

Respiratory Block Obstructive Pulmonary Diseases

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Objectives of lecture

- Know that the major obstructive disorders and compare the major clinical and functional differences between them
- Aware that the symptom common to all these disorders is "dyspnea" (difficulty in breathing) but each have their own clinical and anatomical characteristics
- Define **emphysema** and the following forms of emphysema: panacinar emphysema, centriacinar emphysema
- Define **chronic bronchitis**, describe its pathogenesis and the morphologic changes. Describe the mechanism of airway obstruction in a patient with chronic bronchitis
- Define **Bronchiectasis**, its causes, presentation, morphology and significant



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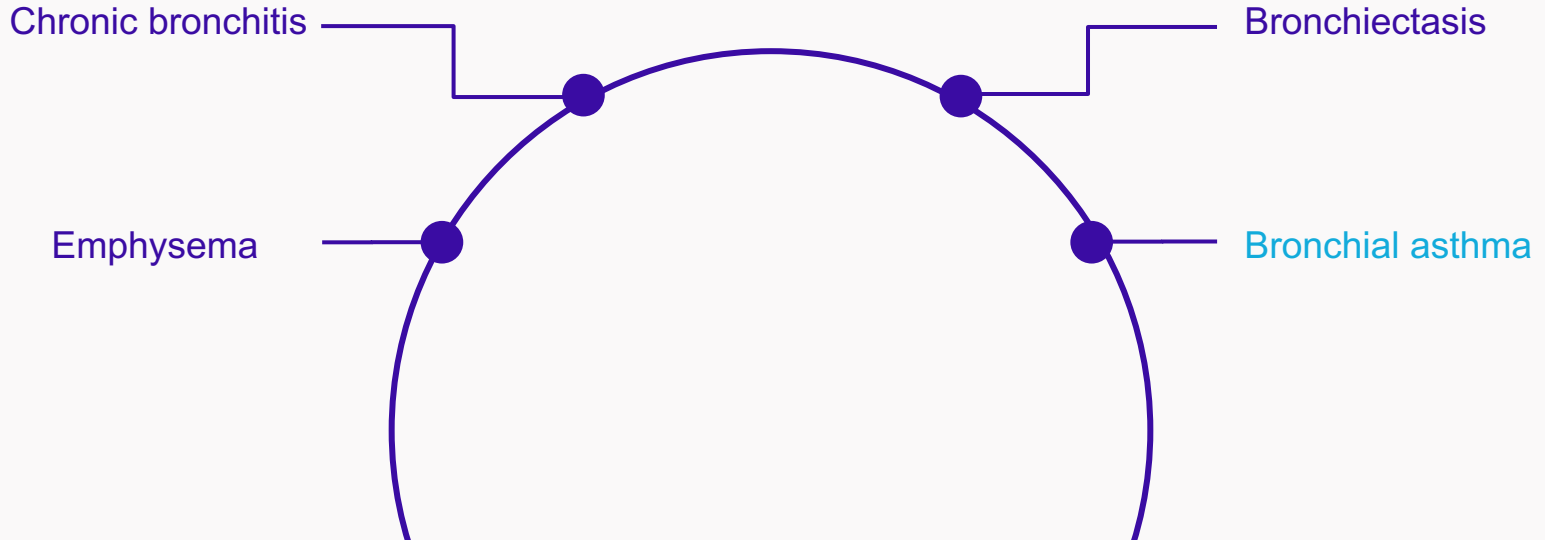
Definition, types, pathogenesis, morphology, clinical picture, complication

04 BRONCHIECTASIS

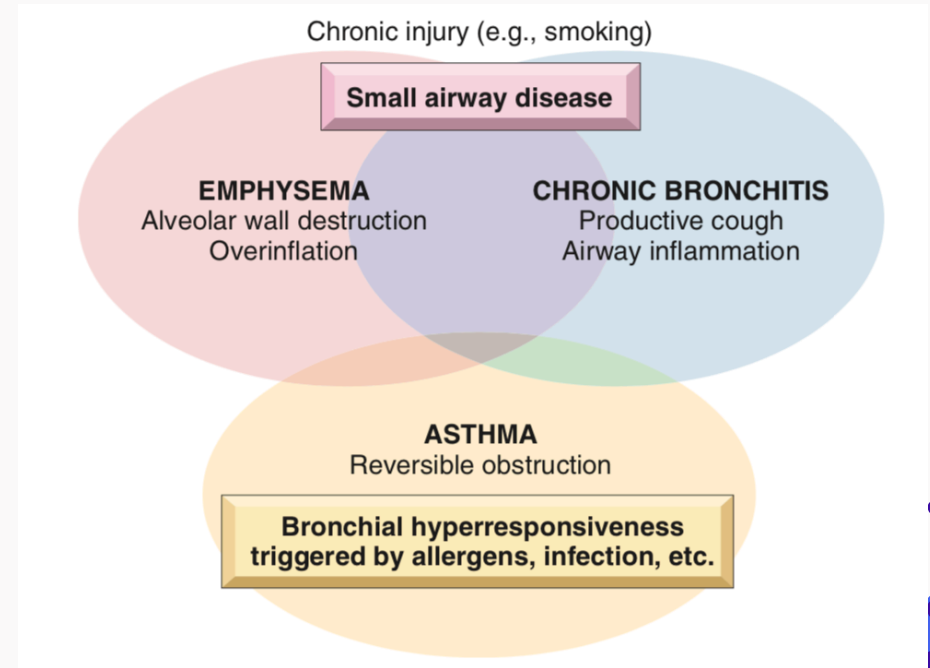
Definition, pathogenesis, morphology, clinical picture, complication

DEFINITION

Obstructive (airway) disease is characterized by an increase in resistance to air flow caused by partial or complete obstruction at any level. Each disease have distinct clinical and anatomic), but overlaps between emphysema, chronic bronchitis, and asthma are common.



- The anatomic distribution of these disorders also is somewhat different, as chronic bronchitis initially involves the large airways, whereas emphysema affects the acinus
- Emphysema and chronic bronchitis often are grouped together under the rubric of *chronic obstructive pulmonary disease (COPD)*



REMEMBER

- Chronic obstruction of lung airflow that interferes with normal breathing and not fully reversible
- Traditionally, regarded as a combination of smoking-related lung disease: emphysema; chronic bronchitis
- Pulmonary function tests:
 - **Reduced FEV1**
 - **Normal or near-normal FVC**
 - **FEV/FVC ratio is reduced**

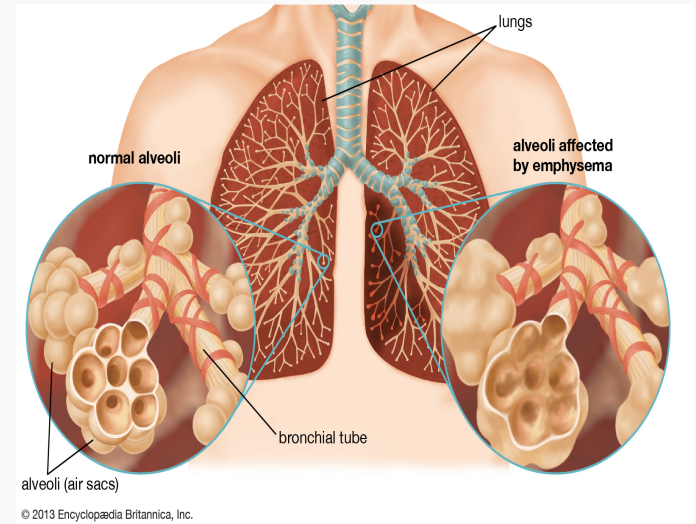


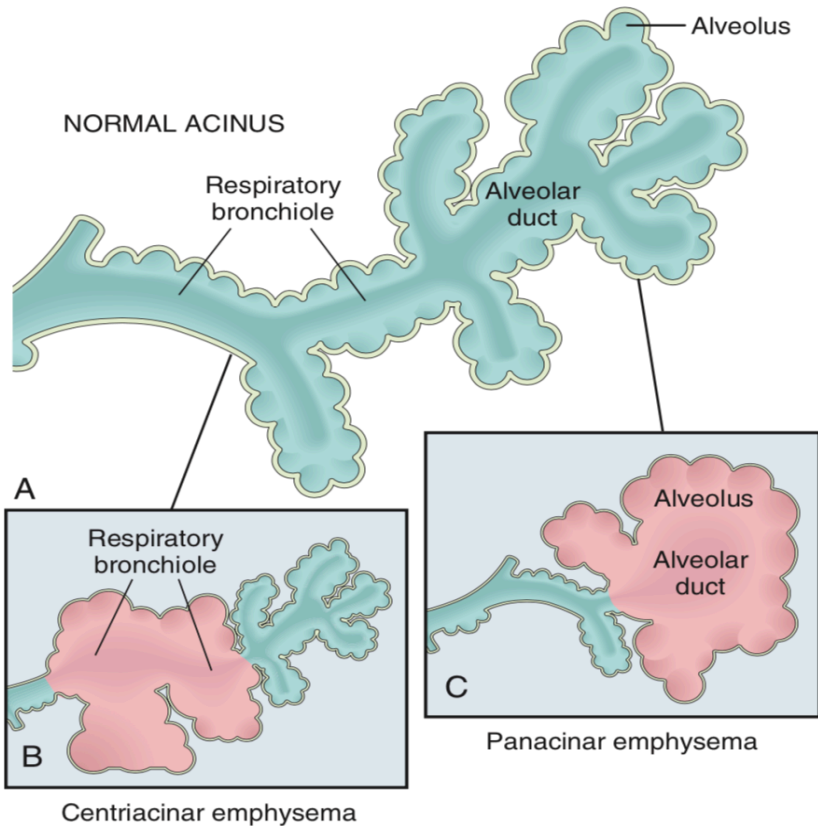
Emphysema



Definition and types

- Is abnormal permanent enlargement of the airspaces distal to the terminal bronchioles accompanied by destruction of their walls, without obvious fibrosis
- There are four major types of emphysema:
 1. Centriacinar
 2. Panacinar
 3. Distal acinar/paraseptal
 4. Irregular
- Only the first two types cause significant airway obstruction

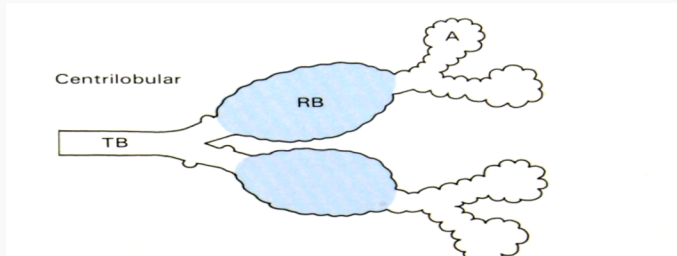




- (A) Diagram of normal structure of the acinus, the fundamental unit of the lung
- (B) Centriacinar emphysema with dilation that initially affects the respiratory bronchioles
- (C) Panacinar emphysema with initial distention of all the peripheral structures (i.e., the alveolus and alveolar duct)

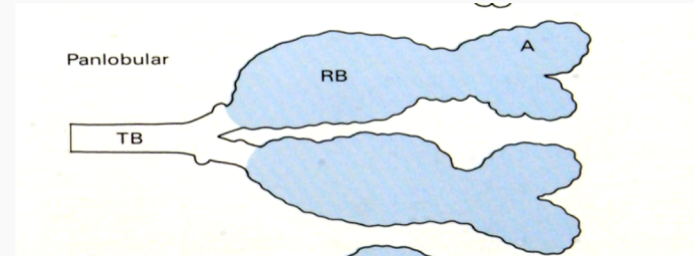
Centriacinar Emphysema

- Abnormal dilatation of respiratory bronchioles and alveolar ducts with normal alveolar sacs
- More common and severe in the upper lobes
- Most common in cigarette smokers, often in association with chronic bronchitis
- About 20 times more common than panacinar disease



Panacinar Emphysema

- Abnormal dilatation of the whole acinus
- More commonly in the lower lung zones
- **Associated with α 1-anti-trypsin deficiency**



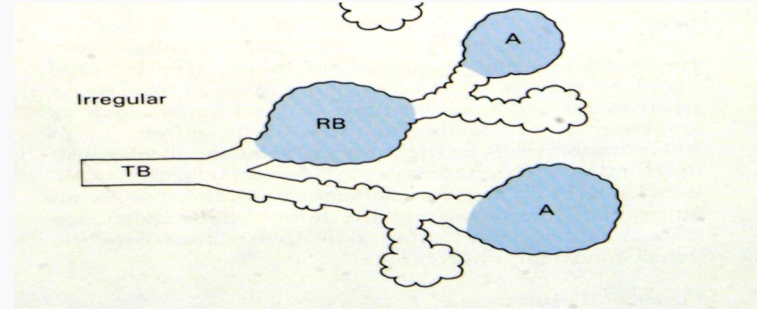
Distal acinar Emphysema

- Proximal portion of the acinus is normal, but the distal part is primarily involved
- Occurs adjacent to areas of fibrosis, scarring, or atelectasis
- More severe in the upper half of the lungs
- Spontaneous pneumothorax in young adults

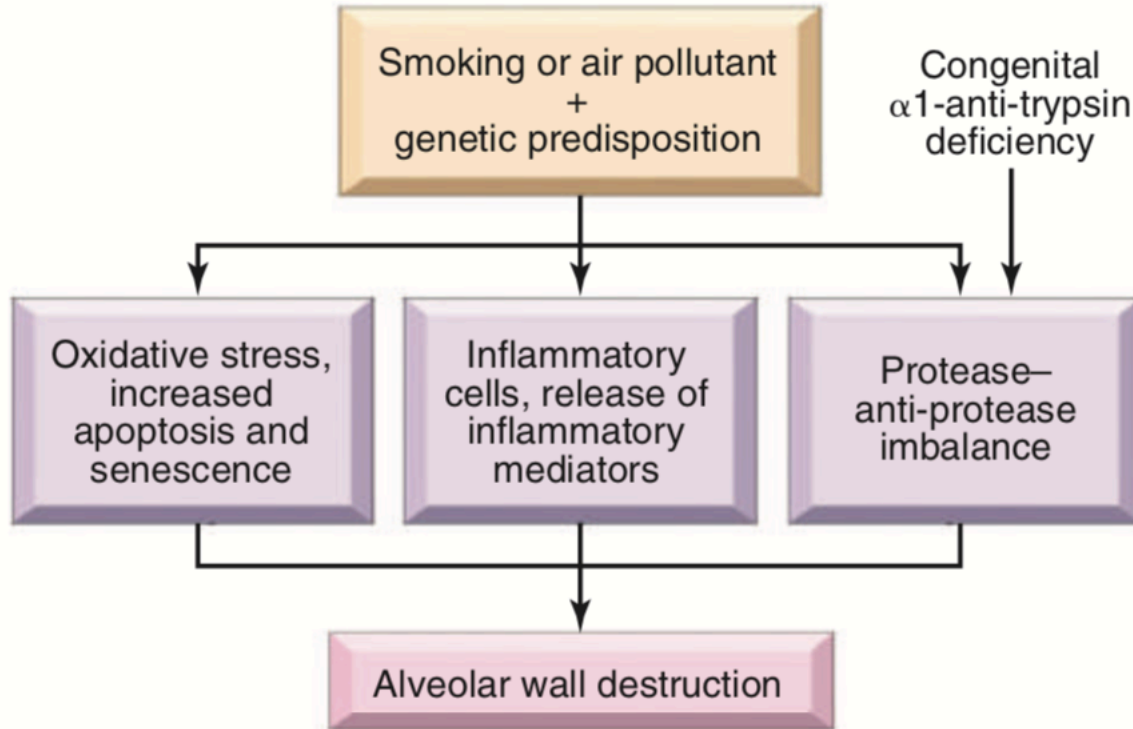


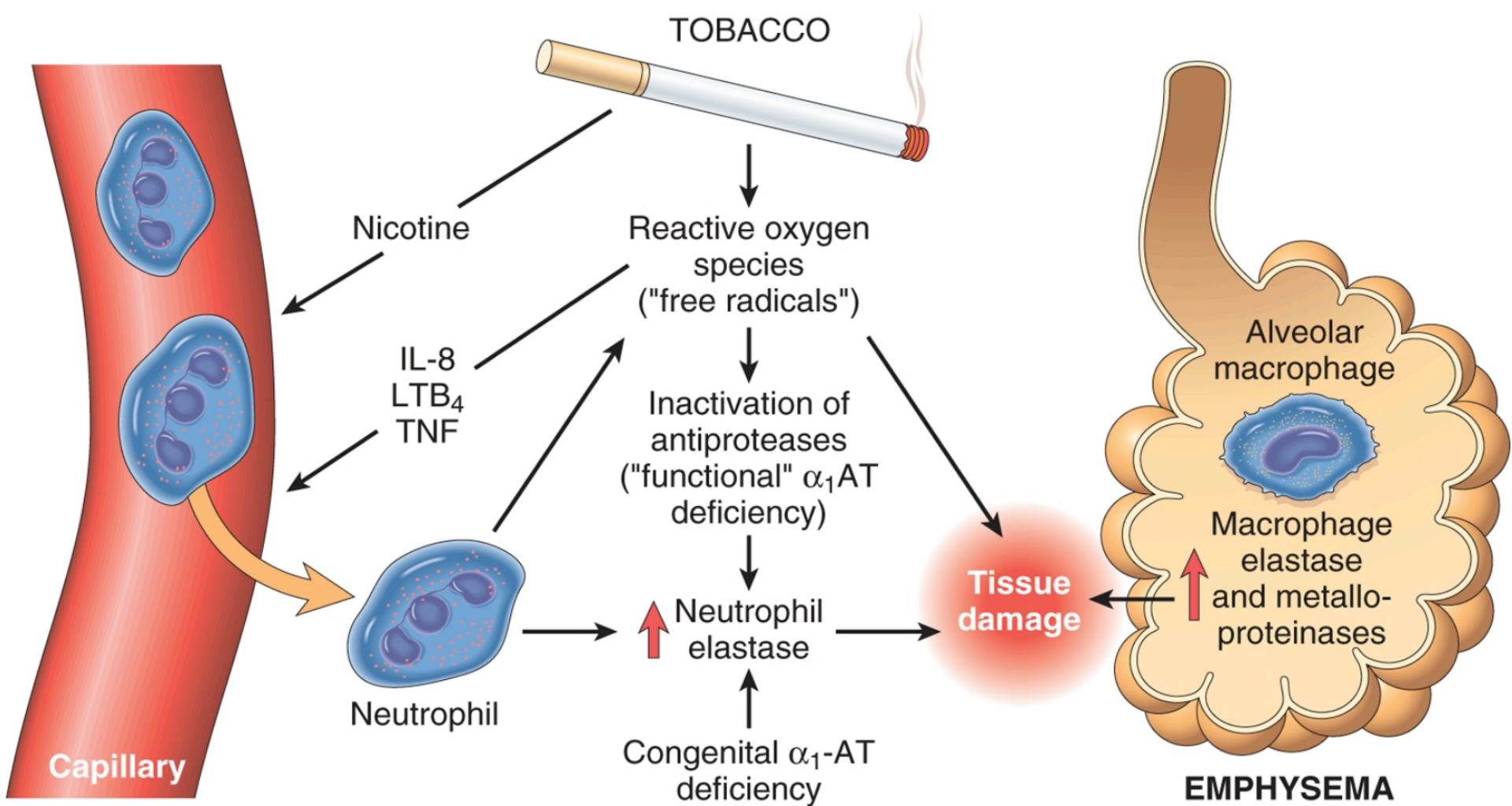
Panacinar Emphysema

- The acinus is irregularly involved,
- Almost associated
- with scarring



PATHOGENESIS

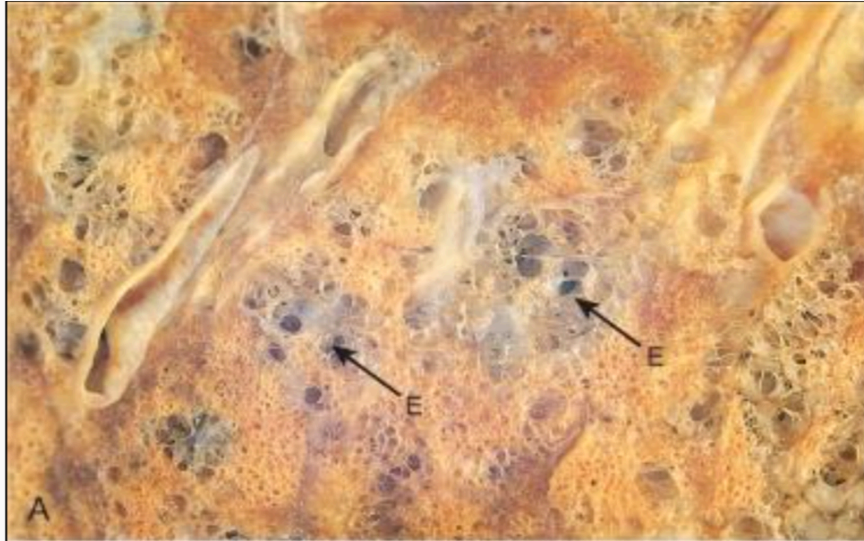




MORPHOLOGY

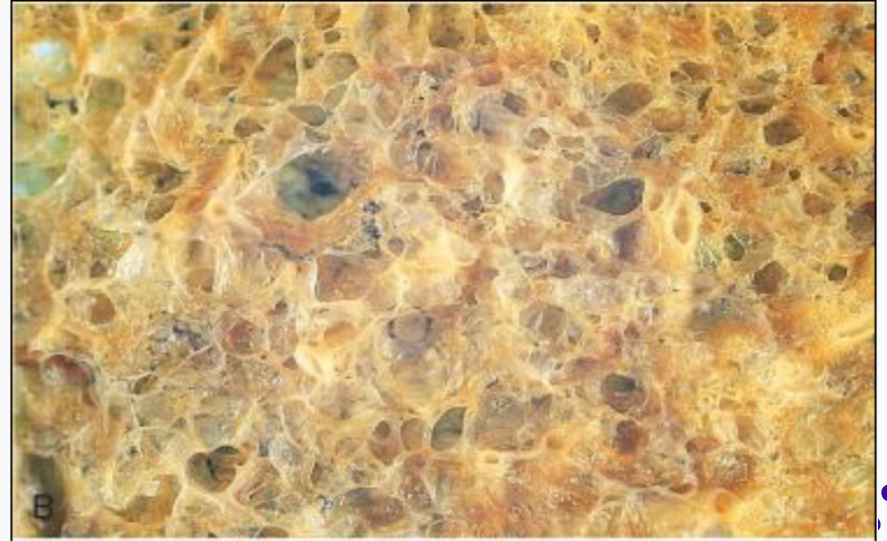


Gross morphology



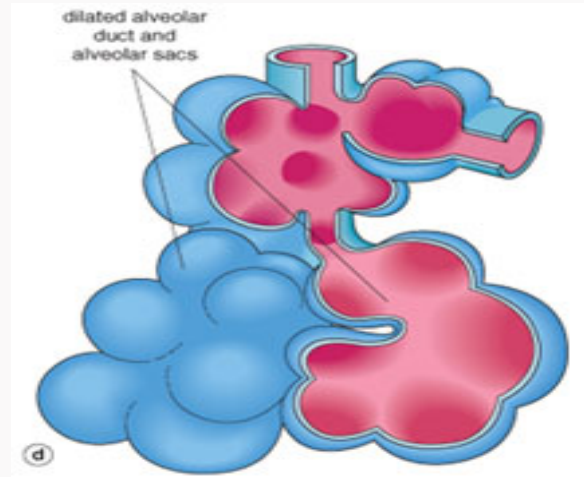
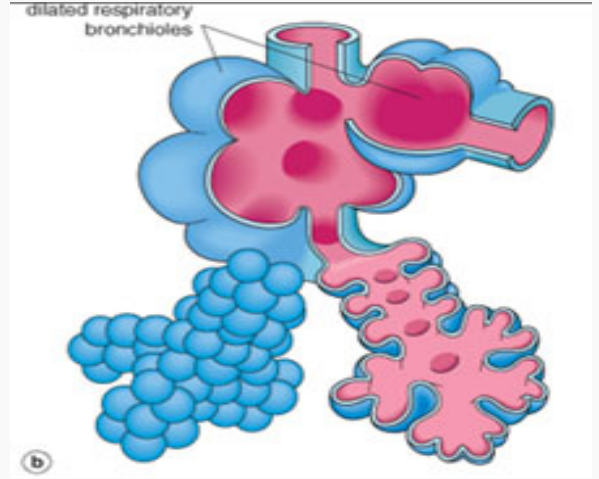
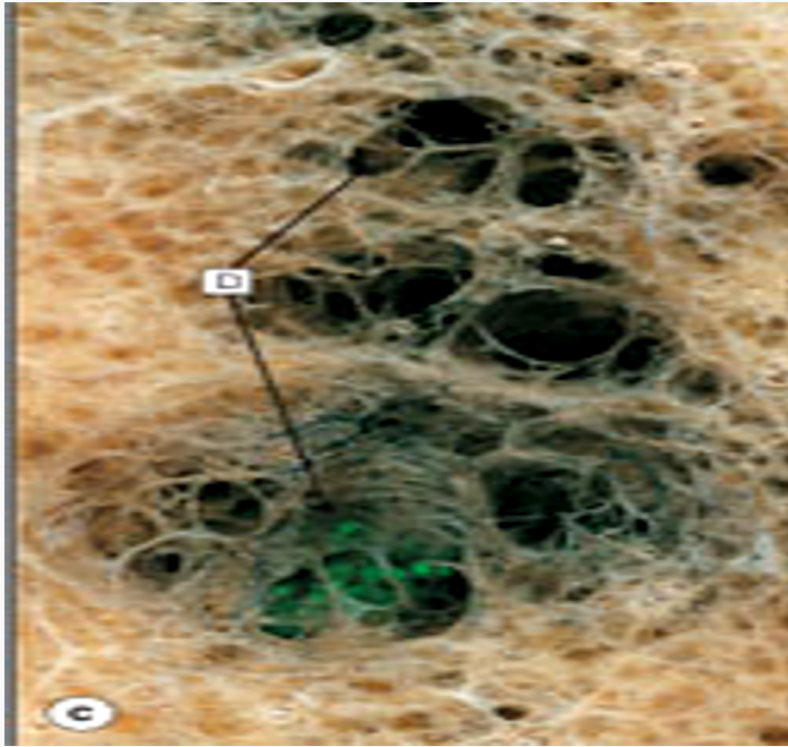
Centriacinar

Some parts are normal And some parts are dilated



Panacinar

pale, voluminous lungs



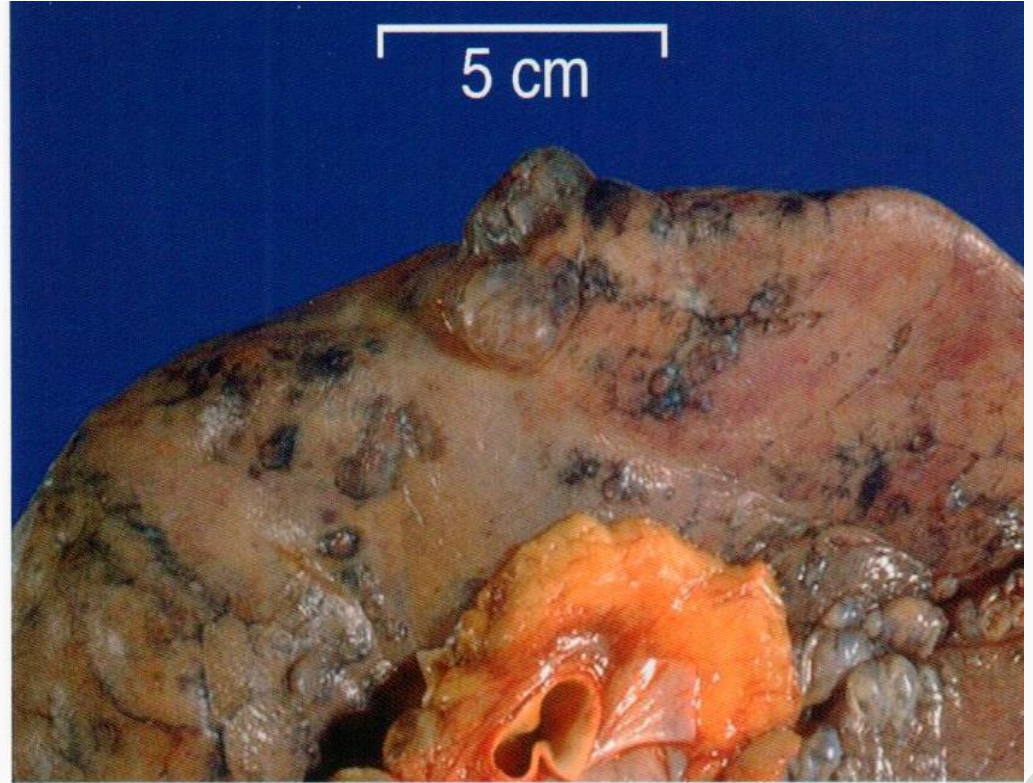
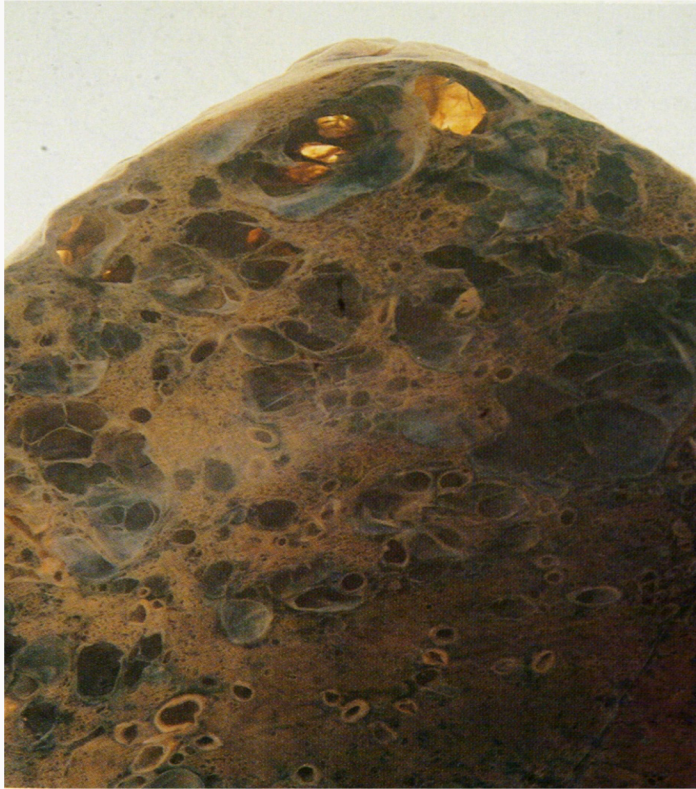


Bullous emphysema
with large subpleural
bullae (upper left)



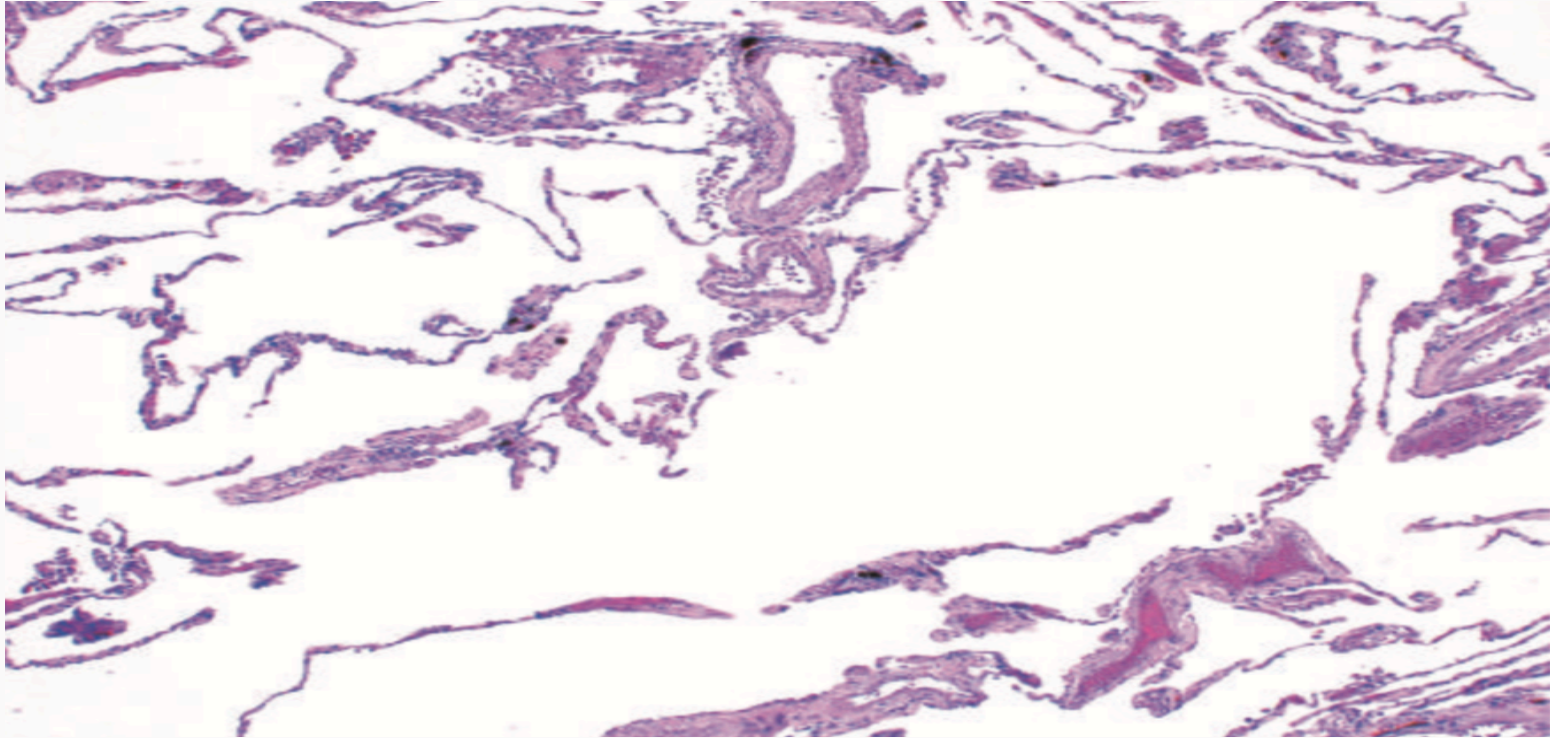
Large apical blebs or bullae are more
characteristic of irregular emphysema
secondary to scarring and of distal
acinar emphysema





Distal acinar /paraseptal:
forming multiple cyst-like structures with spontaneous
pneumothorax

Microscopic examination



Thinning, dilated and destroyed alveolar walls (septa) with coalescence (fusion) of air spaces without fibrosis

Clinical Presentation

Dyspnea usually is the first symptom; it begins insidiously but is steadily progressive

Cough and wheezing In patients with underlying chronic bronchitis or chronic asthmatic bronchitis

Weight loss is common and may be severe enough to suggest an occult malignant tumor



Clinical presentation



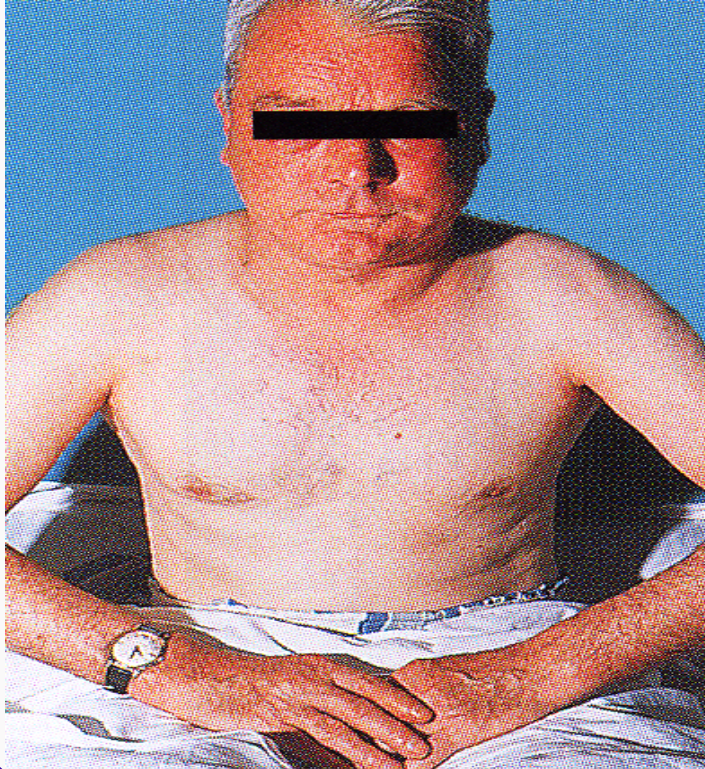
Barrel-shaped chest in a patient with emphysema

As a result, from:

- ✓ Air-trapping with inflammatory changes
- ✓ Hypersecretion of viscid contraction in the small airways

Note the associated indrawing of the intercostal muscles. Similar changes are seen in patients with chronic bronchitis and asthma

Clinical presentation

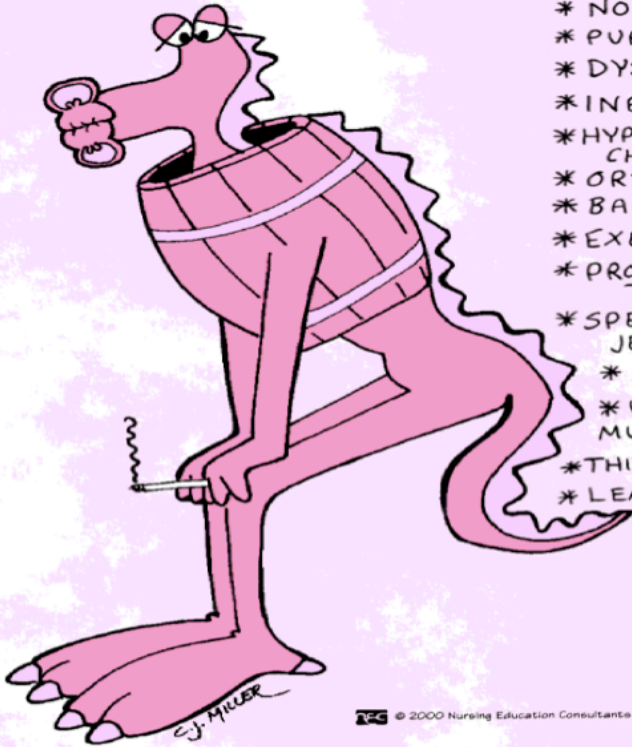


Fish-mouth breathing

- Pursed lip expiration is a common maneuver adopted by patients with severe chronic obstructive pulmonary disease including emphysema.
- The patient starts to breathe out closed or nearly closed lips to keep the intrabronchial pressure high and prevent collapse of the bronchial wall and expiratory obstruction. Later in expiration the lips are blown forwards and open, often with a grunt

PULMONARY EMPHYSEMA "PINK PUFFER"

- * ↑ CO₂ RETENTION (PINK)
- * NO CYANOSIS
- * PURSE LIP BREATHING
- * DYSPNEA
- * INEFFECTIVE COUGH
- * HYPERRESONANCE ON CHEST PERCUSSION
- * ORTHOPNEIC
- * BARREL CHEST
- * EXERTIONAL DYSPNEA
- * PROLONGED EXPIRATORY TIME
- * SPEAKS IN SHORT JERKY SENTENCES
- * ANXIOUS
- * USE OF ACCESSORY MUSCLES TO BREATHE
- * THIN APPEARANCE
- * LEADS TO RIGHT SIDED ♥ FAILURE

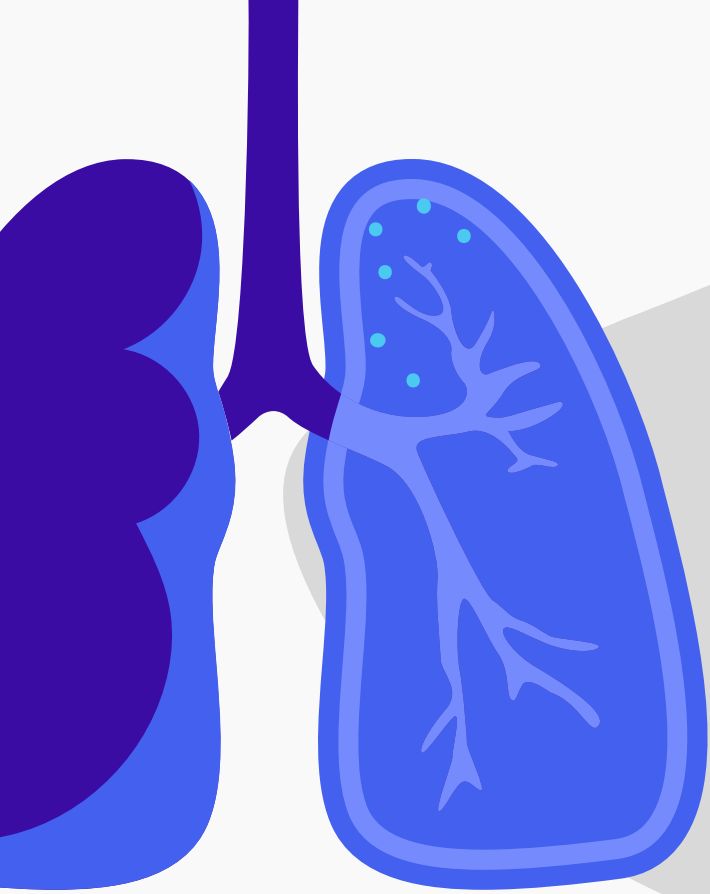


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Pink Puffer Emphysema



Because of prominent dyspnea and adequate oxygenation of hemoglobin

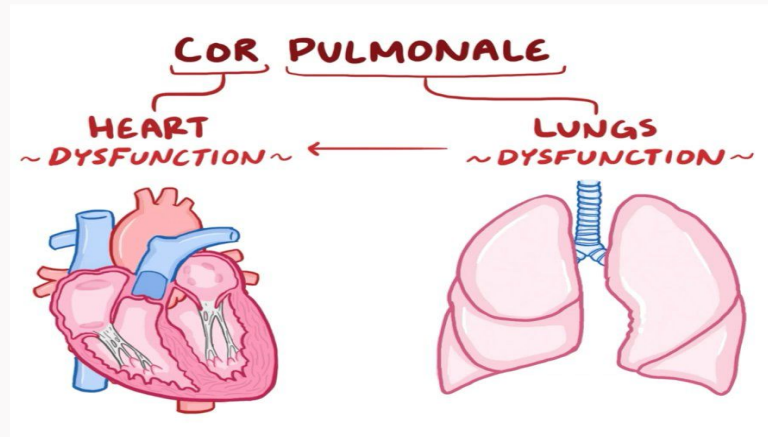


Pulmonary function test

- Reduced FEV1
- Normal or near-normal FVC
- FEV1/FVC ratio is reduced

Complications

- Pneumothorax
- Death from emphysema is related to:
 1. Pulmonary failure with respiratory acidosis, hypoxia and coma
 2. Secondary pulmonary hypertension (arising from both hypoxia-induced pulmonary vascular spasm and loss of pulmonary capillary surface area from alveolar destruction)
 3. Right-sided heart failure (Cor pulmonale)



Summery

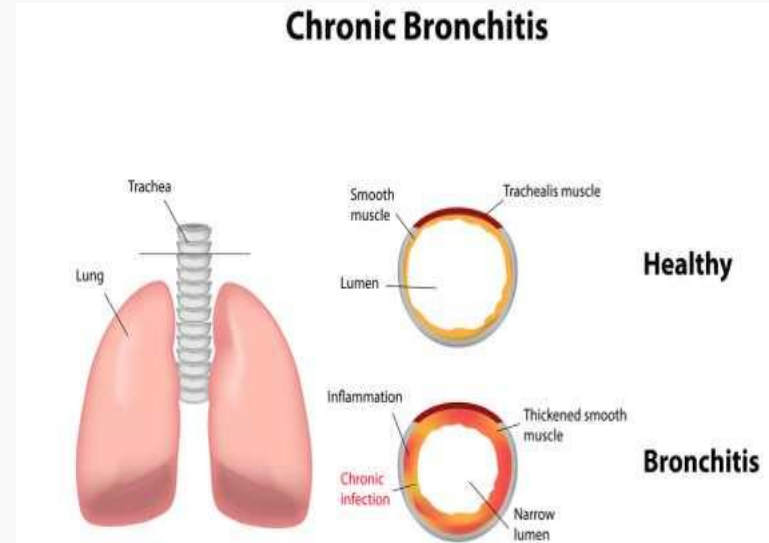
1. Emphysema is a chronic obstructive airway disease characterized by enlargement of air spaces distal to terminal bronchioles
2. Subtypes include centriacinar (most common: smoking- related), panacinar (seen in α_1 -anti-trypsin deficiency), distal acinar, and irregular
3. Smoking and inhaled pollutants cause ongoing accumulation of inflammatory cells, which are the source of proteases such as elastases that irreversibly damage alveolar walls
4. Patients with uncomplicated emphysema present with increased chest volumes, dyspnea, and relatively normal blood oxygenation at rest (“pink puffers”)
5. Most patients with emphysema also have signs and symptoms of concurrent chronic bronchitis, since cigarette smoking is a risk factor for both

Chronic Bronchitis



Definition

- Is diagnosed on clinical grounds: it is defined by the presence of a persistent productive cough for at least 3 consecutive months in at least 2 consecutive years
- Common among cigarette smokers ; air pollutants also contribute



Pathogenesis

Cigarette smoking , air pollutants and Environmental irritants induce:

1. Hypertrophy of mucous secreting cells in trachea and bronchi Increase goblet cells in bronchiole
2. Chronic inflammation ; macrophages, neutrophils
3. Secretion of IL-13 by T lymphocytes
4. Chronic inflammation with increased mucous formation leads to bronchiolar obstruction along with fibrosis
5. As result; mild or significant air flow obstruction, which almost always complicated by emphysema

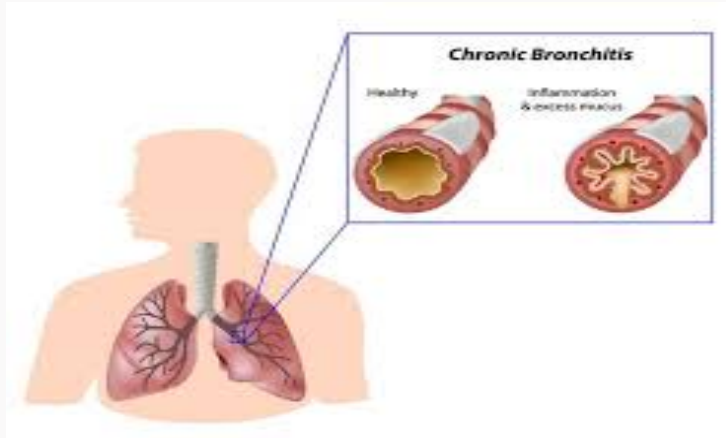


MORPHOLOGY



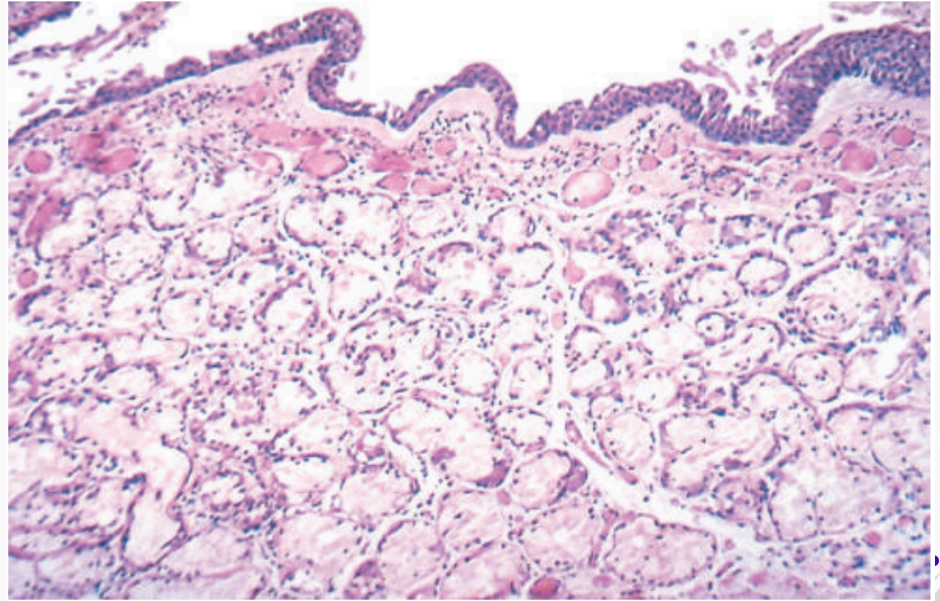
Gross Morphology

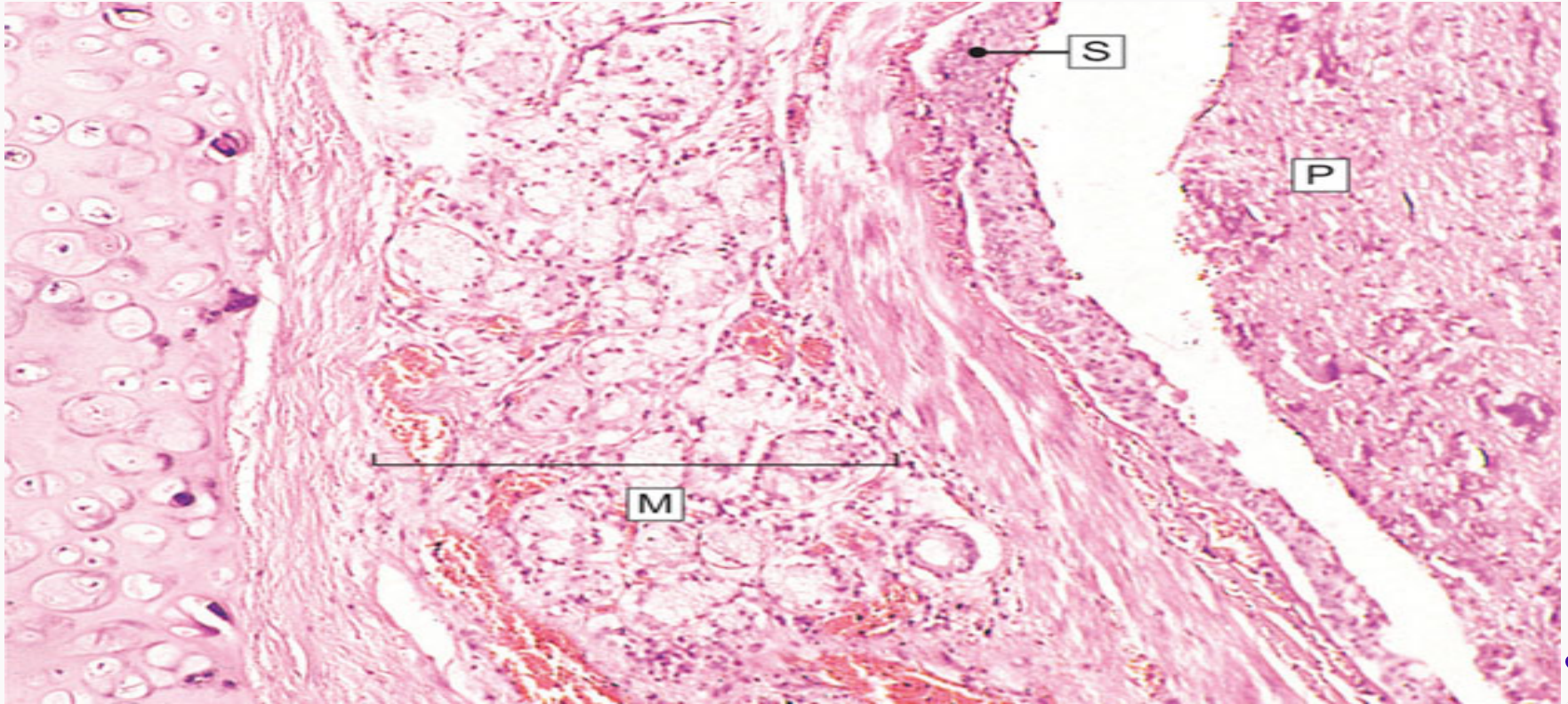
- Bronchial wall shows; Redness, swelling, covered by mucopurulent Secretion
- Thickening of the wall Mild narrowing of bronchial lumen



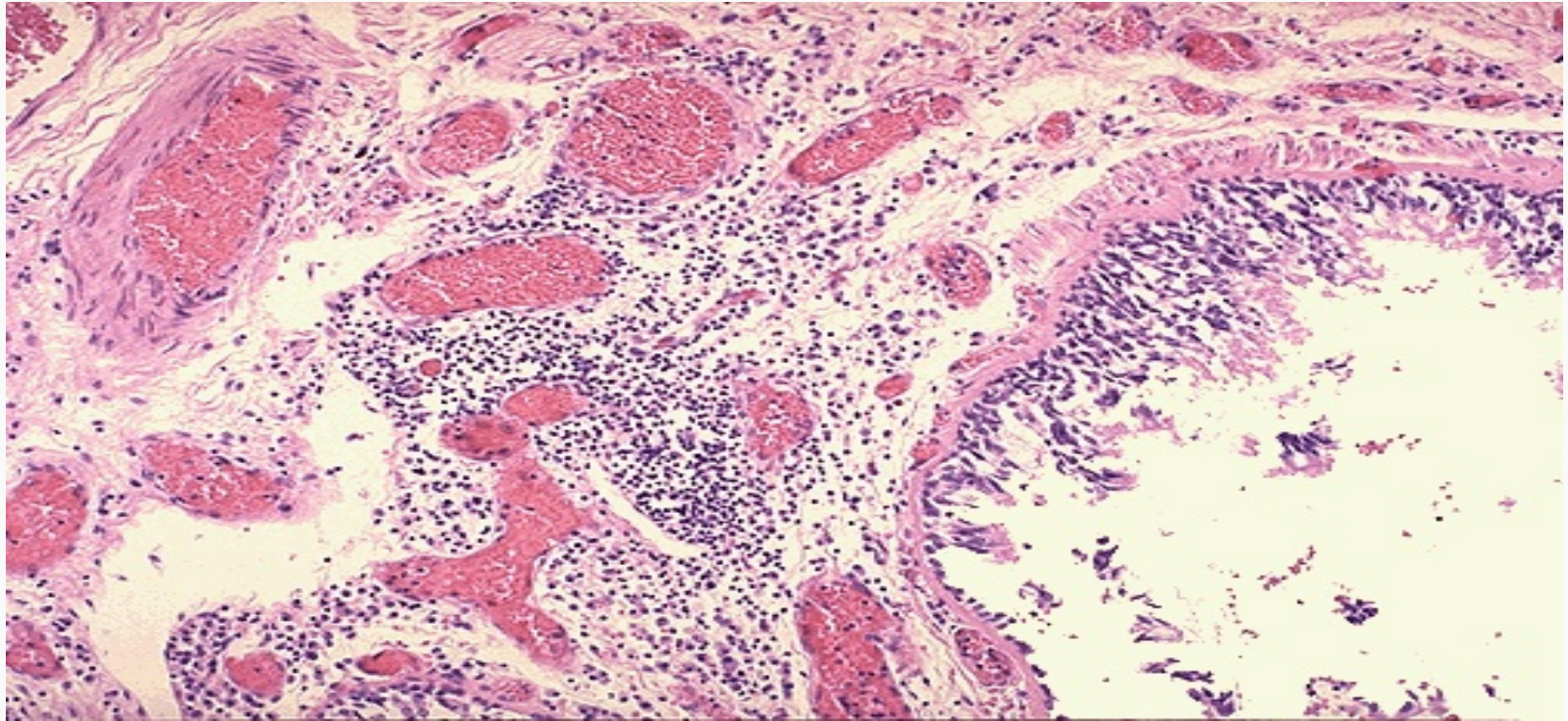
Microscopic morphology

- Histologic examination
 1. Chronic inflammation
 2. Enlargement of mucus secreting glands
 3. Goblet cell metaplasia
 4. Bronchiolar wall fibrosis





The main abnormality is secretion of abnormal amounts of mucus, causing plugging of the airway lumen



Chronic inflammation in the bronchial wall



Clinical Presentation & Complications

Cough and sputum production persist indefinitely without ventilatory dysfunction

Outflow obstruction marked by hypercapnia, hypoxemia, and cyanosis

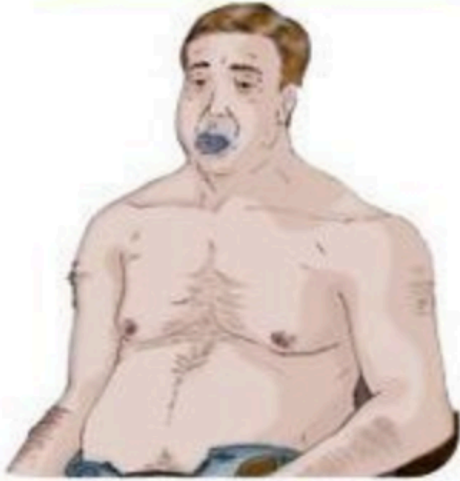
Patients with chronic bronchitis and COPD have frequent exacerbations, more rapid disease progression, and poorer outcomes than those with emphysema alone

Death due to further impairment of respiratory functions after superimposed acute bacterial infections



Blue Bloater

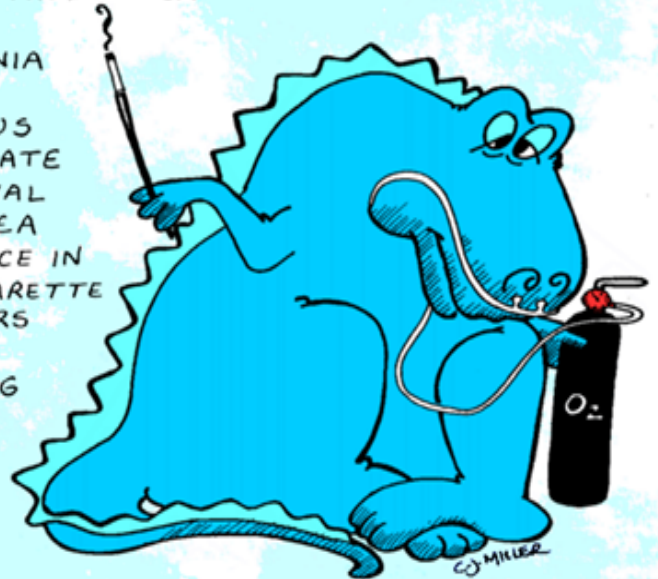
Chronic Bronchitis



Patient with emphysema who also has pronounced chronic bronchitis and a history of recurrent infections. Dyspnea usually is less prominent, and in the absence of increased respiratory drive the patient retains carbon dioxide, becoming hypoxic and often cyanotic

CHRONIC BRONCHITIS "BLUE BLOATER"

- * COLOR DUSKY TO CYANOTIC
- * RECURRENT COUGH &
↑ SPUTUM PRODUCTION
- * HYPOXIA
- * HYPERCAPNIA
- * ACIDOSIS
- * EDEMATOUS
- * ↑ RESP RATE
- * EXERTIONAL
DYSPNEA
- * ↑ INCIDENCE IN
HEAVY CIGARETTE
SMOKERS
- * DIGITAL
CLUBBING



- * CARDIAC ENLARGEMENT
- * USE OF ACCESSORY MUSCLES TO BREATHE
- * COR PULMONALE

Summery

1.Chronic bronchitis is defined as persistent productive cough for at least 3 consecutive months in at least 2 consecutive years

1.Cigarette smoking is the most important underlying risk factor; air pollutants also contribute

2. Chronic airway obstruction largely results from small airway disease (chronic bronchiolitis) and coexistent emphysema

3. Histologic examination demonstrates enlargement of mucus- secreting glands, goblet cell metaplasia, and bronchiolar wall fibrosis



	Predominant Bronchitis	Predominant Emphysema
Age (yr)	40–45	50–75
Dyspnea	Mild; late	Severe; early
Cough	Early; copious sputum	Late; scanty sputum
Infections	Common	Occasional
Respiratory insufficiency	Repeated	Terminal
Cor pulmonale	Common	Rare; terminal
Airway resistance	Increased	Normal or slightly increased
Elastic recoil	Normal	Low
Chest radiograph	Prominent vessels; large heart	Hyperinflation; small heart
Appearance	<i>Blue bloater</i>	<i>Pink puffer</i>

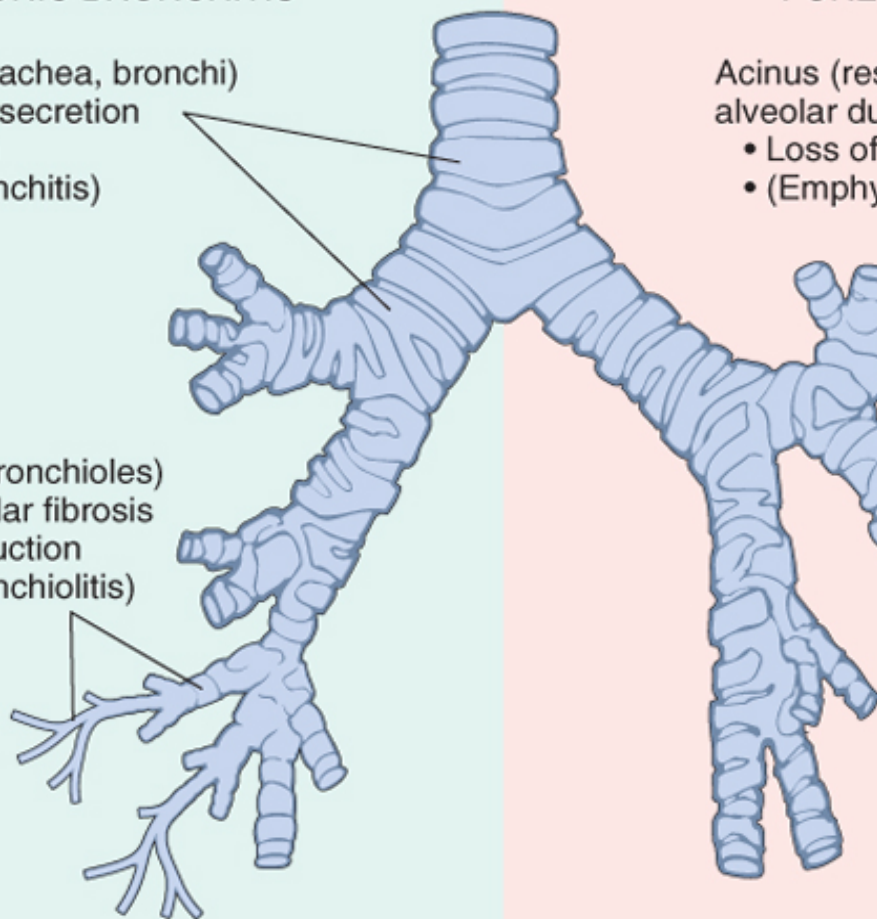
PURE CHRONIC BRONCHITIS

Large airways (trachea, bronchi)

- Mucus hypersecretion
- Inflammation
- (Chronic bronchitis)

Small airways (bronchioles)

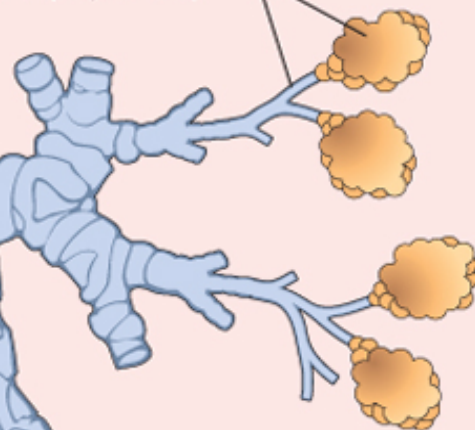
- Peribronchiolar fibrosis
- Airway obstruction
- (Chronic bronchiolitis)



PURE EMPHYSEMA

Acinus (respiratory bronchiole, alveolar ducts, and alveoli)

- Loss of elastic recoil
- (Emphysema)

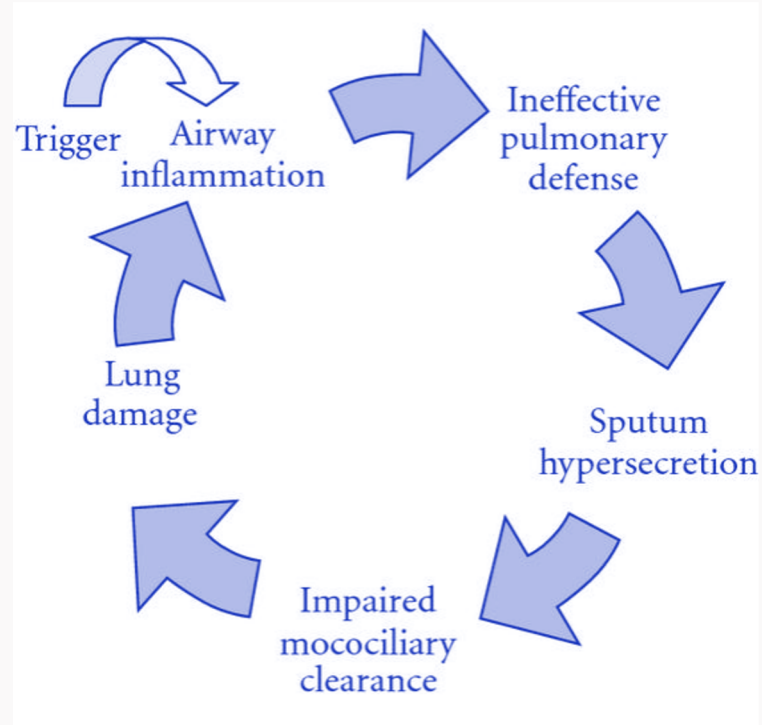


Bronchiectasis



Definition

- Permanent dilation of bronchi and bronchioles caused by destruction of smooth muscle and the supporting elastic tissue; it typically results from or is associated with chronic necrotizing infections
- Not a primary disorder, as it always occurs secondary to persistent infection or obstruction caused by a variety of conditions



Causes



Congenital or hereditary conditions

cystic fibrosis,
intra-lobar
sequestration



Postinfectious conditions

bacteria, viruses
and fungi



Bronchial obstruction

Tumors, foreign
bodies



Other conditions

RA, SLE

Pathogenesis

1. Obstruction & infections are the major cause.

After obstruction→ air is resorbed from the airways distal to the obstruction→ atelectasis.

Accumulation Of intraluminal secretions→ dilatation of the airways AND Bronchial wall inflammation

2. If the obstruction persists during the period of growth

These changes become irreversible

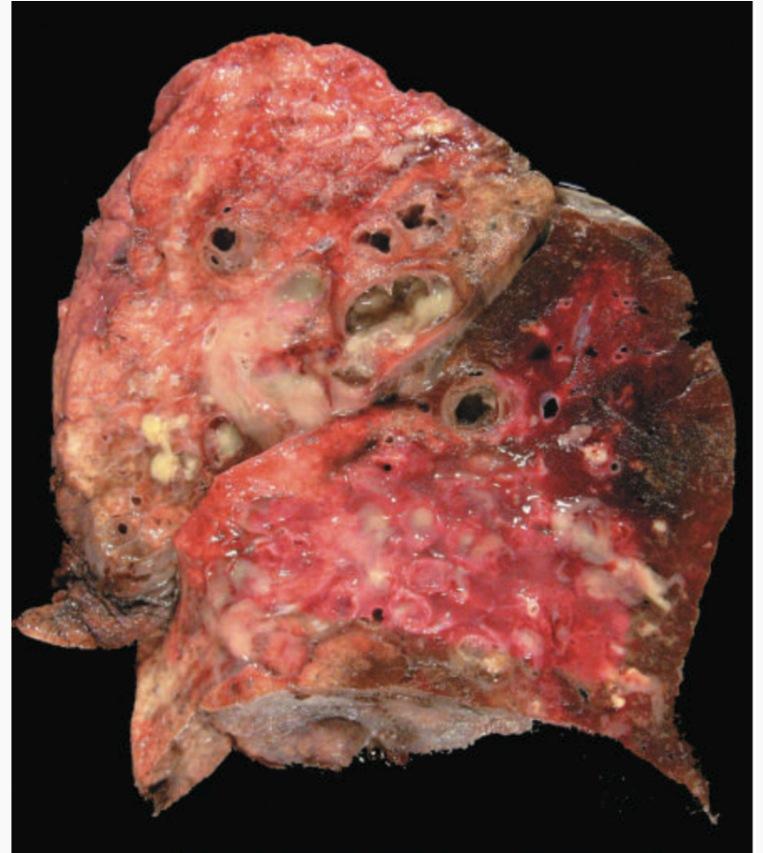
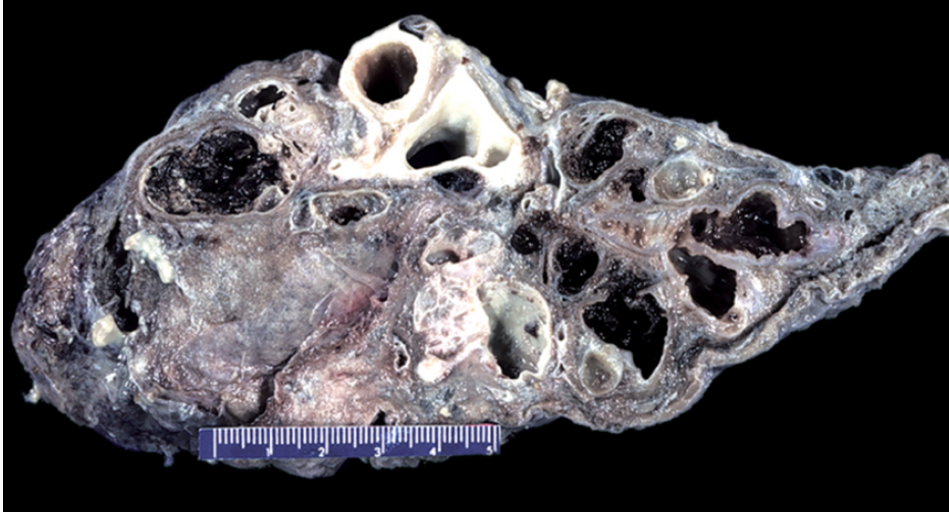
3. When superadded suppurative necrotizing type of infection

Extensive bronchial and bronchiolar wall damage (destruction with loss of elastic and smooth muscle fibers)

MORPHOLOGY



Gross examination



- Usually, lower lobes or distal
- Dilatation about Four times the normal diameter
- Mucosa: congestion, ulcers

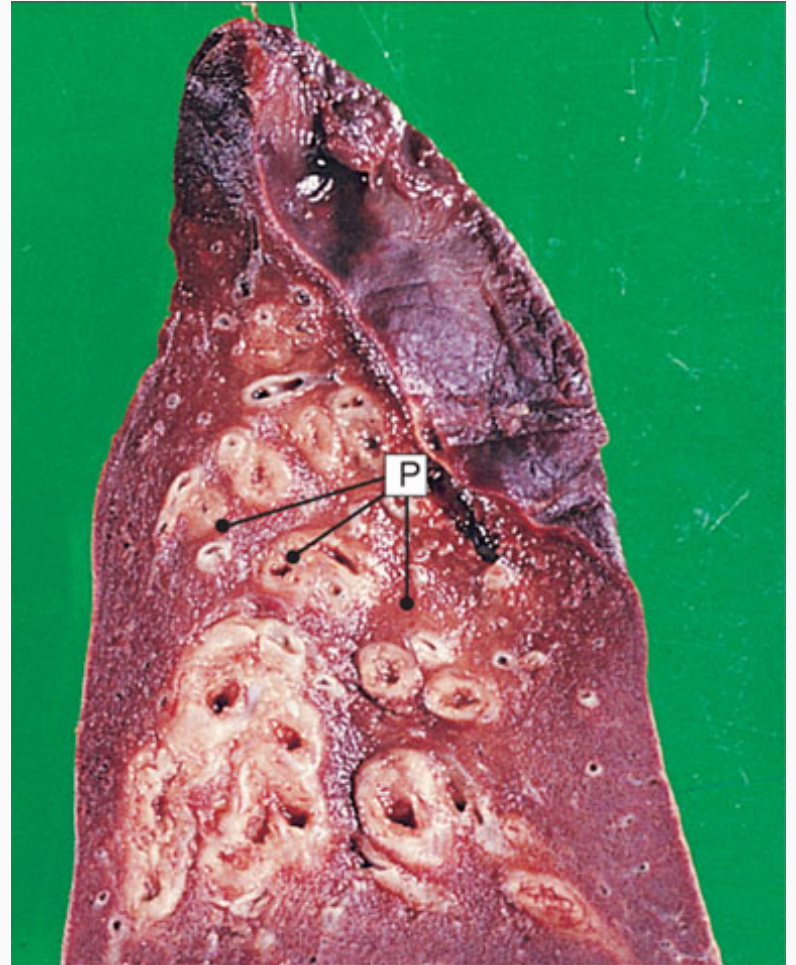
Gross examination

- **Dilatation of bronchi with destruction of bronchial walls**



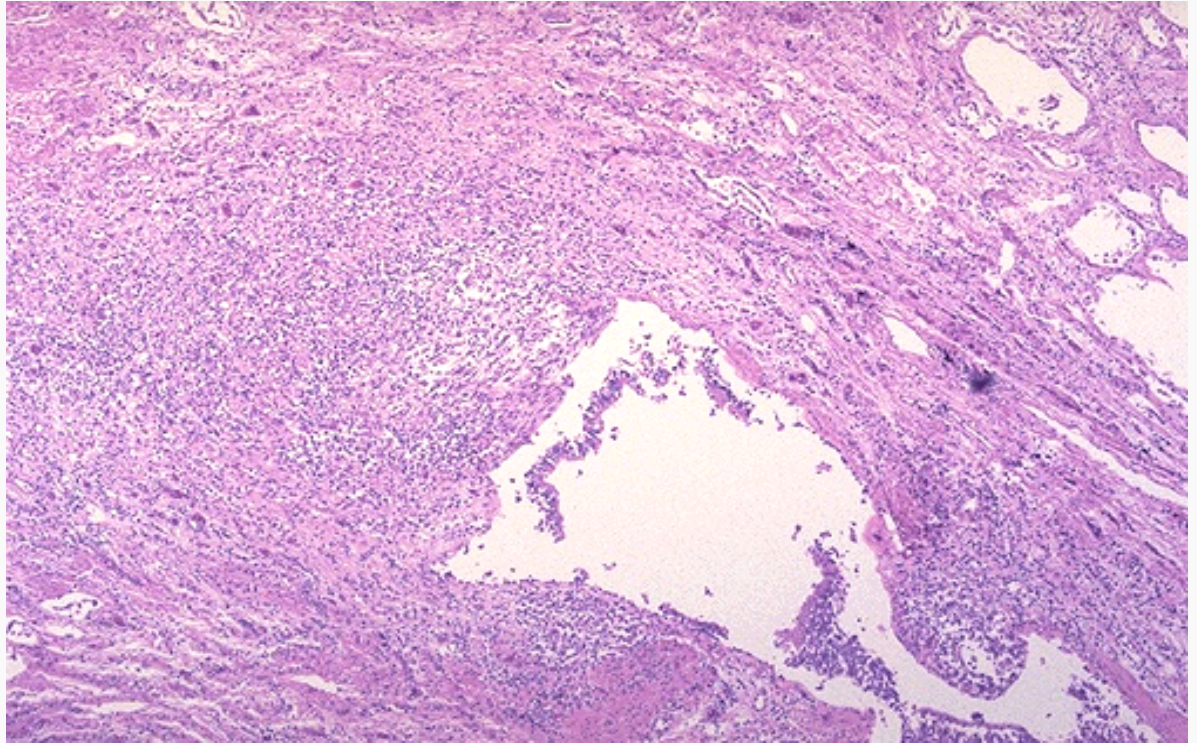
Gross examination

- A lower lobe of lung surgically resected for bronchiectasis



Microscopic examination

- Acute and chronic inflammation
- Destruction with abscesses
- Epithelial ulcerations
- +/- squamous metaplasia
- Glandular atrophy
- Fibrosis of bronchiolar wall



Clinical Presentation

Sever persistent cough with sputum (mucopurulent sputum) sometime with blood

Dyspnea

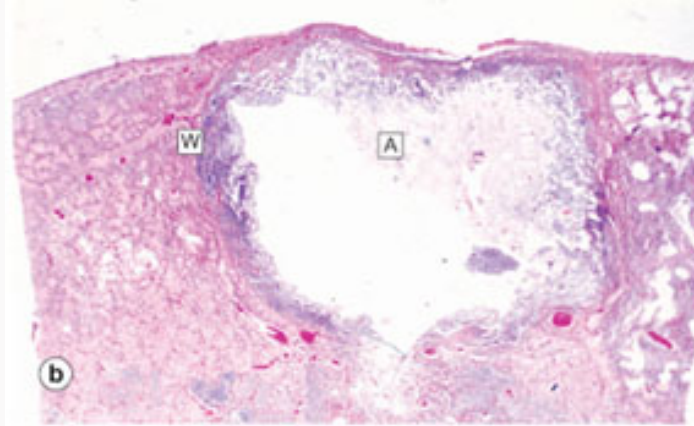
Hypoxia, hypercapnia, cyanosis

Clubbing of fingers



Complications

- Significant obstructive ventilatory defects, with hypoxemia, hypercapnia, pulmonary hypertension, and cor pulmonale
- Lung abscess
- Brain abscess
- Amyloidosis



The Spectrum of Chronic Obstructive Pulmonary Disease

Clinical Entity	Anatomic Site	Major Pathologic Changes	Etiology	Signs/Symptoms
Chronic bronchitis	Bronchus	Mucous gland hypertrophy and hyperplasia, hypersecretion	Tobacco smoke, air pollutants	Cough, sputum production
Bronchiectasis	Bronchus	Airway dilation and scarring	Persistent or severe infections	Cough, purulent sputum, fever
Asthma	Bronchus	Smooth muscle hypertrophy and hyperplasia, excessive mucus, inflammation	Immunologic or undefined causes	Episodic wheezing, cough, dyspnea
Emphysema	Acinus	Air space enlargement, wall destruction	Tobacco smoke	Dyspnea

Thanks for your attention

