puffers •*
- exhibit dyspnea without significant hypoxemia •*
- tend to be thin •*
- to have hyperinflated lung fields at total lung capacity, and •*
- to be free of signs of right heart failure •*

Emphysema – Gross Anatomy



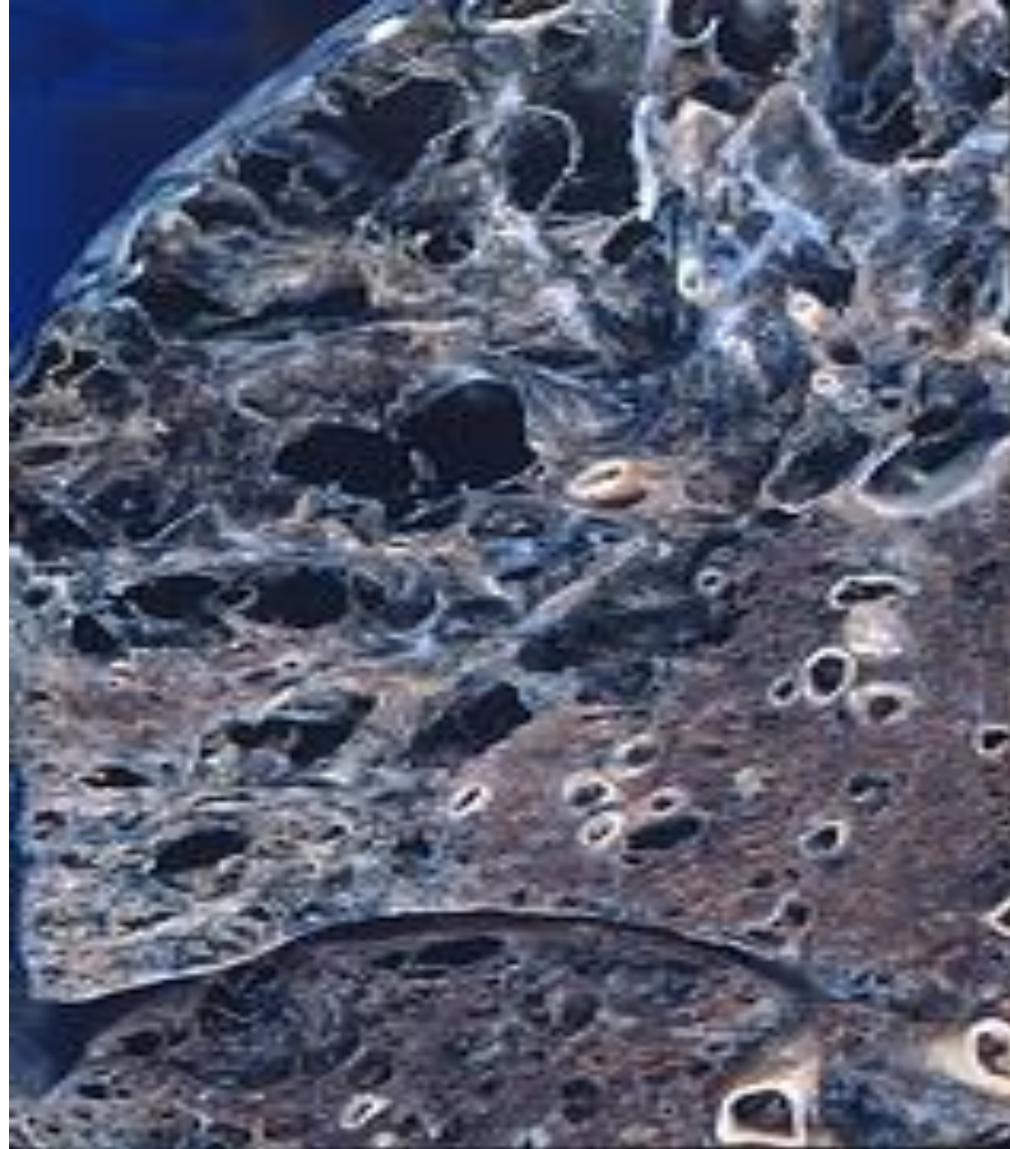
- The chest cavity is opened at autopsy to reveal:*
- numerous large emphysematous bullae* •
 - apparent on the surface of the lungs*
 - Bullae are large dilated airspaces that* •
 - bulge out from beneath the pleura.*

Emphysema – Gross pathology



*Dilated airspaces 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, without fibrosis***

Bullous Emphysema – Gross pathology



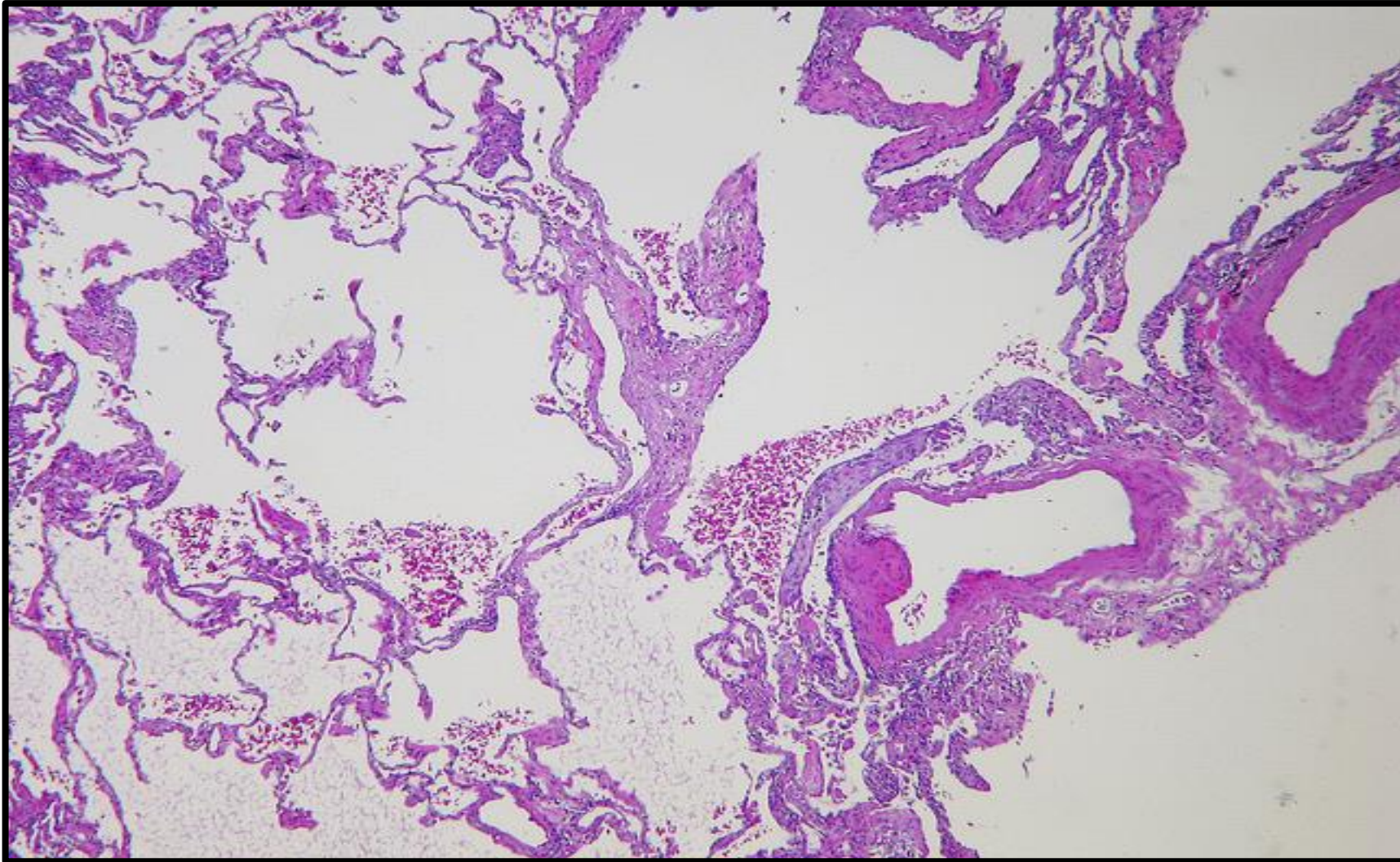
A bulla is defined as an emphysematous space larger than 1 cm.

Centrilobular Emphysema – Gross pathology



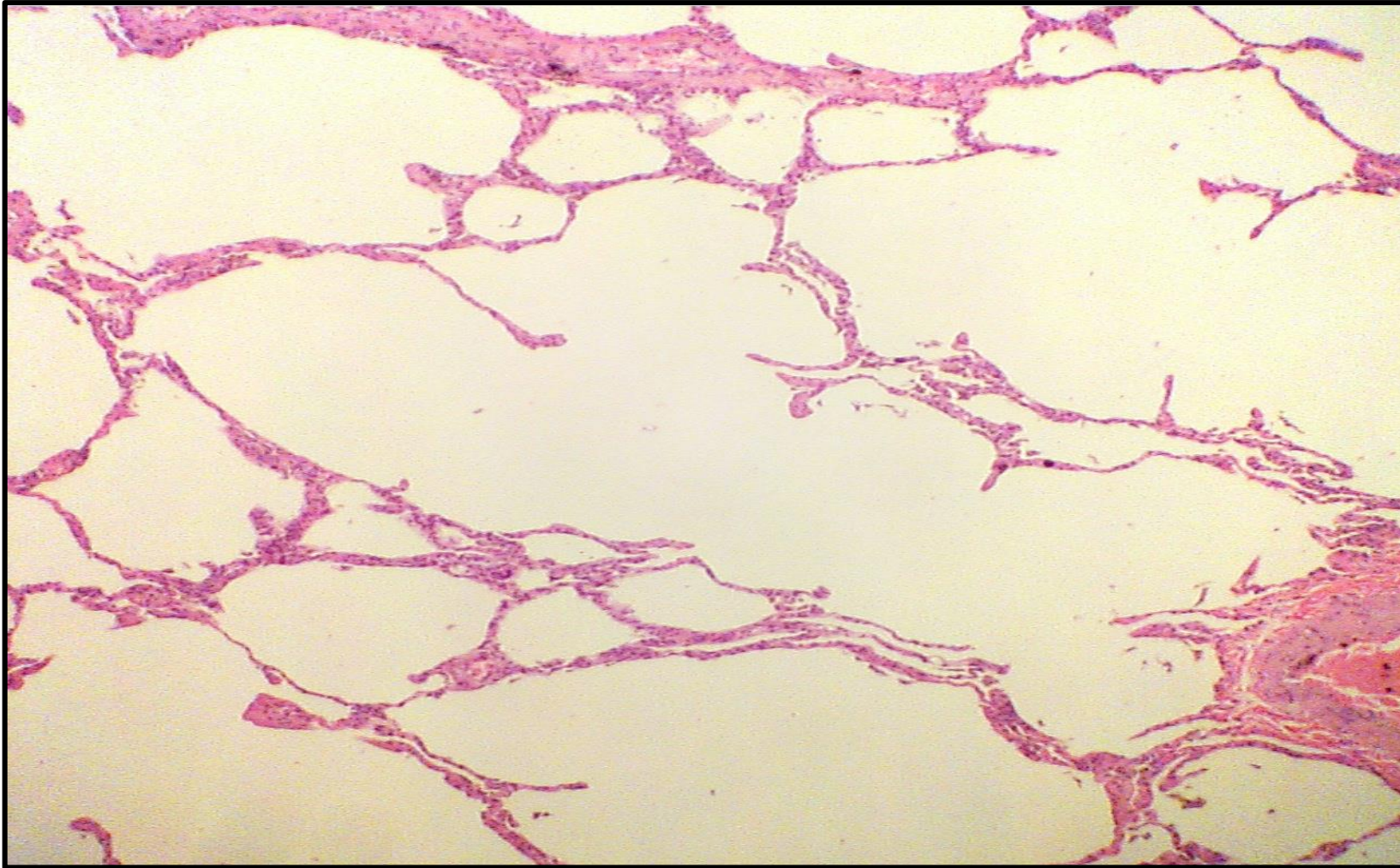
Centrilobular emphysema : Fixed, cut surface of a lung shows multiple cavities lined by heavy black carbon deposits characteristic of smoking.

Panacinar Emphysema – LPF



Some of the alveolar septae are ruptured and the ruptured septa project within air spaces on the form of spurs.

Panacinar Emphysema - HPF

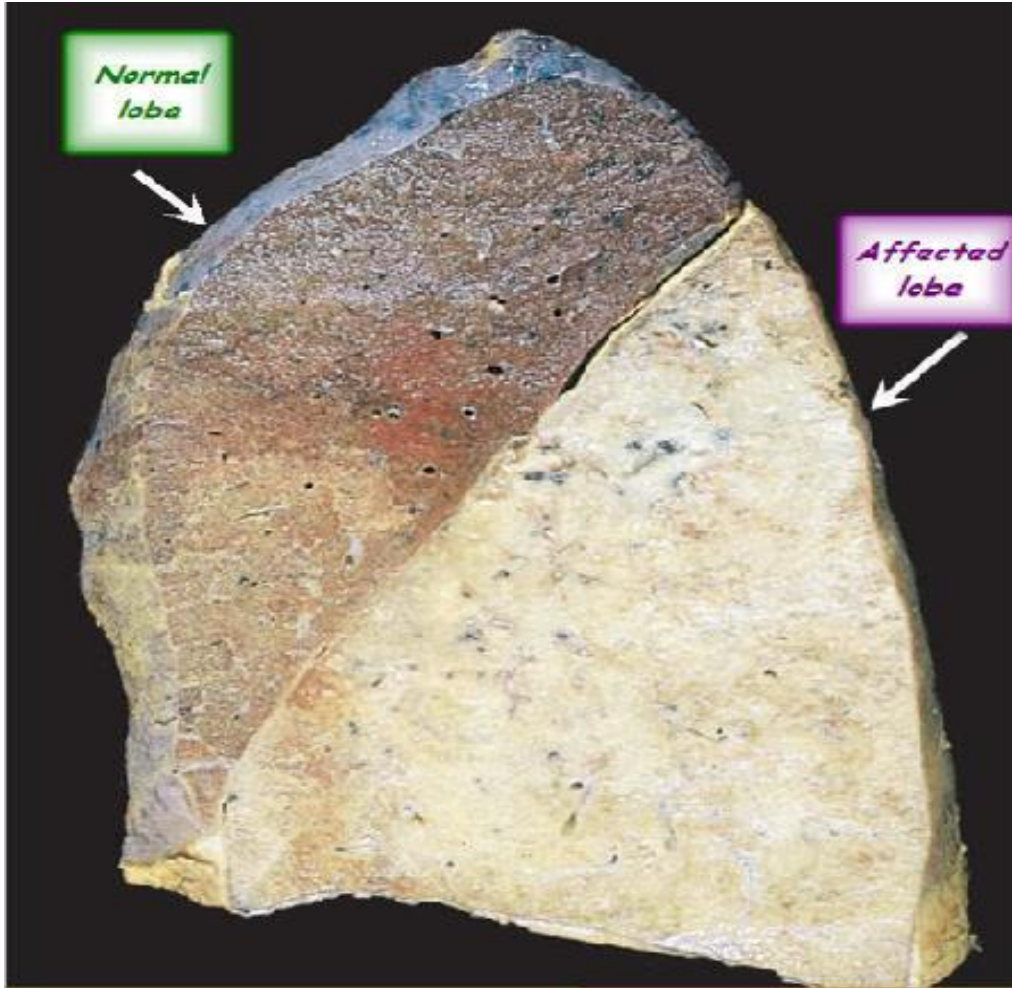


Destruction of tissue leaves emphysematous spaces with little surface area, few capillaries, and large air spaces. Large vessel at lower left

LOWER RESPIRATORY TRACT INFECTIONS

1. Lobar Pneumonia

Lobar Pneumonia - Gross pathology



Finrinosuppurative consolidation of a large portion of a lobe or of an entire lobe

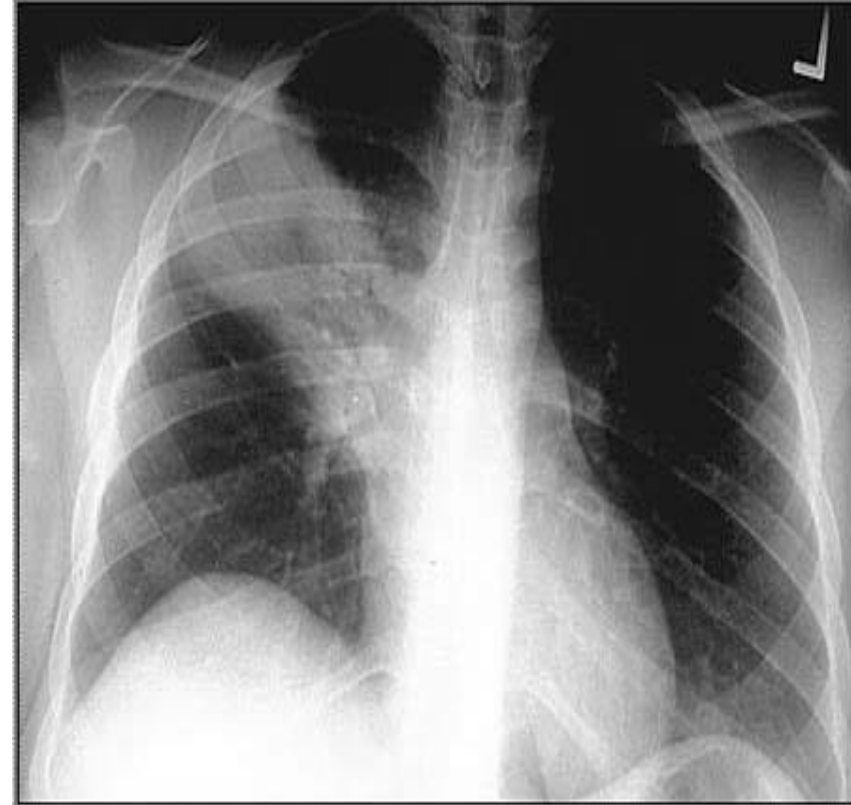


A closer view of the lobar pneumonia demonstrates the distinct difference between the upper lobe and the consolidated lower lobe.

Lobar Pneumonia : X - Ray



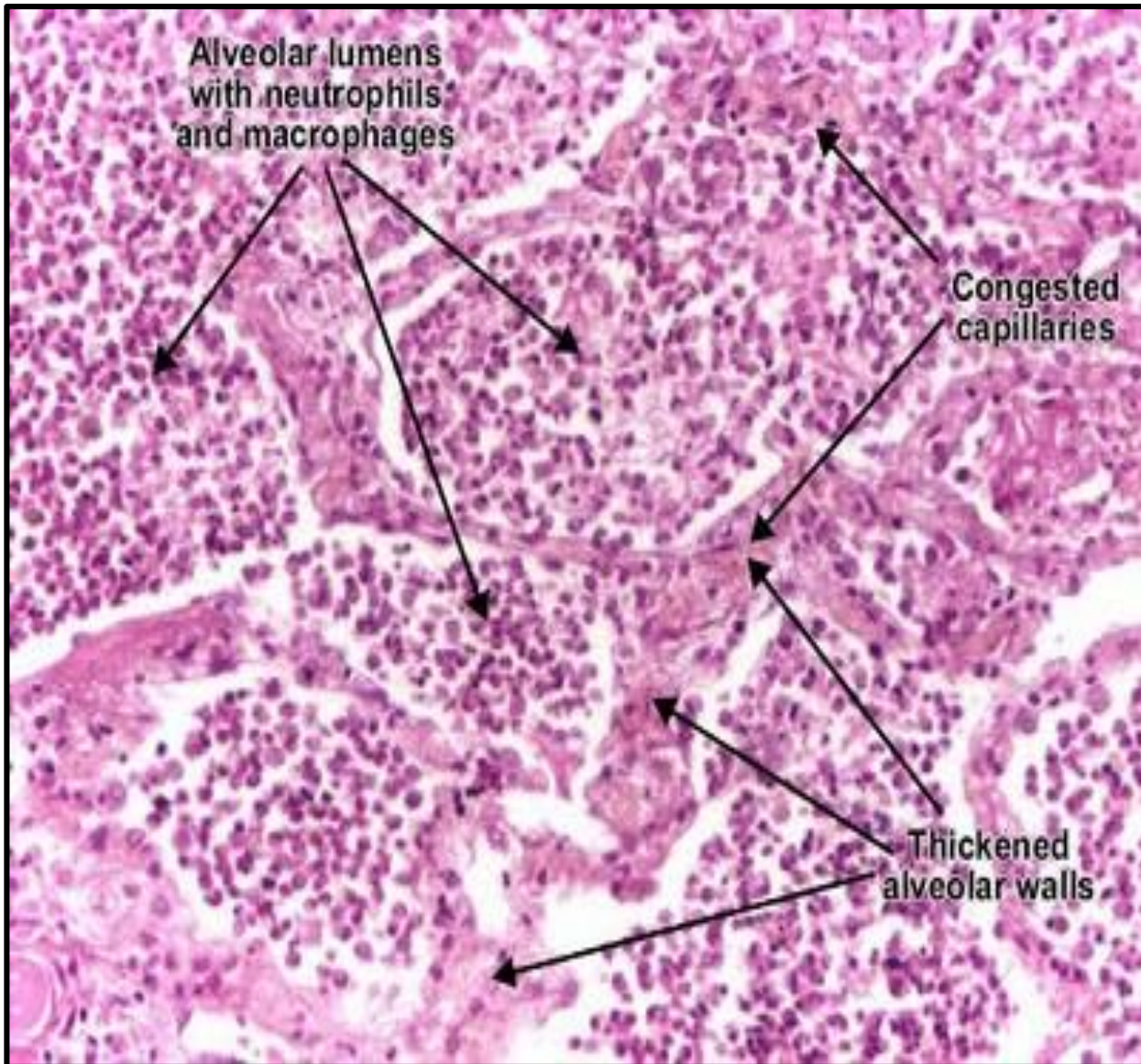
Lobar Pneumonia of the right Lower lobe



Lobar Pneumonia of the right middle lobe

A localised focus of consolidation caused by lobar pneumonia can be seen in both X-ray films taken from 2 different patients .

Lobar Pneumonia - Histopathology



4 staged of inflammatory response:

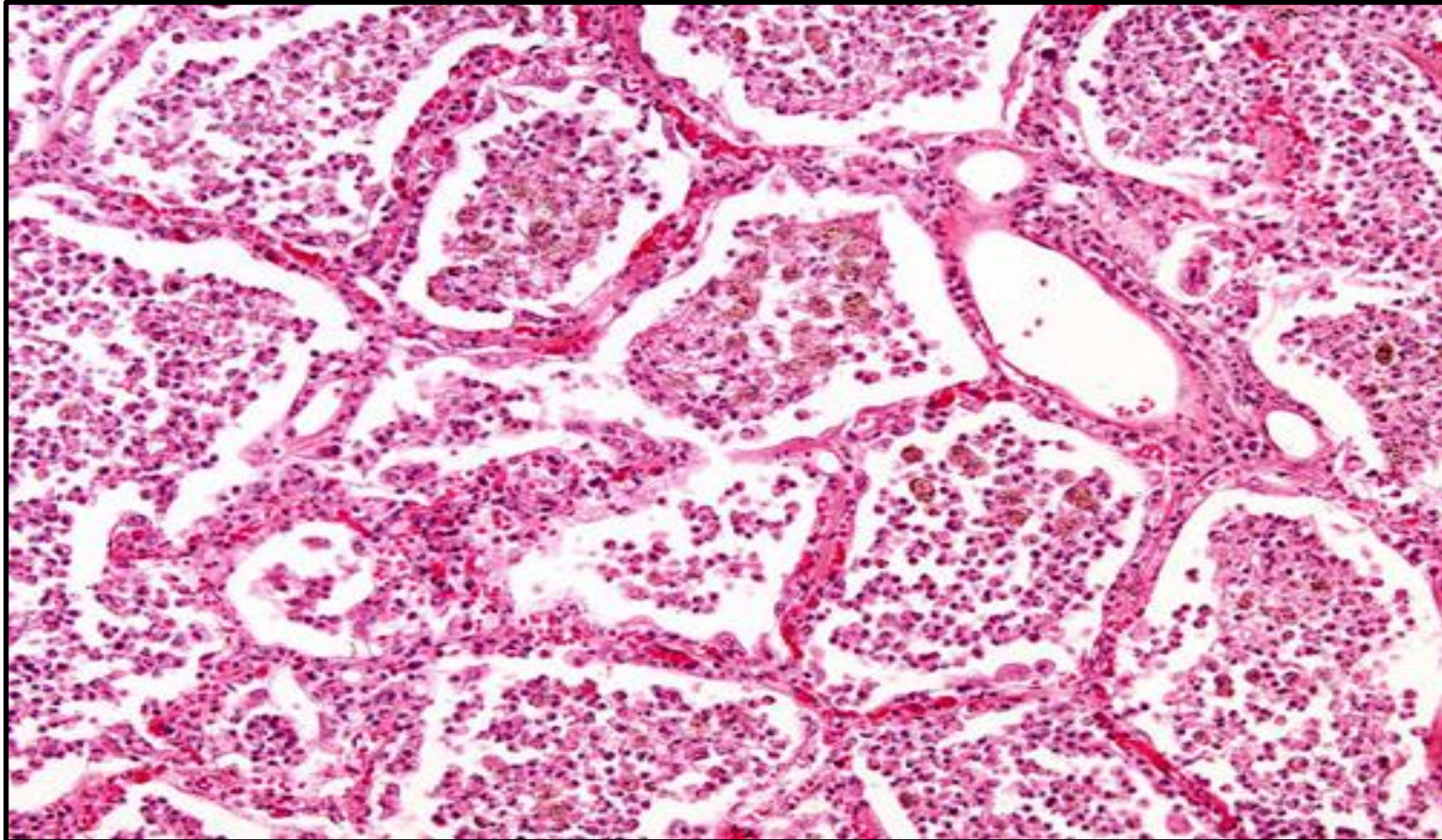
Congestion (first 2 days): heavy and red lung, chch by Intra-alveolar fluid and few neutrophils .1

Red hepatisation (fibrinous alveolitis) .2
(2nd to 4th day), chch by massive confluent exudation with neutrophils, red cells, and fibrin filling the alveolar spaces.

Grey hepatisation (leukocytic alveolitis) .3
(4th to 8th day), RBC destruction and persistence of fibrinosuppurative exudate.

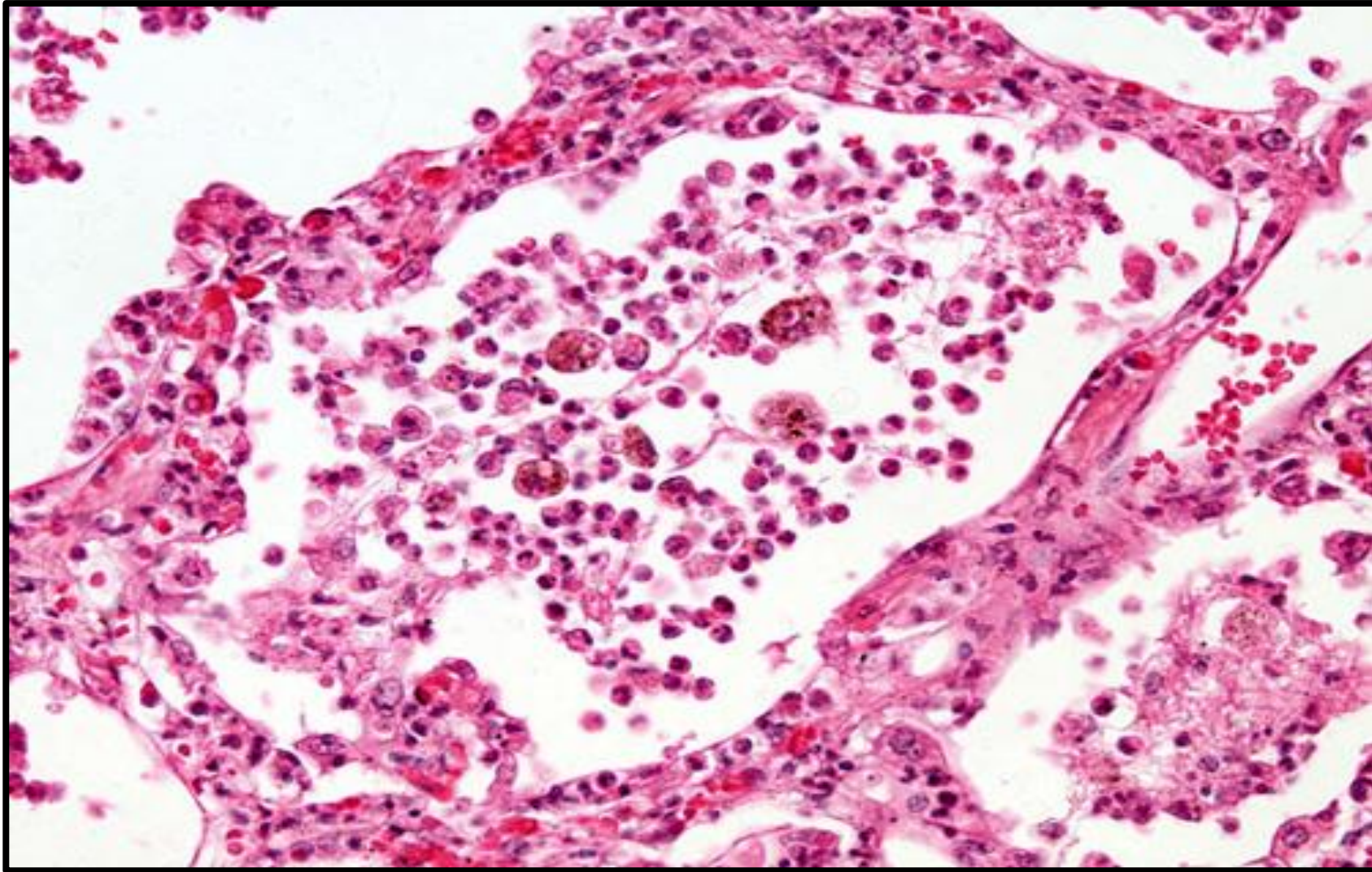
Resolution (after 8th day) .4
Consolidated exudate with macrophage within alveolar spaces

Lobar Pneumonia - LPF



All the alveoli are filled with fibrinous exudate containing fibrin threads, polymorphs, macrophages and red cells. Alveolar walls are congested. Pleura is covered by fibrinous exudate.

Lobar Pneumonia - HPF



High power field of alveolar exudate and thickened alveolar wall

2. Bronchopneumonia

Bronchopneumonia – Gross pathology



patchy consolidated areas here very closely match the pattern of lung lobules (hence the term "lobular pneumonia").

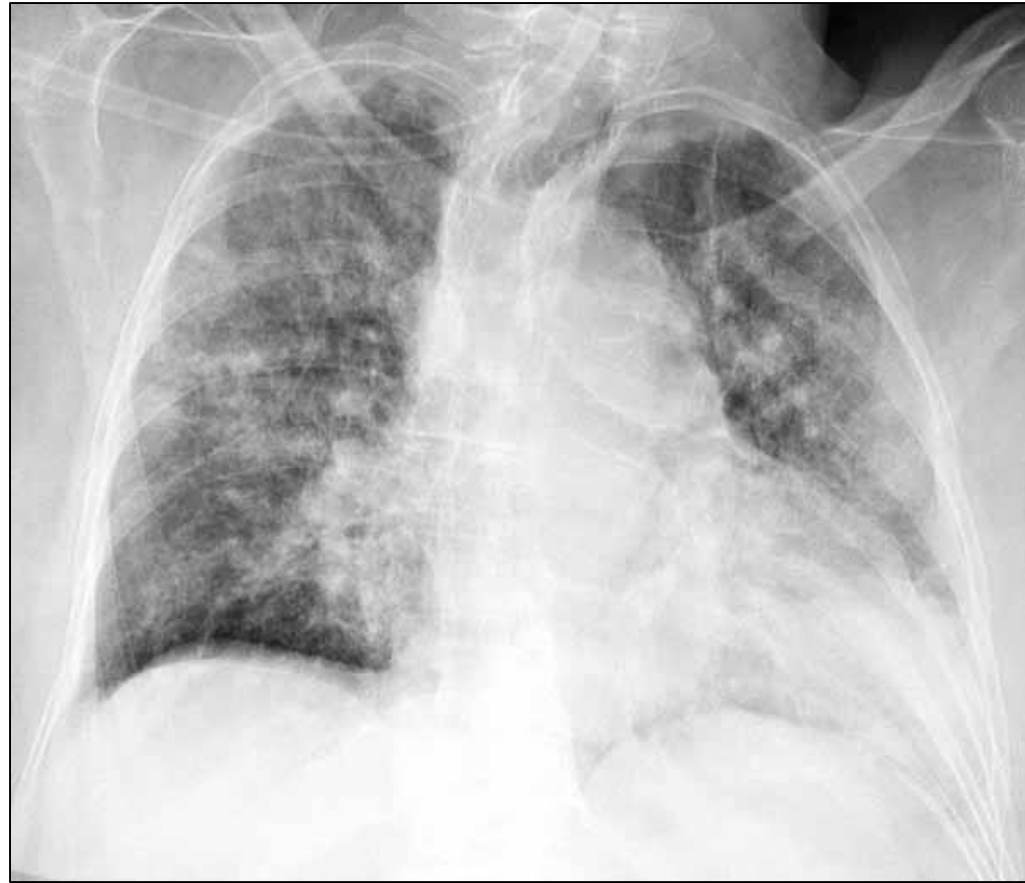
Bronchopneumonia is classically a "hospital acquired" pneumonia seen in persons already ill from another diseases e.g. DM, old age, immune deficiency process.

Bronchopneumonia – Cut section



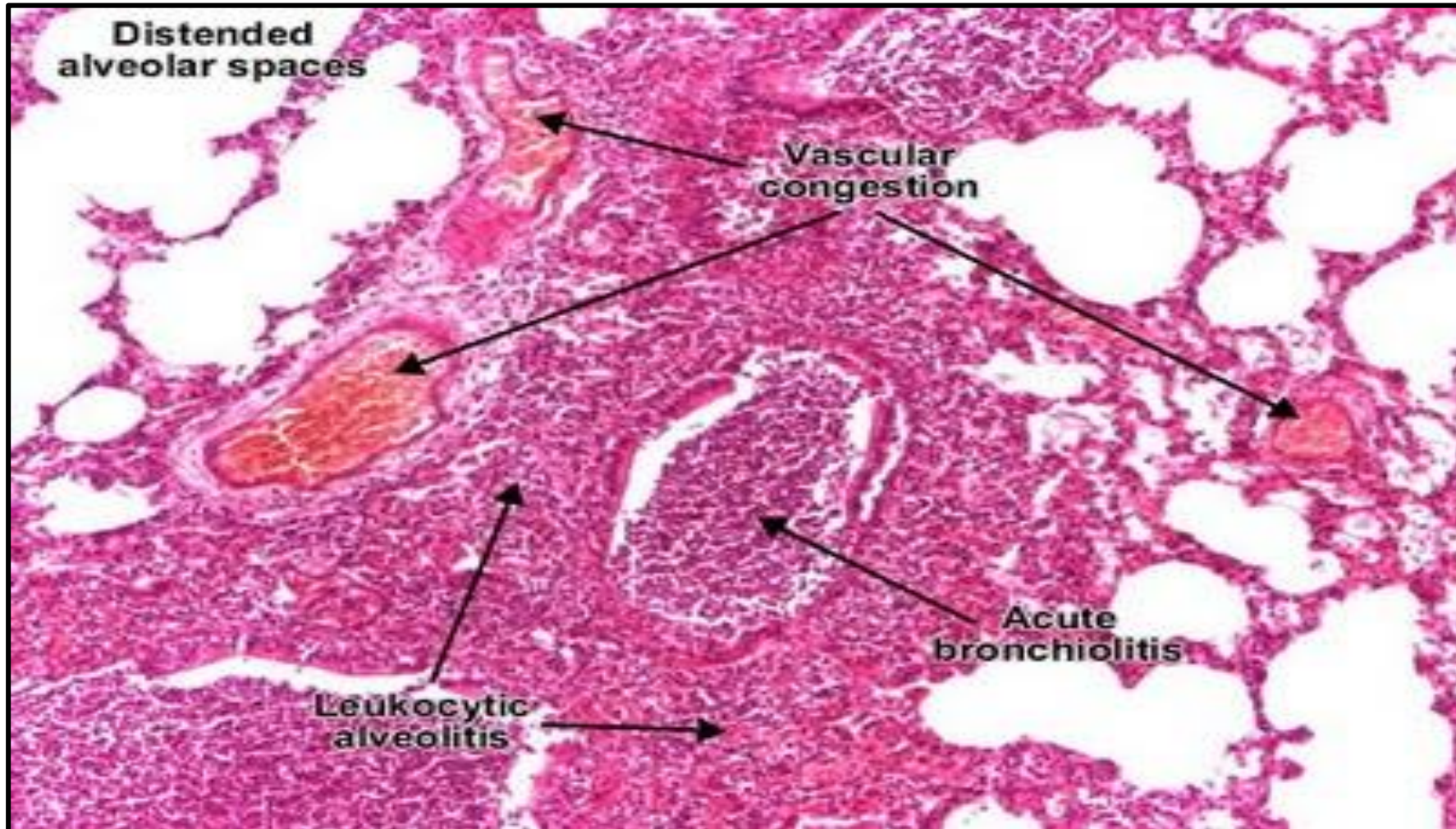
This bronchopneumonia is more subtle, but there are areas of lighter tan consolidation. The hilum is seen at the lower left with radiating pulmonary arteries and bronchi

Bronchopneumonia – X-Ray



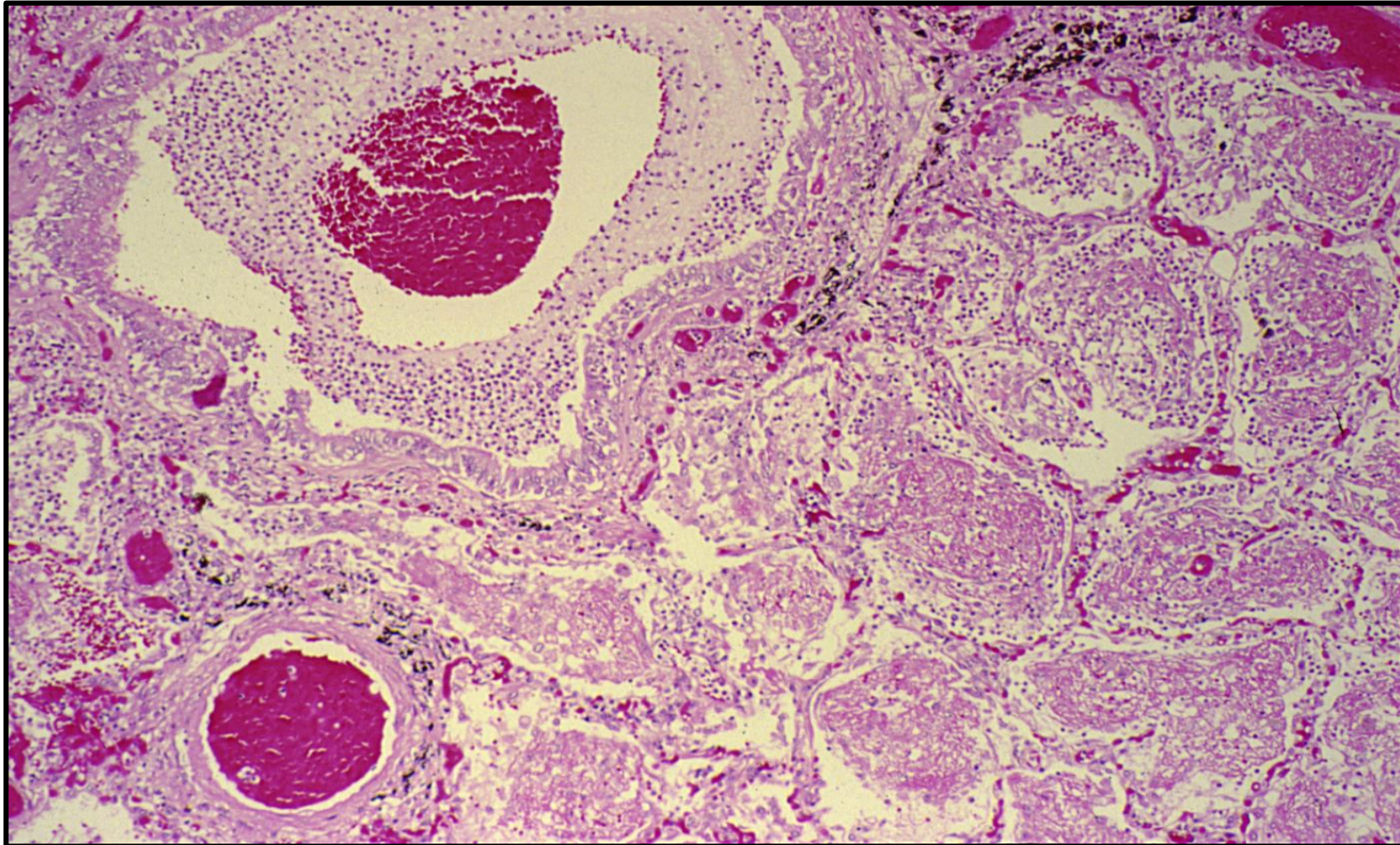
This radiograph demonstrates patchy infiltrates consistent with a bronchopneumonia from a bacterial infection.

Bronchopneumonia – Histopathology



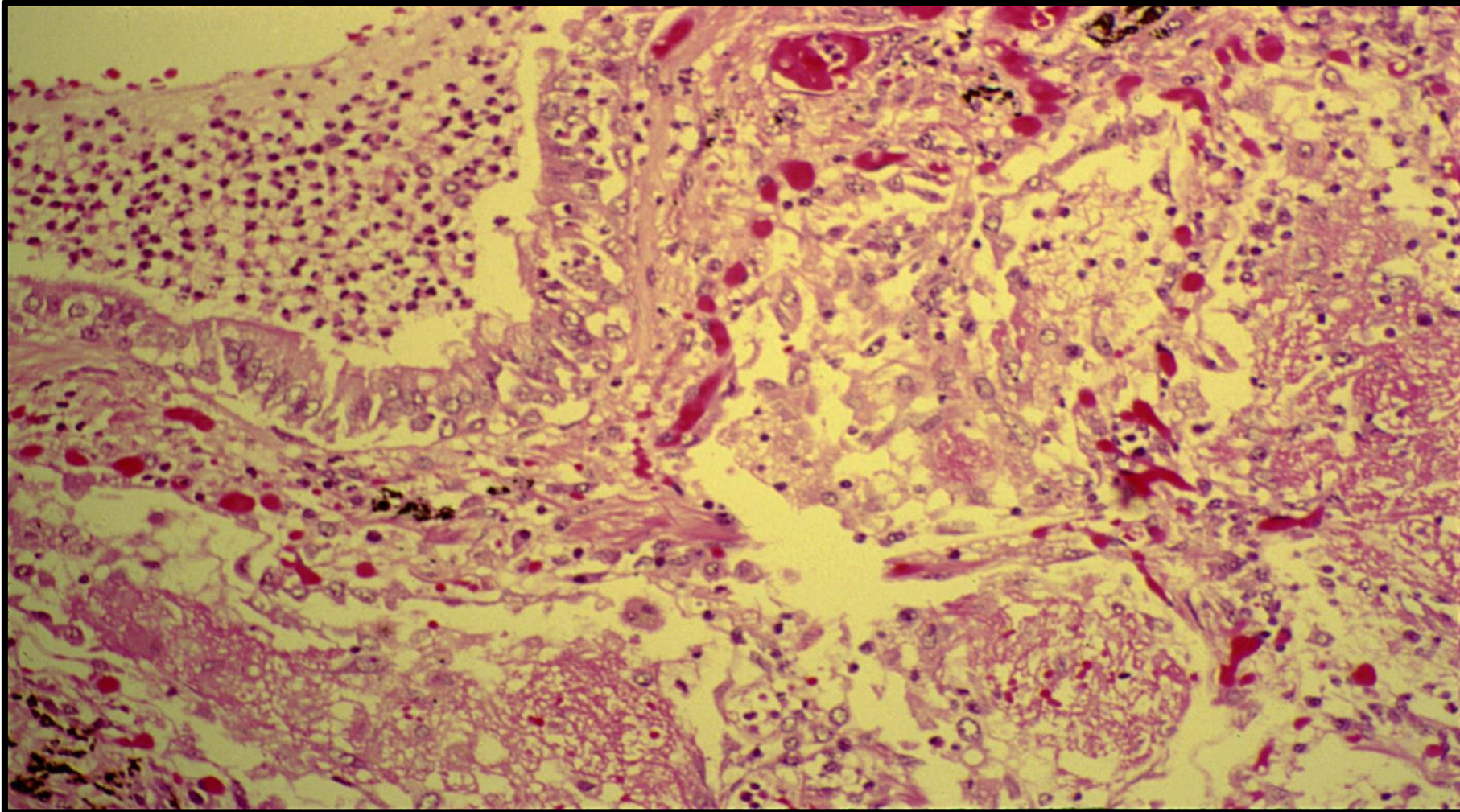
Bronchopneumonia is an acute exudative inflammation of the lungs characterised by foci of consolidation surrounded by normal parenchyma. Usually, bronchopneumonia affects one or more lobes and is bilateral.

Bronchopneumonia – LPF



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

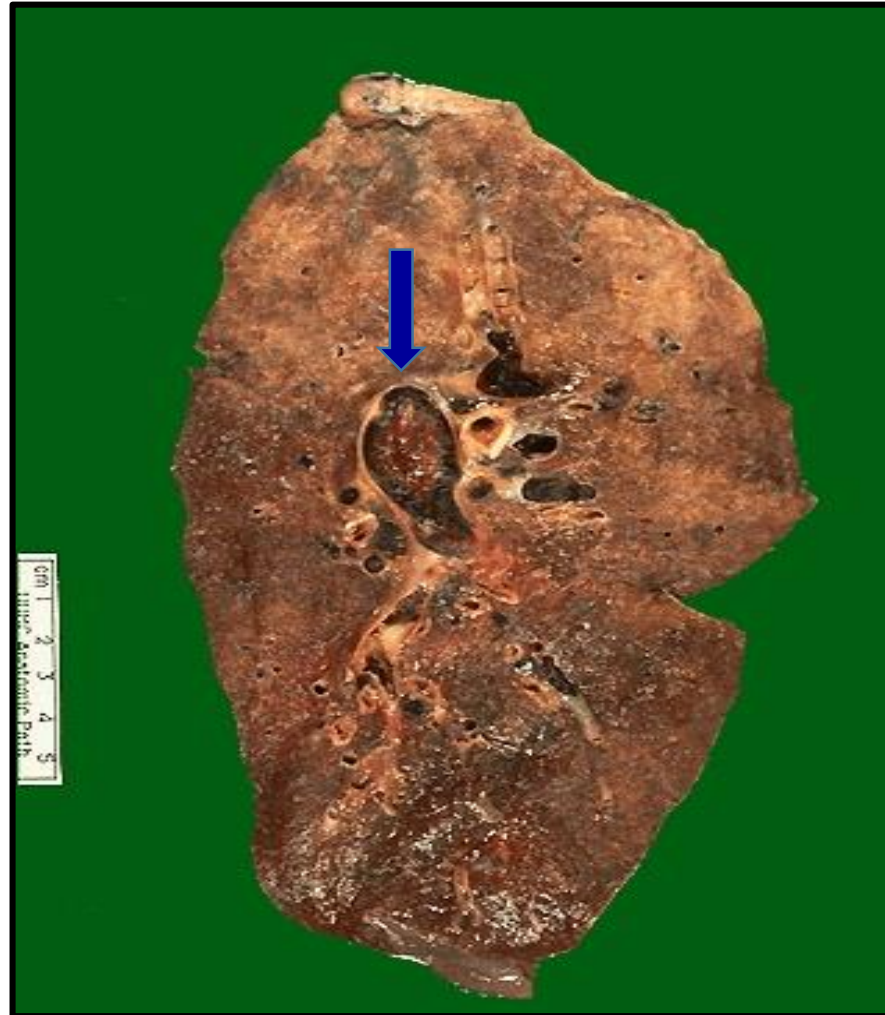
Bronchopneumonia – MPF



At high magnification, the alveolar exudate of mainly neutrophils is seen. The surrounding alveolar walls have capillaries that are dilated and filled with RBC's. Such an exudative process is typical for bacterial infection. This exudate gives rise to the productive cough of purulent yellow sputum seen with bacterial pneumonias

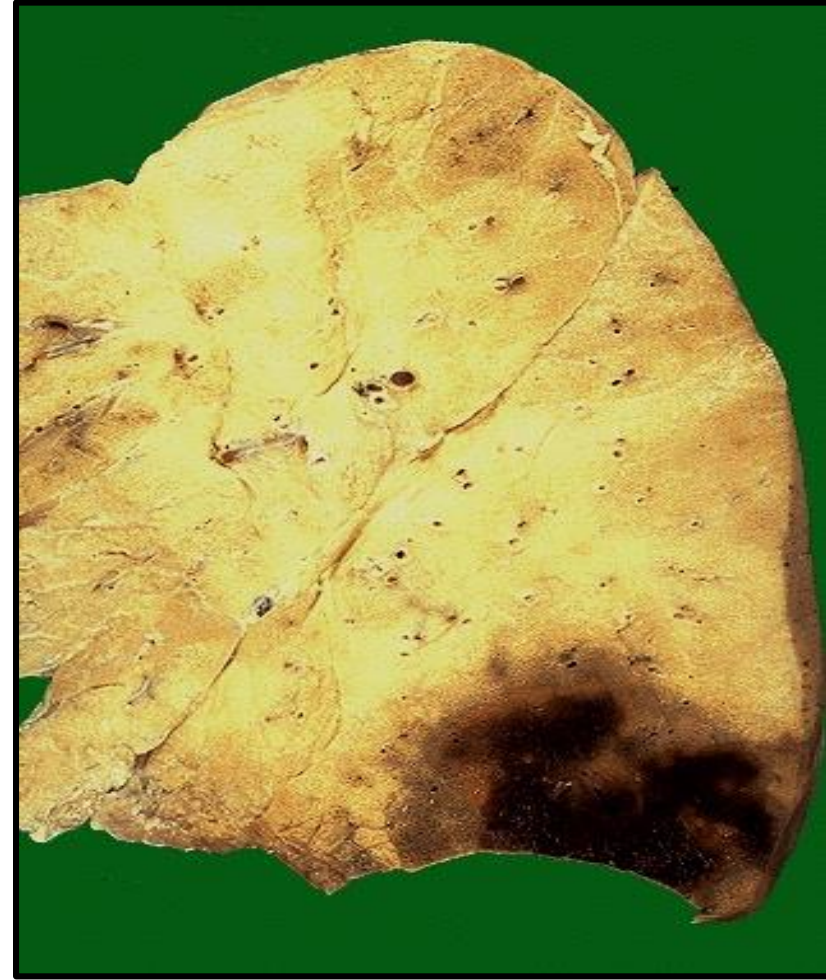
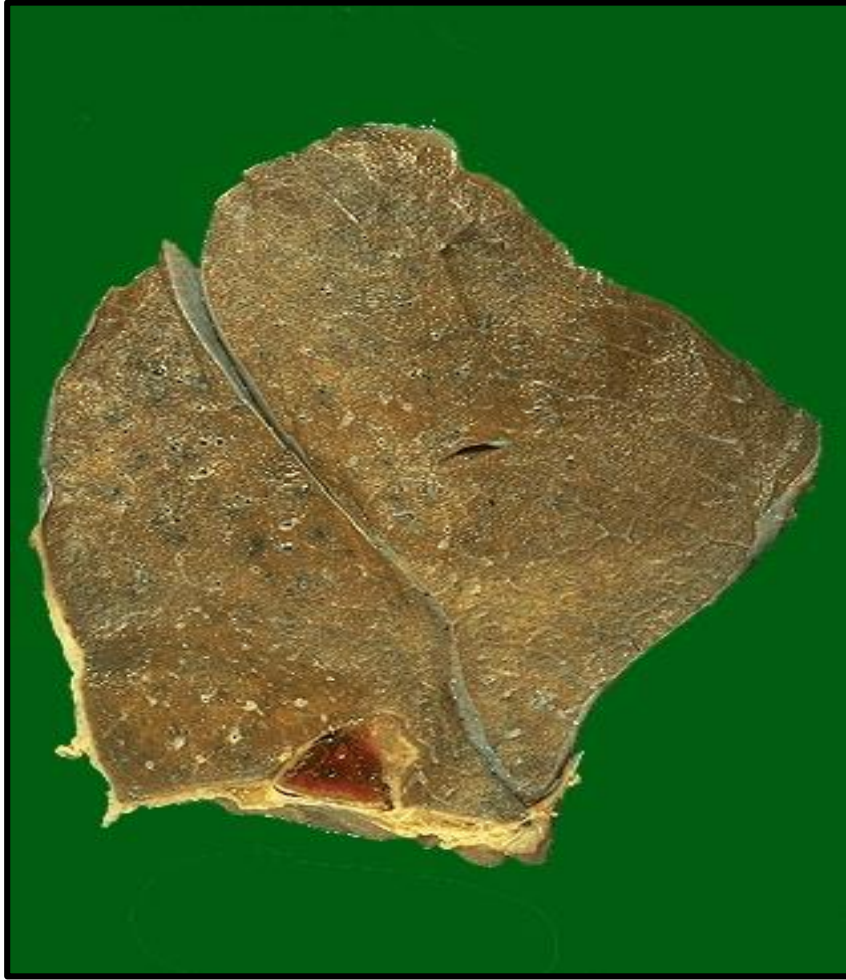
PULMONARY EMBOLUS AND INFARCTION

Thromboembolism in the Lung – Gross



A large pulmonary thromboembolus is seen 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 thrombemboli (blocking a pulmonary artery to a lobule or set of lobules) can produce the lesion seen here -a hemorrhagic pulmonary infarction which is a wedge-shaped and based on the pleura.

Pulmonary embolus and infarction in the Lung

A Longitudinal transection of a lung showing a wedge shaped peripheral hemorrhagic infarction .

A thrombus is seen in a major branch of pulmonary artery (arrow head) .

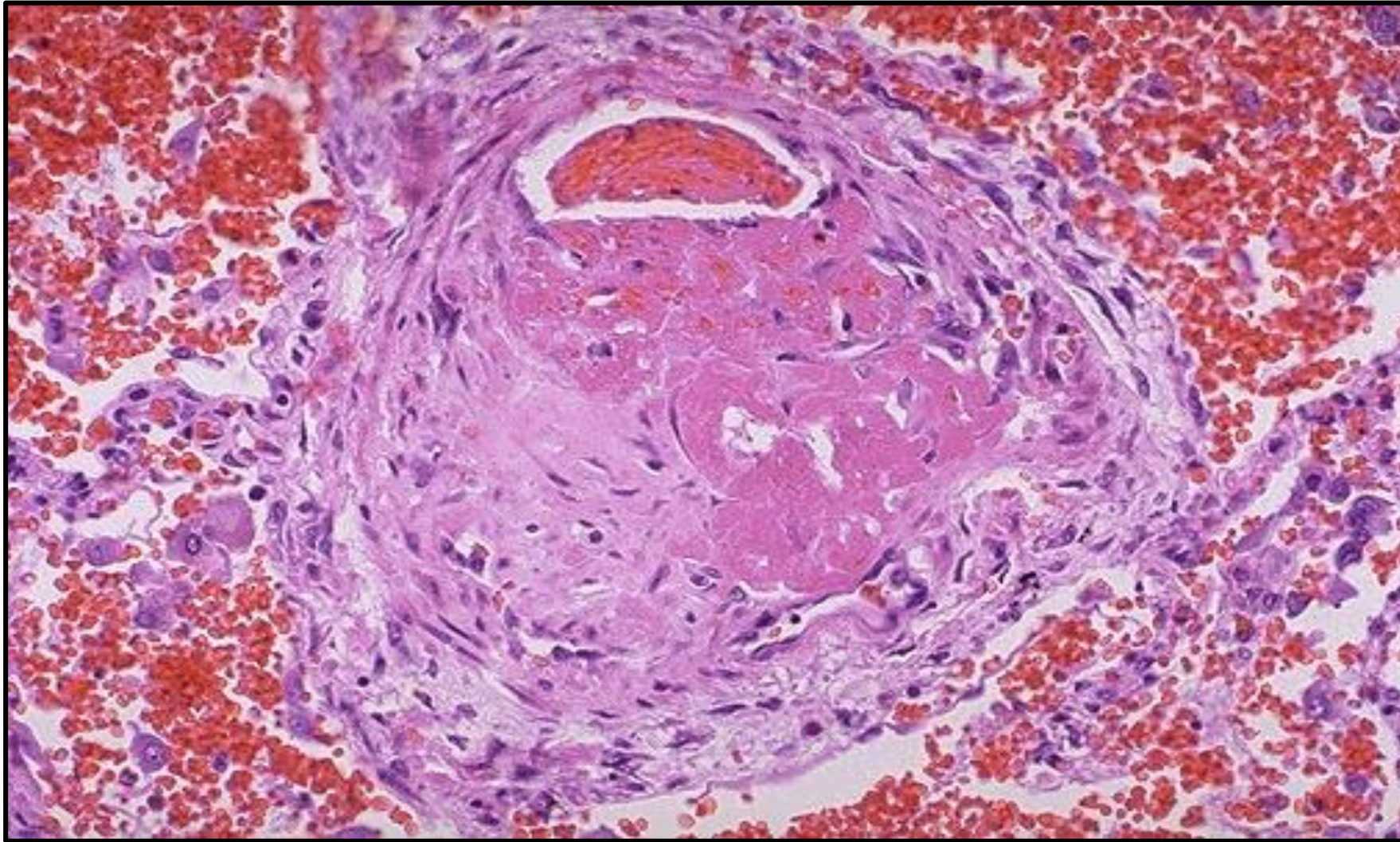


Pulmonary artery thromboembolus - LPF



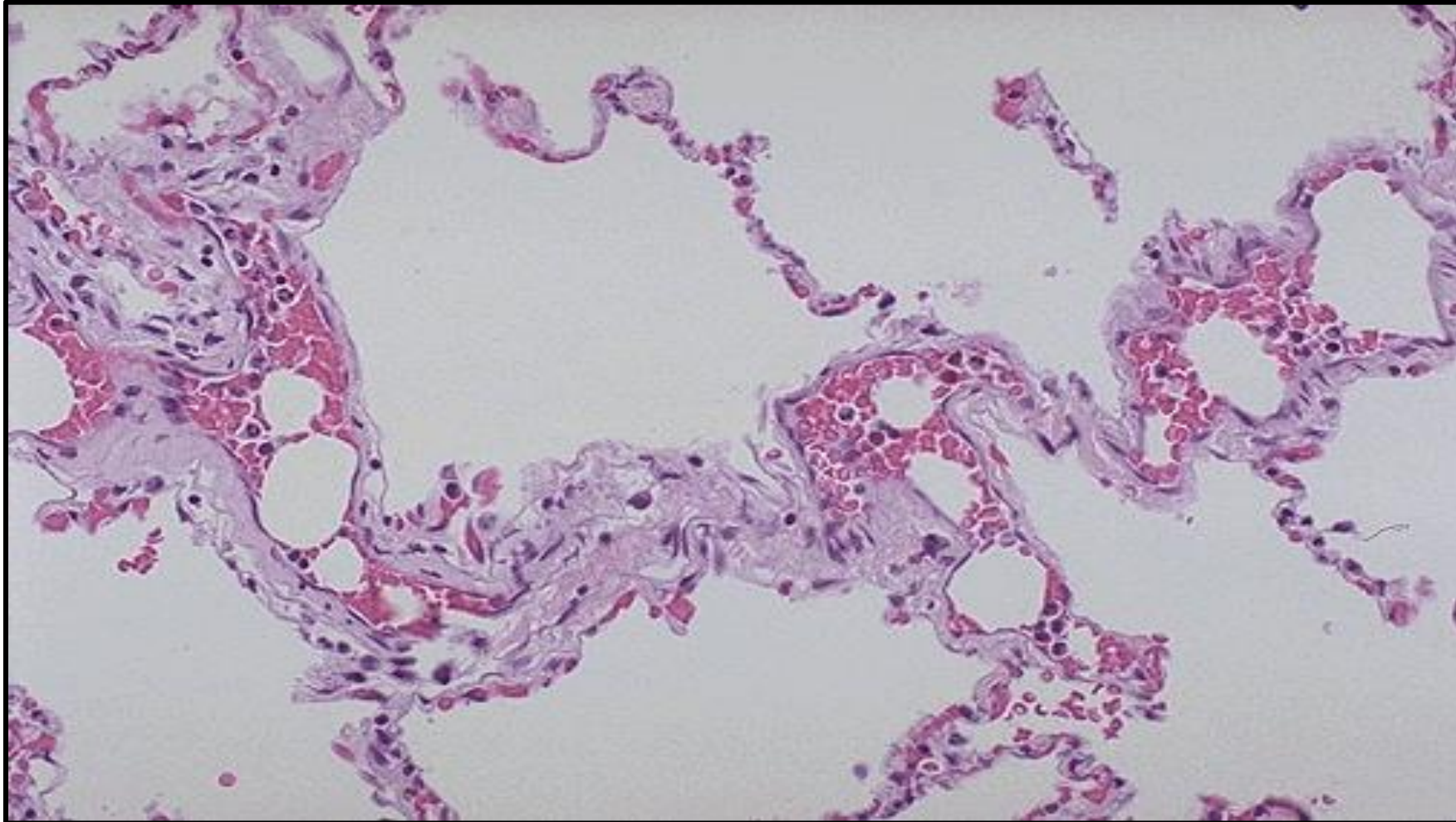
Microscopic appearance of a pulmonary thromboembolus in a large pulmonary artery. There are interdigitating areas of pale pink and red that form the "lines of Zahn" characteristic for a thrombus.

Small pulmonary artery thromboembolus - HPF



A small peripheral pulmonary artery thromboembolus. If these small PE are showered into the pulmonary circulation at once or over a period of time will lead to pulmonary hypertension.

Fat Embolism in the Lung - HPF



The rounded holes that appear in the vascular spaces here in the lung are fat emboli. 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