

COPD (Chronic Obstructive Pulmonary Disease)

Biomedical Engineering - URJC

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Understanding COPD: A Comprehensive Overview

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COPD Overview

Key concepts on **COPD**:

- 1 Common disease with **progressive** (and **non-reversible**) airflow limitation.
- 2 Structural lung changes due to chronic inflammation from noxious particles leading to **tissue destruction**.
- 3 Symptoms: cough, dyspnea, **sputum production**.
- 4 Ranges from asymptomatic to respiratory failure.

Chronic Bronchitis and Emphysema

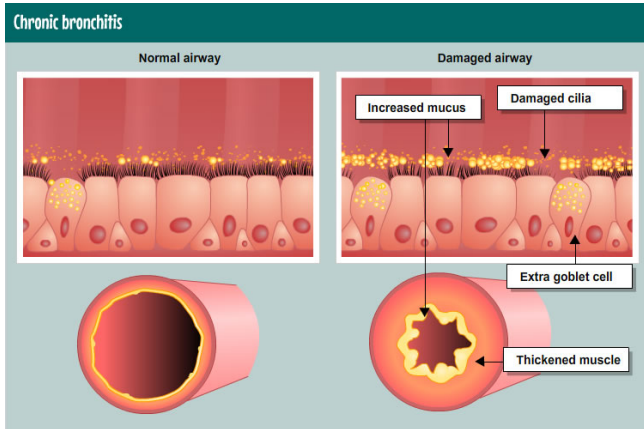
Chronic bronchitis

- Chronic **productive cough**, strong association with smoking.
- Chronic **thickening** of bronchii.

Pulmonary emphysema

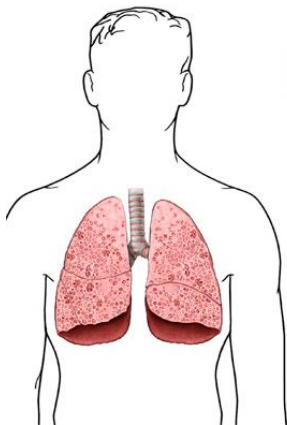
- Permanent dilatation of distal airways, interrupts gas exchange.
- **Destruction of alveoli.**

Chronic Bronchitis and Emphysema



Chronic Bronchitis and Emphysema

Normal Lung vs. Emphysemic Lung



Normal bronchiole
and alveoli



Emphysema



Epidemiology of COPD

- Primarily in **smokers** and those over 40.
- Third most common cause of morbidity and mortality worldwide.
- Underdiagnosis leads to underestimated prevalence.

Etiology of COPD

- Causal factors: cigarette smoke, inhaled irritants, infections.
- Environmental and occupational exposures, alpha-1 antitrypsin deficiency (AATD).

Pathophysiology of COPD

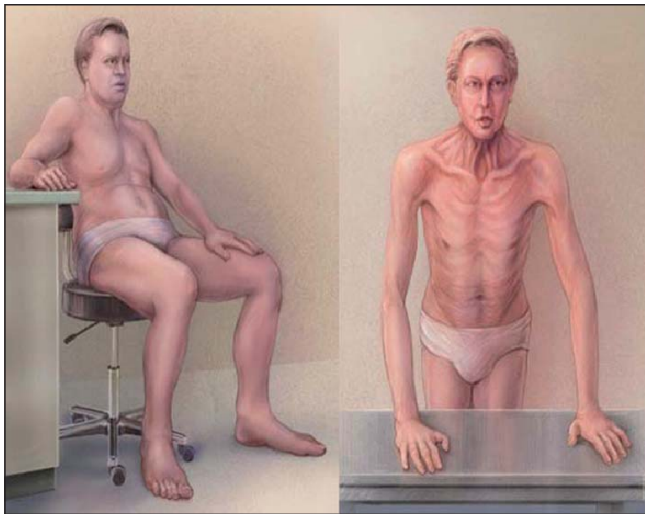
Chronic, non-reversible changes

- **Inflammatory condition affecting airways**, lung parenchyma, and pulmonary vasculature.
- **Emphysema**: Inflammatory response leads to air sac destruction, obstructive ventilation defect.
- **Chronic bronchitis**: Overproduction of mucus, bronchial mucous membrane inflammation.

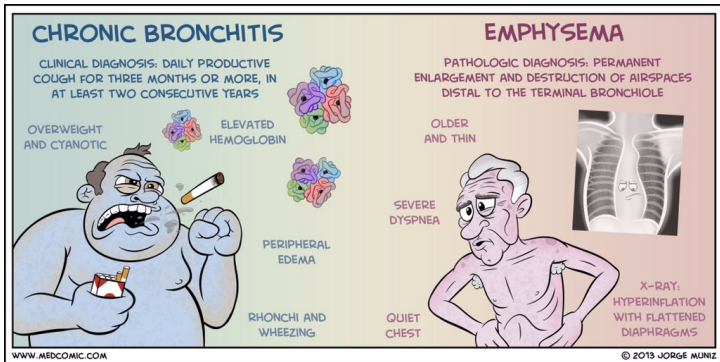
Clinical Presentation

- Typical patient: Fourth-fifth decade, extensive smoking history.
- Symptoms: Chronic productive cough, worsening shortness of breath.
- Advanced stages: Interference with daily activities, unintentional weight loss, cachexia.
- "Pink puffers" (emphysema) vs. "blue bloaters" (chronic bronchitis).

Clinical Presentation



Clinical Presentation



Evaluation and Diagnosis

- **Spirometry:** Reduction in both FVC and FEV1, **FEV1/FVC ratio less than 0.7.**
- Obstructive ventilatory defect, potential restrictive defect.
- Grading severity based on FEV1 according to GOLD criteria.
- Radiology: Chest X-ray shows hyperinflation, CT confirms emphysema.

Treatment of COPD

- Medications: Bronchodilators (beta2-agonists, antimuscarinics), inhaled corticosteroids (ICS), systemic glucocorticoids.
- Mechanisms of action: Relaxation of smooth muscle, prevention of bronchoconstriction, inflammation reduction.
- Combination therapy often more beneficial than individual drugs.
- Oral corticoids and antibiotics for acute exacerbations.