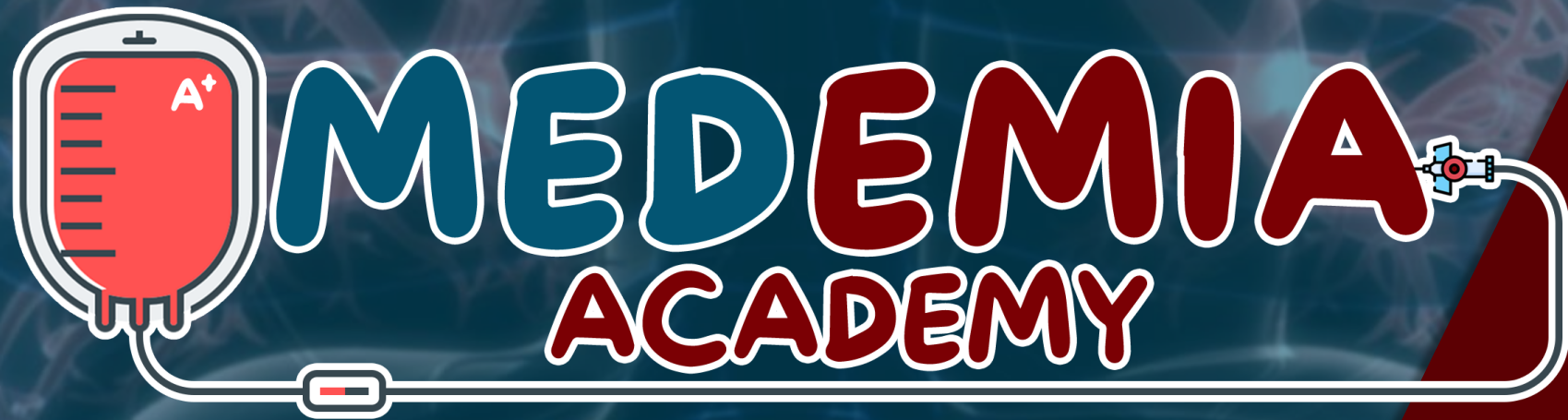


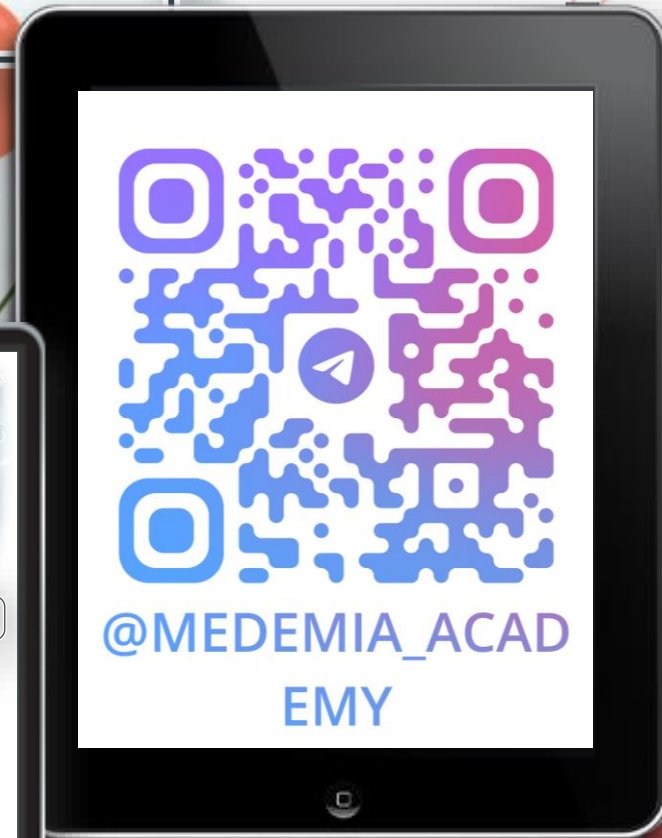
Chronic obstructive lung disease (COPD)



MEDEMIACADEMY

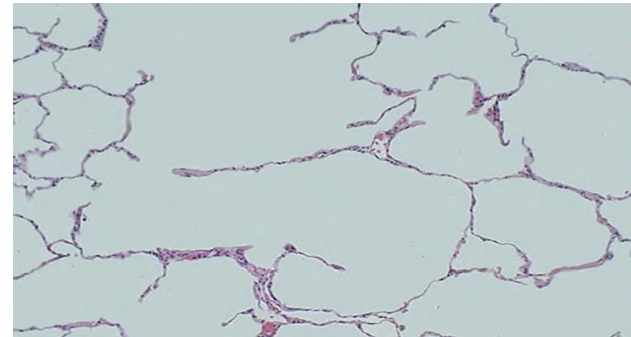


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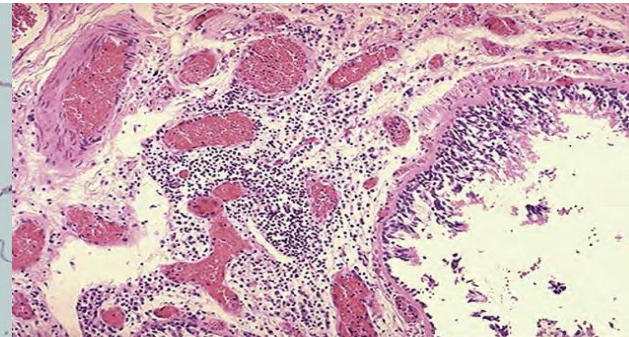


Obstructive Lung disease

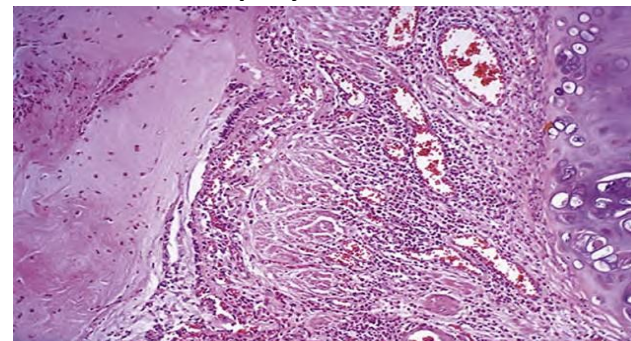
- ❖ **Definition:** Group of lung diseases associated with increased resistance to airflow, , making breathing difficult .
 - **Examples:** chronic obstructive pulmonary disease, bronchial asthma, and bronchiectasis.



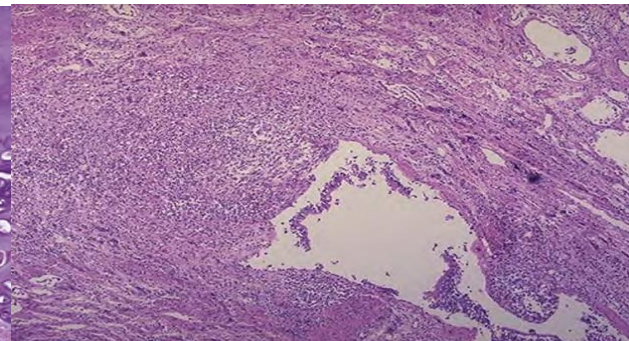
Emphysema



Chronic Bronchitis



Asthma



Bronchiectasis

Chronic obstructive pulmonary disease

- ❖ **Chronic obstructive pulmonary disease:** a lung condition characterized by persistent respiratory symptoms (cough, dyspnea) and airflow limitation, (problems in exhale)
 - postbronchodilator FEV1:FVC ratio < 0.70 (irreversible opposite to asthma)..
 - it includes : **Emphysema** and **Chronic bronchitis**.
- ❖ **Risk Factors:**
 - Smoking .
 - Environmental Pollutants.
 - Genetics : as like Alpha-1 Antitrypsin Deficiency
- ❖ **Note:**
 - Lung compliance : is a measure of lung's ability to stretch or expand.
 - Total lung capacity (TLC) : is the volume of air in the lungs upon the maximum effort of inspiration.



Chronic Obstructive Lung Disease Cont.

❖ Diagnosis:

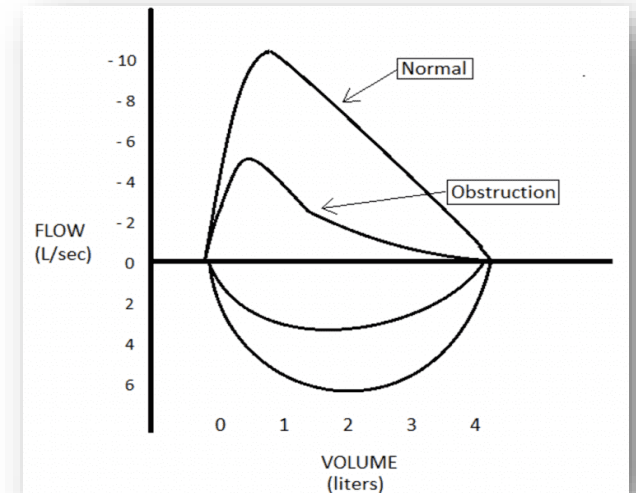
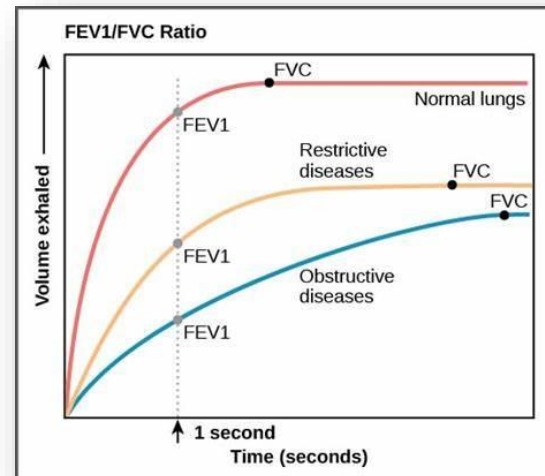
❖ 1. Spirometry :

○ Lung Function Changes in COPD:

- Increased (TLC), Increased (RV) , Decreased (FEV1), Decreased FEV1/FVC Increased (FRC) .

❖ 2. Chest X-ray/CT Scan – hyperinflation (due to air trapping).

❖ 3. Arterial Blood Gas (ABG) – Measures oxygen and carbon dioxide levels in the blood.





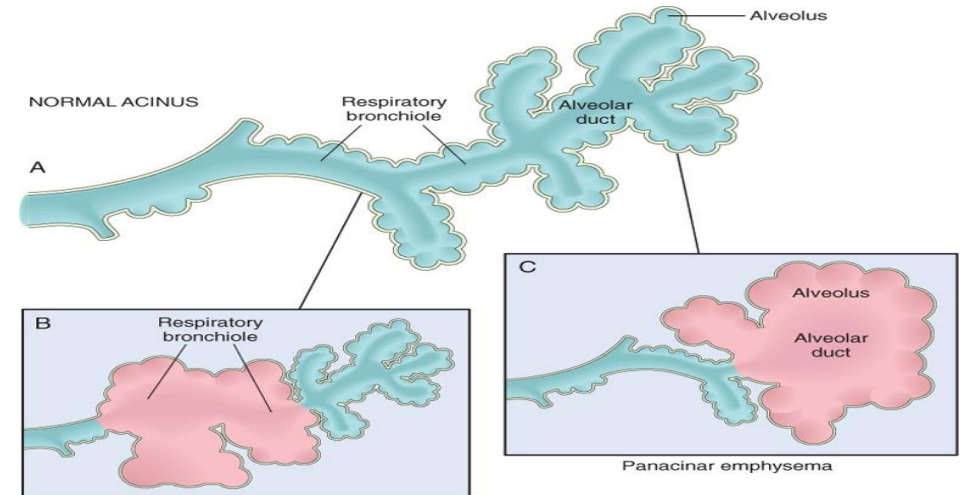
Emphysema

Definition

❖ **Definition:** Permanent (irreversible) enlargement of the air spaces distal to the terminal bronchioles with destruction of their walls (rupture of septa between alveoli leads to its enlargement) and without significant fibrosis (opposite to restrictive lung disease), its anatomically defined condition.

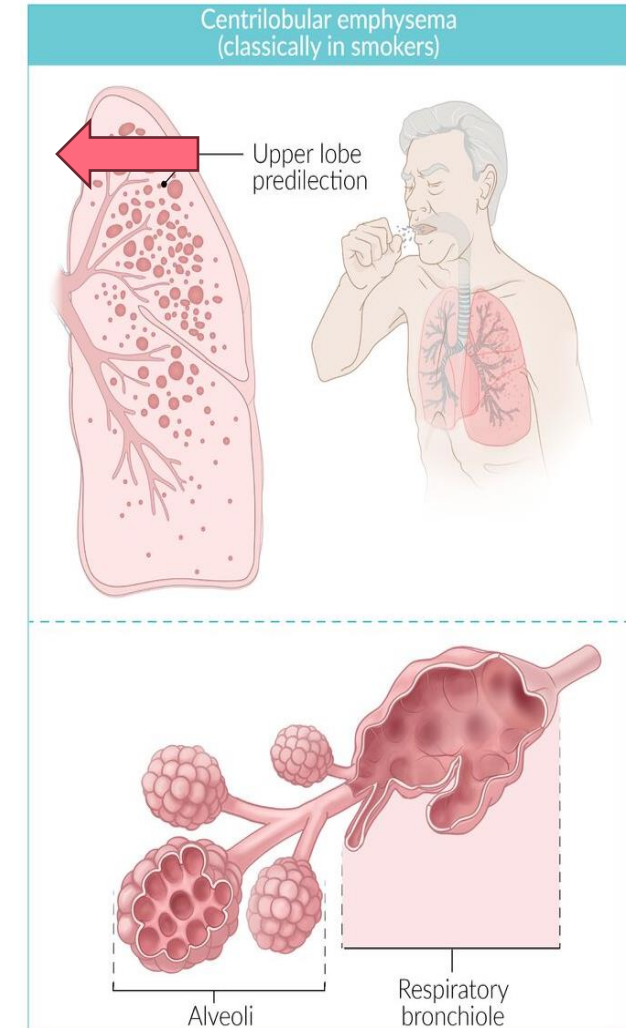
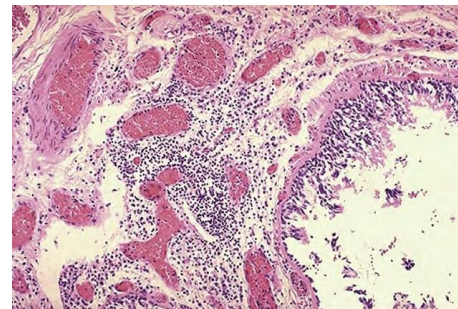
❖ Classified according to its anatomic distribution into :

1. Centriacinar (proximal acinar)
2. Panacinar (proximal and distal)
3. Distal acinar
4. Irregular (random involvements)



Centriacinar (centrilobular)emphysema

- ❖ Affects the central or proximal parts of the acini first, formed by respiratory bronchioles, while **distal alveoli are spared (less severe presentation)**.
- ❖ Classically seen in **cigarette smokers** (quit smoking will reverse the sign and symptoms but the anatomy won't).
- ❖ More common and severe in the **upper lobes**, particularly in the apical segments.
- ❖ Associated with chronic bronchitis (mixed two disorder) **as seen in picture below** .



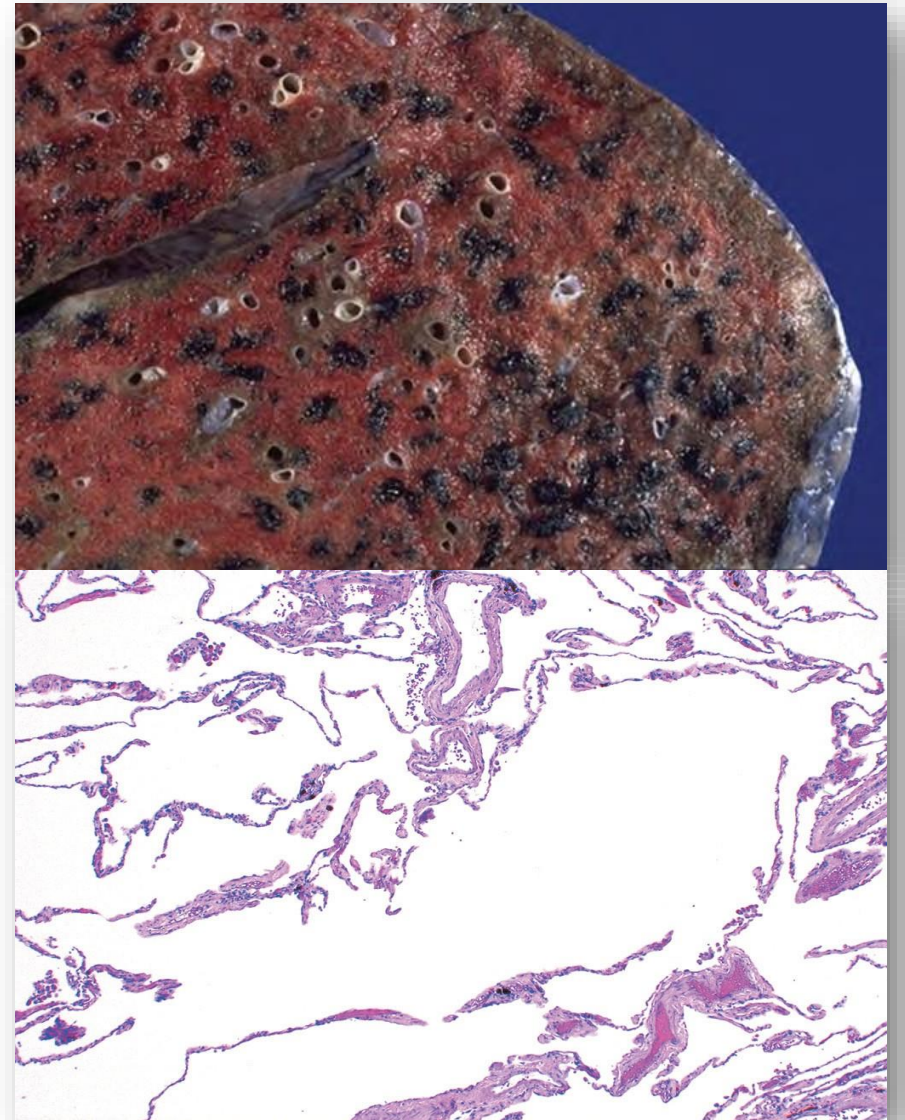
Centriacinar emphysema Cont.

❖ Morphology (Gross) :

- Less impressive changes (**better prognosis**).
- Deeper pink and less voluminous lungs

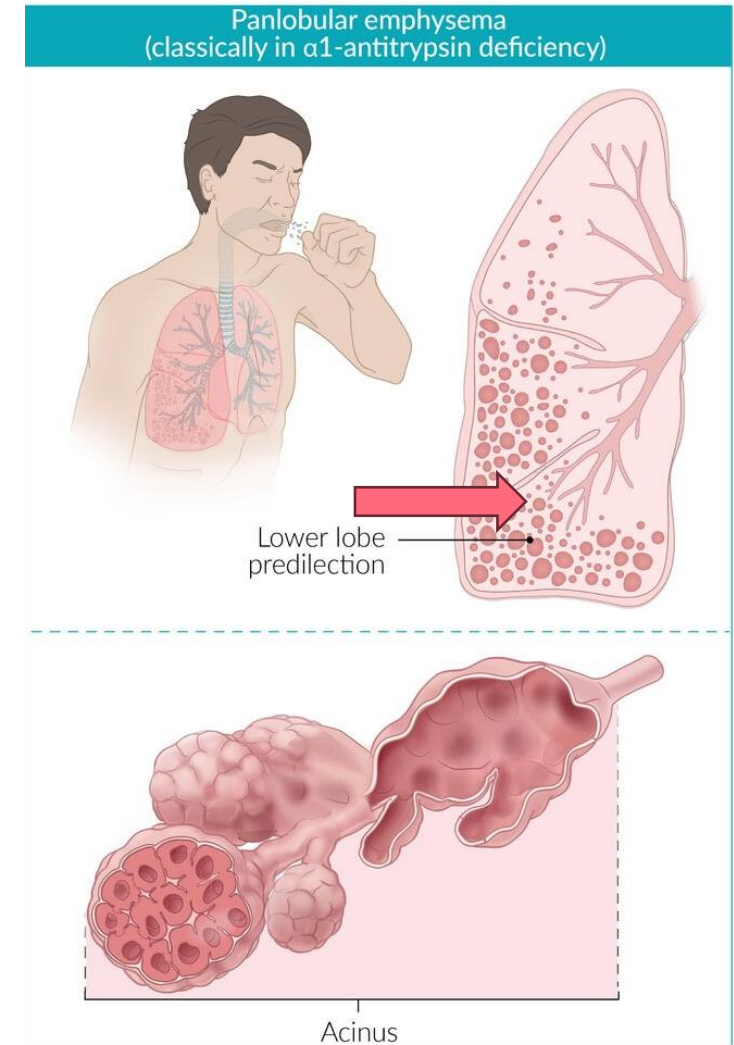
❖ Microscopic examination of All types :

- Destruction of alveolar walls & enlarged air spaces.
- No significant fibrosis.
- Small airways collapse due to loss of elastic tissue in the surrounding alveolar septa during expiration (chronic airflow obstruction).
- Bronchiolar inflammation in advanced cases.



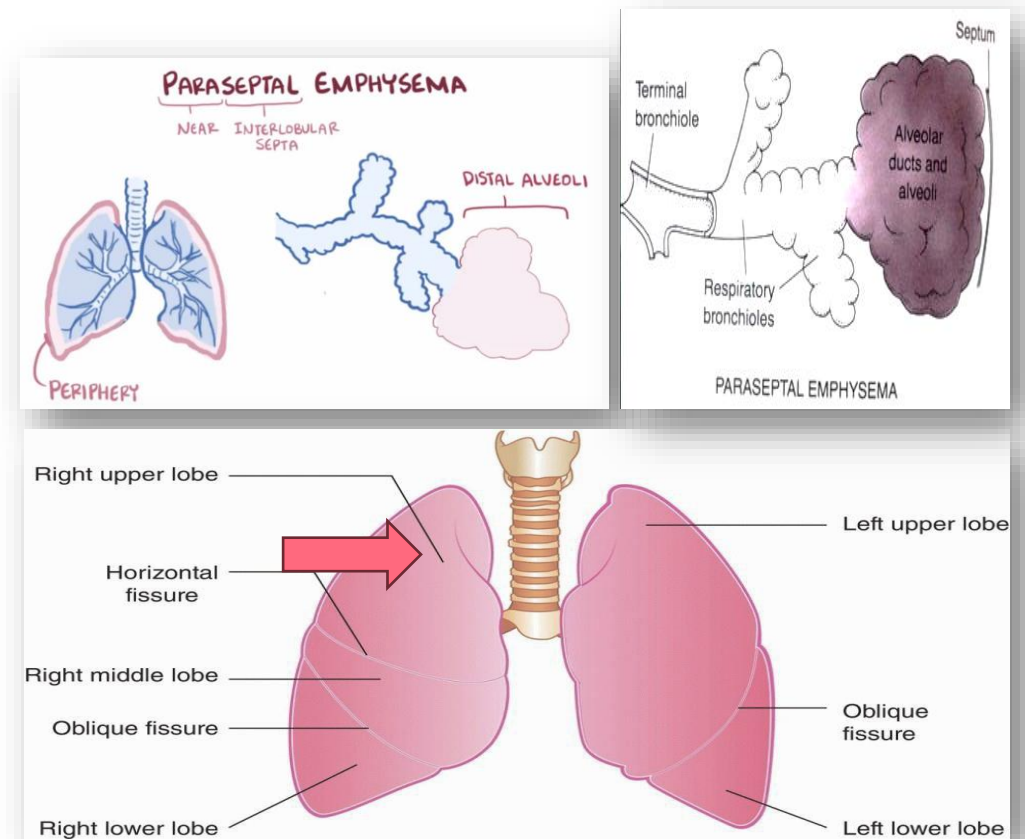
Panacinar (panlobular) emphysema:

- ❖ The acini are **uniformly enlarged**, from the level of the respiratory bronchiole to the terminal blind alveoli.
- ❖ Associated with Genetic condition : **α 1-antitrypsin deficiency (loss Elastic recoil of lung and regarded as most common cause)**, usually occurs at a younger age, raises suspicion if there is no smoking history, and involvement of liver).
- ❖ More common in the **lower lung zones**.
- ❖ **Macroscopic examination (Gross)** : Pale, voluminous lungs (**worse prognosis**).



Distal Acinar (Paraseptal) Emphysema

- ❖ The cause is unknown.
- ❖ Involves the **distal portion of the acinus** while the proximal part is normal.
- ❖ Present adjacent to the pleura, along the lobular connective tissue septa, at the margins of the lobules.
- ❖ Adjacent to fibrosis, scarring or atelectasis (as after healing of pneumonia by fibrosis, the distal part of alveoli blocked and emphysema forms).
- ❖ More severe in the upper half of the lungs.



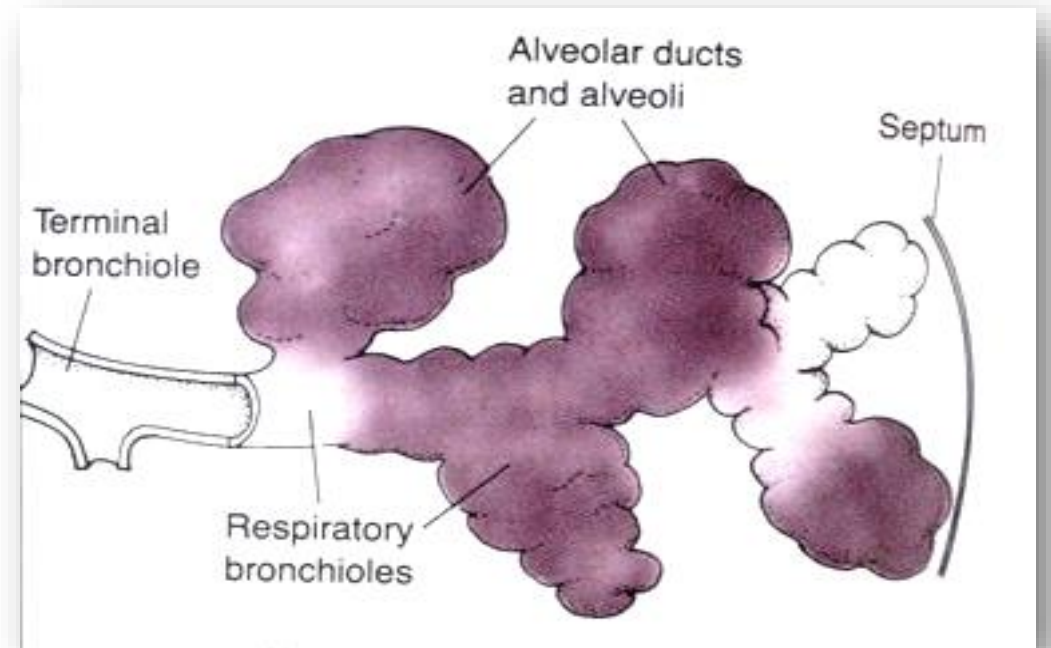
Distal Acinar (Paraseptal) Emphysema Cont.

- ❖ The presence of multiple, enlarged air spaces may form large cystic structures that give rise to bullae (only removed by surgical excision).
- ❖ The most common cause of spontaneous pneumothorax in young adults.
 - Managed by chest tube insertion, and surgical remove of bullae.
 - Suspected in young athletic.



Irregular emphysema

- ❖ The acinus is **irregularly involved**.
- ❖ Almost invariably associated with scarring.
- ❖ Clinically it's asymptomatic, **incidental found by imaging**.
- ❖ Considered the commonest form of emphysema.



Pathogenesis of emphysema

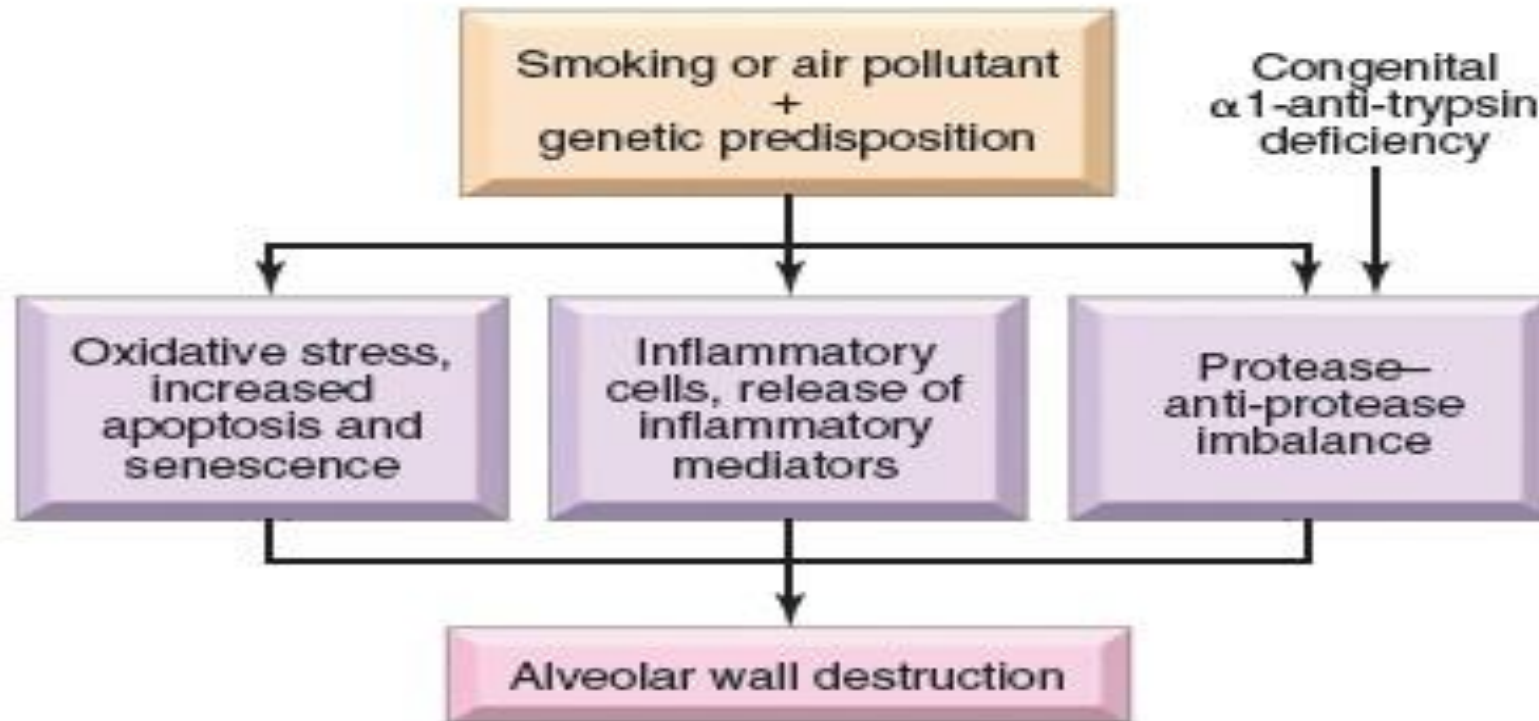


Fig. 13.6 Pathogenesis of emphysema. See text for details.



Emphysema Clinical Feature

➤ The Classic presentation of emphysema with **no bronchitis component:**

❖ **Dyspnea**

❖ **Barrel-chested:**

- The lungs become hyperinflated due to air trapping, causing the chest to expand, often seen in advanced emphysema.

❖ **Prolonged expiration:**

- The damaged alveoli lose their elasticity, making it harder to exhale air, which leads to a prolonged breathing out phase.

❖ **Pursed lip breathing :** The patient breathes in through the nose and breathes out slowly through pursed lips.

- This style of breathing increases airway pressure and prevents bronchial collapse during the last phase of expiration.



Emphysema Clinical Feature Cont.

❖ Sitting forward in a hunched-over position:

- This posture, also called "tripod position", helps patients breathe more easily by using accessory muscles of respiration and increase the pressure prevents airway collapse.

❖ Hyperventilation:

- To expelled the air inside .

❖ Adequate oxygenation of hemoglobin and prominent dyspnea:

- Despite difficulty of breathing, patients may still have adequate blood oxygen levels early in the disease due to compensatory hyperventilation, **that called pink puffers.**

❖ Pink puffers:

- Refer to able to maintain relatively normal oxygen levels (hence "pink") ,They do not turn blue (cyanotic) as often as those with chronic bronchitis.

❖ Cough and wheezing if coexistent asthma and chronic bronchitis.



Emphysema and Chronic Bronchitis

- Emphysema with pronounced chronic bronchitis and a history of recurrent infections:
 - ❖ Less dyspnea (**adapt to hypoxia**).
 - ❖ Absence of increased respiratory drive > hypoxic and cyanotic.
 - ❖ For unclear reasons, patients with chronic bronchitis tend to be **obese** hence the designation **blue bloaters** > carbon dioxide retention, hypoxia, and cyanosis.

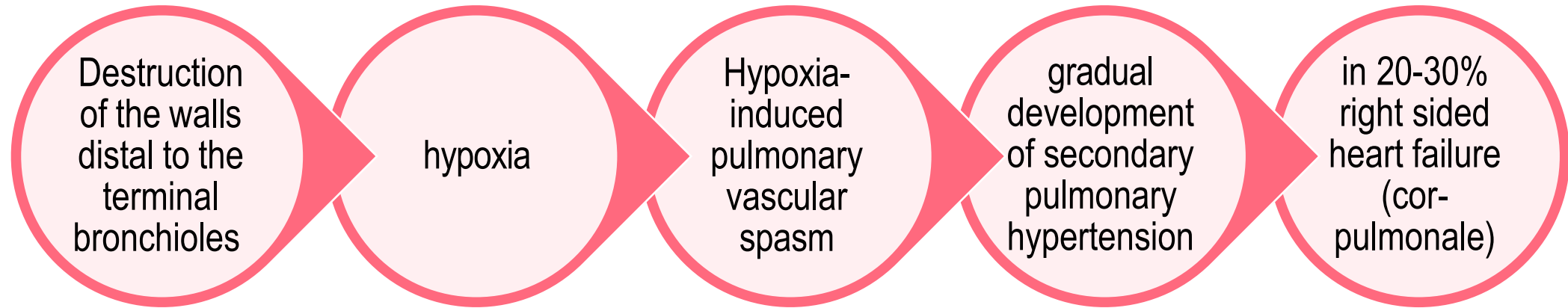


Pink puffer Vs Blue bloater

| | Pink Puffer | Blue Bloater |
|----------------------------|---|--|
| Main pathomechanism | Emphysema | Chronic bronchitis |
| Clinical features | <ul style="list-style-type: none">• Noncyanotic• Cachectic• Pursed-lip breathing• Mild cough | <ul style="list-style-type: none">• Productive cough• Overweight• Peripheral edema |
| PaO₂ | Slightly reduced | Markedly reduced |
| PaCO₂ | Normal (possibly in late hypercapnia) | Increased (early hypercapnia) |



Complication



- ❖ Death from emphysema is related to either respiratory failure or right-sided heart failure.



Condition related to emphysema

❖ **Compensatory emphysema:** Either occurs in same or opposite lungs.

- Compensatory dilation of alveoli in response to loss of lung substance.
- As hyper-expansion of residual lung parenchyma following surgical removal of a diseased lung.

❖ **Obstructive overinflation:**

- Lung expands because air is trapped within it.
- Subtotal obstruction by a tumor or foreign object.
- Can be Life-threatening emergency if distends sufficiently to compress the remaining normal lung.



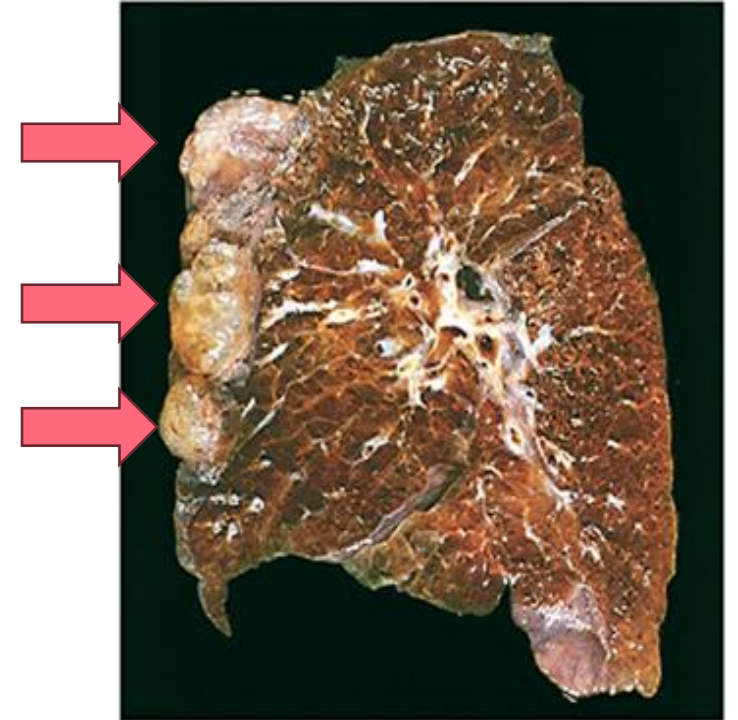
Condition related to emphysema Cont.

❖ Bullous emphysema:

- Any form of emphysema, Most are subpleural.
- Large subpleural blebs or bullae (As in pointed arrows)
- Pneumothorax if rupture.

❖ Mediastinal (interstitial) emphysema:

- due to condition outside the lungs as stab wound or RTA.
- Bacteria infection as in (Fasciitis),enterocolitis.
- Air in connective tissue of the lung, mediastinum, and subcutaneous tissue.





Chronic Bronchitis

Chronic Bronchitis

- ❖ **Definition:** Persistent productive cough for at least 3 consecutive months in at least 2 consecutive years.
- ❖ **Clinical diagnosis** (usually occurs in elderly).
- ❖ Common in cigarette smokers; air pollutants also contribute.
- ❖ In early stages airflow is not obstructed.
- ❖ Heavy smokers: develop chronic outflow obstruction, usually with associated emphysema.
- ❖ May coexist with hyper-responsive airways with intermittent bronchospasm and wheezing, asthmatic bronchitis.



Pathogenesis

A. hypersecretion of mucus:

- beginning in the large airways.
- cigarette smoking, other air pollutants:
 - hypertrophy of mucous glands in the trachea and bronchi ,measure postpartum by:
 - Reid index : is the ratio of the thickness of the submucosal mucus-secreting glands to the thickness between the epithelium and cartilage in the bronchial tree.
 - Reid index > 0.5 is characteristic of chronic bronchitis.
 - increase in mucin-secreting goblet cells in the epithelial surfaces of smaller bronchi and bronchioles.
- inflammation without eosinophils (opposite to asthma).



Pathogenesis Cont.

B. airflow obstruction, results from :

1. Small airway disease:

- chronic bronchiolitis: results in early and mild airflow obstruction. Induced by mucus plugging of the bronchiolar lumen, inflammation, and bronchiolar wall fibrosis.

2. Coexistent emphysema:

- The cause of significant airflow obstruction.

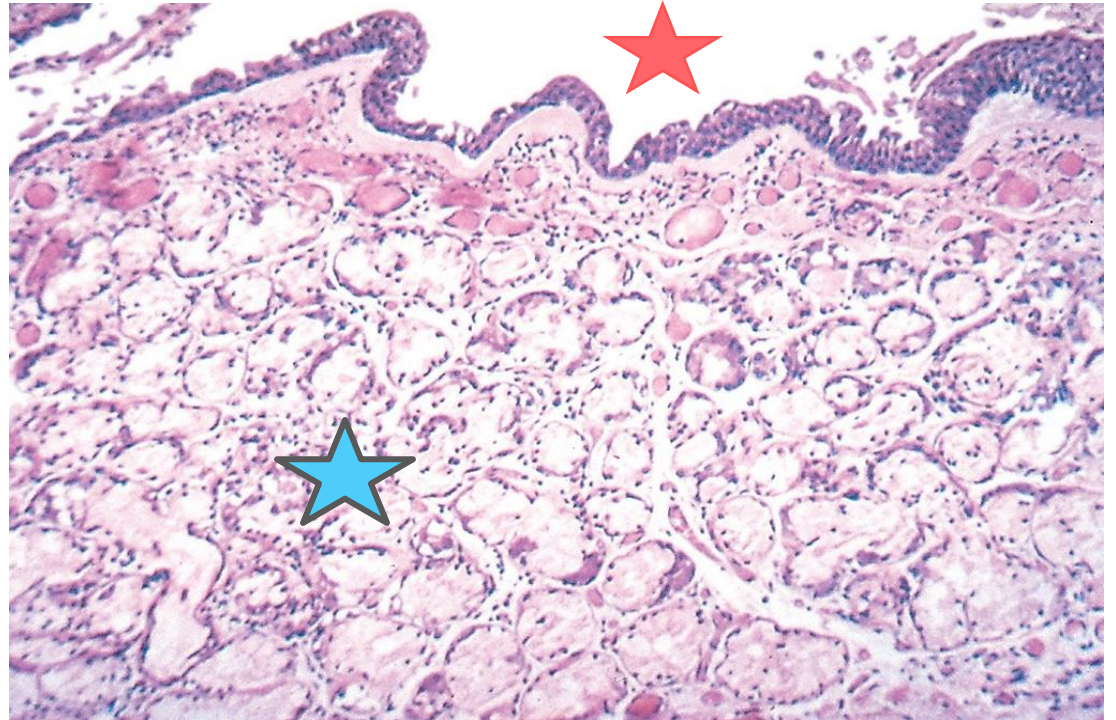


Morphology

❖ Macroscopic feature :

- Mucosal lining is hyperemic and swollen
- Layers of mucinous or mucopurulent (pus, with collection of neutrophils) secretions ,The smaller bronchi and bronchioles also may be involved

➤ According to the picture :The lumen of the bronchus is above Note the marked thickening of the mucous gland layer (approximately twice-normal) and squamous metaplasia (means the disease is chronic) of lung epithelium (normal is pseudostratified columnar epithelium).



Microscopic feature

- ❖ Enlargement of the mucus-secreting glands.
- ❖ Inflammatory cells, largely mononuclear and neutrophils.
- ❖ Chronic bronchiolitis (small airway disease), characterized by goblet cell metaplasia, mucous plugging, inflammation, and submucosal fibrosis.
- ❖ Bronchiolitis obliterans in severe cases: complete obliteration of the lumen as a consequence of fibrosis (**obstructed due to mucopurulent exudate**).
- ❖ Changes of emphysema often co-exist, (**may lead to compensatory emphysema**).



Clinical Features

- ❖ Prominent cough with production of sputum.
- ❖ chronic bronchitis and COPD patients show frequent exacerbations, rapid disease progression, and poorer outcomes than emphysema alone.
- ❖ **No cure, only by lung transplant.**
- ❖ Progressive disease is marked by the development of pulmonary hypertension, cardiac failure, recurrent infections; and ultimately respiratory failure.





MCQs

Case

❖ A 20-year-old, previously healthy gentleman is jogging one morning when he falls to the ground. He suddenly becomes markedly short of breath. In ER, no breath sounds are audible over the right side of the chest. A CXR shows a shift of the mediastinum from right to left. A chest tube is inserted on the right side, and air rushes out. Which of the following underlying diseases is most likely to have produced this complication?

- A. Centriacinar emphysema
- B. Chronic bronchitis
- C. **Distal acinar emphysema**
- D. Panlobular emphysema



MCQs

1. One of the following pairs between the emphysema type and its feature is wrongly matched?
- a. Panacinar emphysema: affects upper lung zones.
 - b. Panacinar emphysema: associated with alpha1-antitrypsin deficiency.
 - c. Centriacinar emphysema: most common type in cigarette smokers.
 - d. Irregular emphysema: clinically asymptomatic and associated with scarring.
 - e. Distal acinar emphysema: present with spontaneous pneumothorax.



MCQs Cont.

2. A 59-year-old man has a history of excessive smoking. For the past 5 years, he has had a cough productive of copious amounts of mucoid sputum for over 3 months at a time. He has had multiple episodes pneumonia, last one complicated by septicemia and he died. At autopsy, his bronchi microscopically revealed Reid index of 0.8. Which of the following diagnoses is likely to explain his clinical course?
- a. Bronchiectasis.
 - b. Centriacinar emphysema
 - c. Bronchial Asthma
 - d. Squamous cell carcinoma.
 - e. Chronic bronchitis



MCQs Cont.

3. Primarily affects the Acinus?

- a. Chronic bronchitis
- b. Bronchiolitis
- c. Bronchiectasis
- d. Emphysema

4. Leukotriene B4 is an inflammatory modulator indicating?

- a. Emphysema



MCQs Cont.

5. Something about bronchitis? **Uncomplete question**

- a. Respiratory zone
- b. All airway generations
- c. Respiratory & conducting zone
- d. Conducting zone
- e. **Terminal bronchi**



MCQs Cont.

6. Considering the pathogenesis of chronic bronchitis, one of the following is incorrect?
- a. Cigarette smoke increasing the risk of infection.
 - **b. Histamine and IL-13 are involved in submucosal gland hypertrophy.**
 - c. Infections does not initiate chronic bronchitis but producing acute exacerbations.
 - d. Mucus hypersecretion is a late feature beginning in the large airways.
 - e. Initiating factor is exposure to irritating substances (90% smokers)



Lab Questions

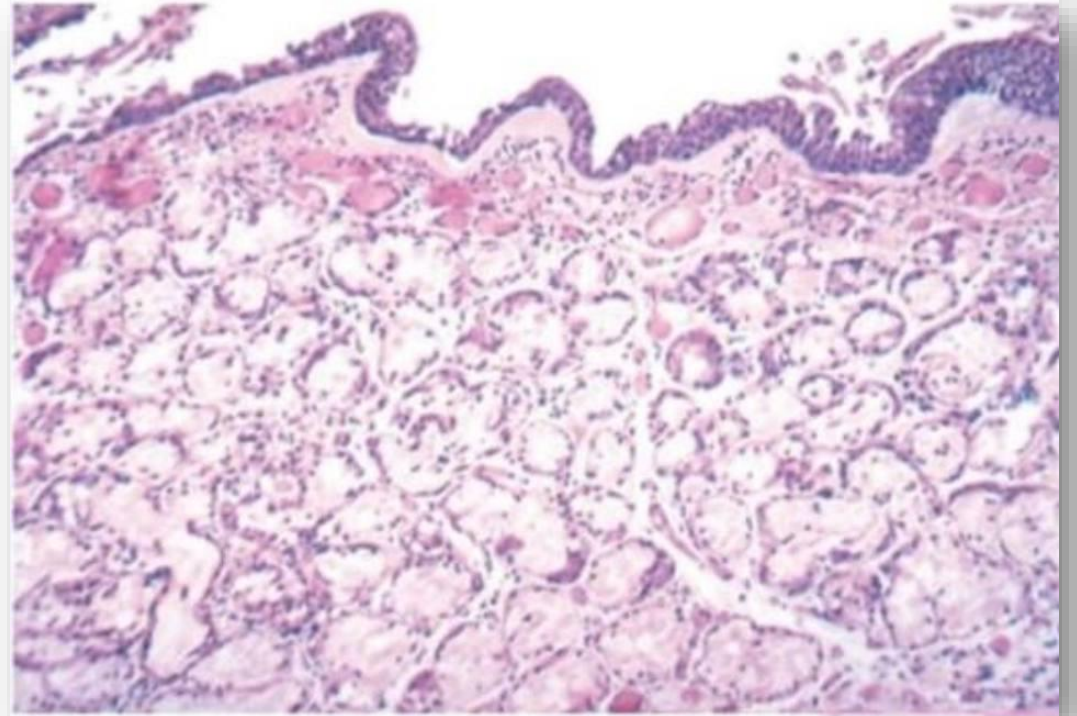
1. Which type of emphysema would produce these changes earlier in the course?
- a. Irregular emphysema
 - b. Panacinar emphysema
 - c. Centriacinar emphysema
 - d. All of the above
 - e. Distal emphysema



Lab Questions Cont.

2. What distinguishes Chronic bronchitis?

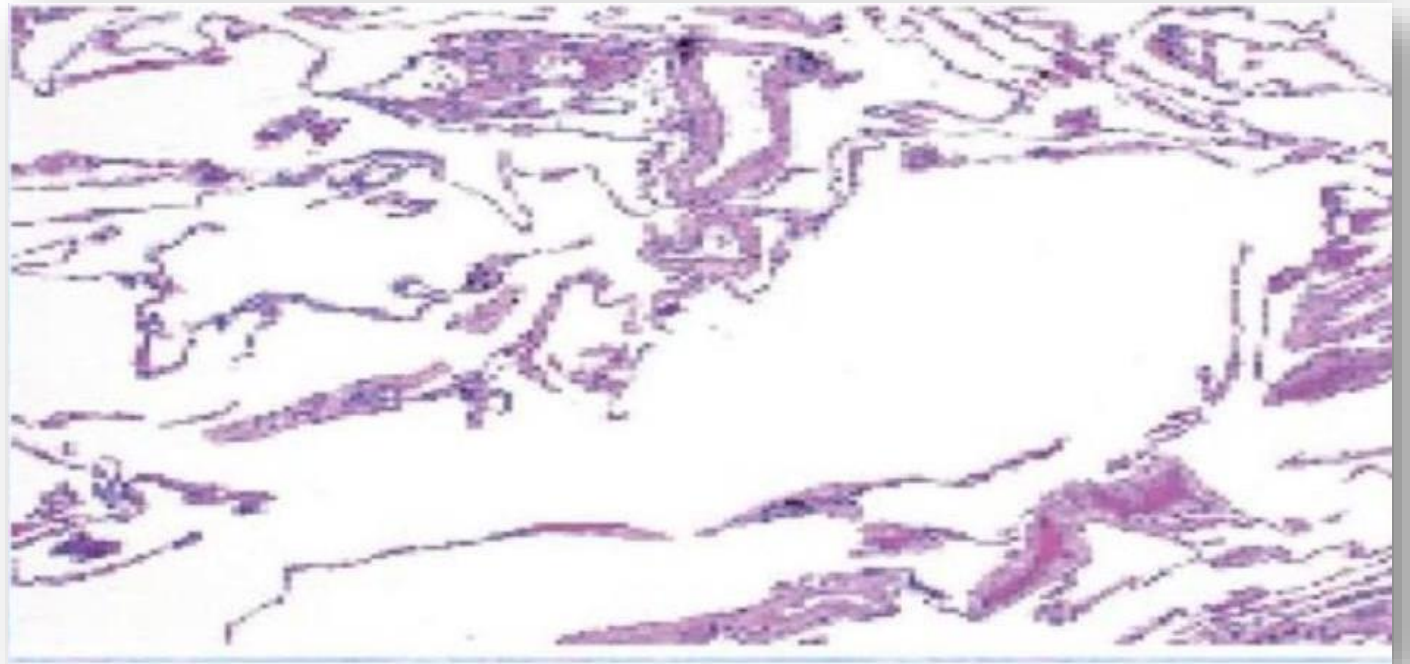
- a. Enlargement of the mucus-secreting glands



Lab Questions Cont.

3. What enzyme is deficient in this picture?

o a. Alpha 1 antitrypsin



Lab Questions Cont.

4. Which type of emphysema?

○ a. Bullous emphysema



Lab Questions Cont.

5. Uncompleted Questions, Centroacinar emphysema as in ???

