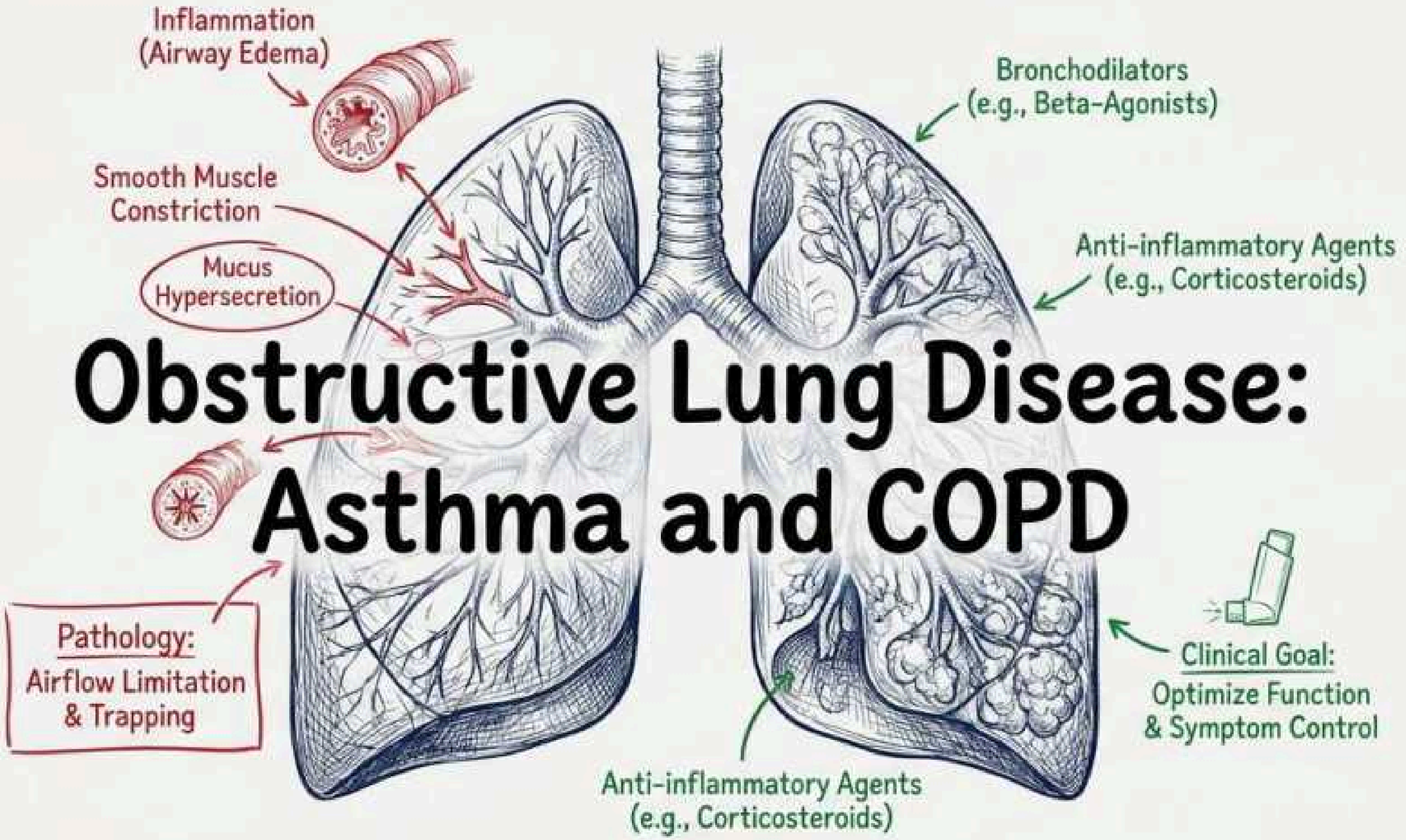


Obstructive Lung Disease: Asthma and COPD

MED 522 B
Lecture 3

Clinical Pathophysiology
& Management Guide

The Asthma Core Definition Matrix

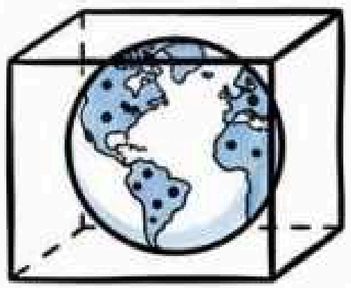
¶ 3.1

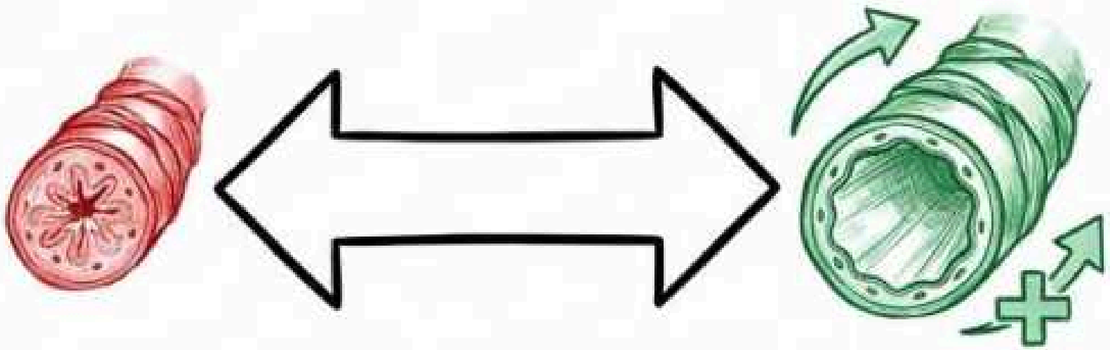


Chronic inflammatory disease of the airways.

- ☑ Wheezing
- ☑ Breathlessness
- ☑ Chest tightness
- ☑ Cough

Affects hundreds of millions globally. Often begins in childhood.



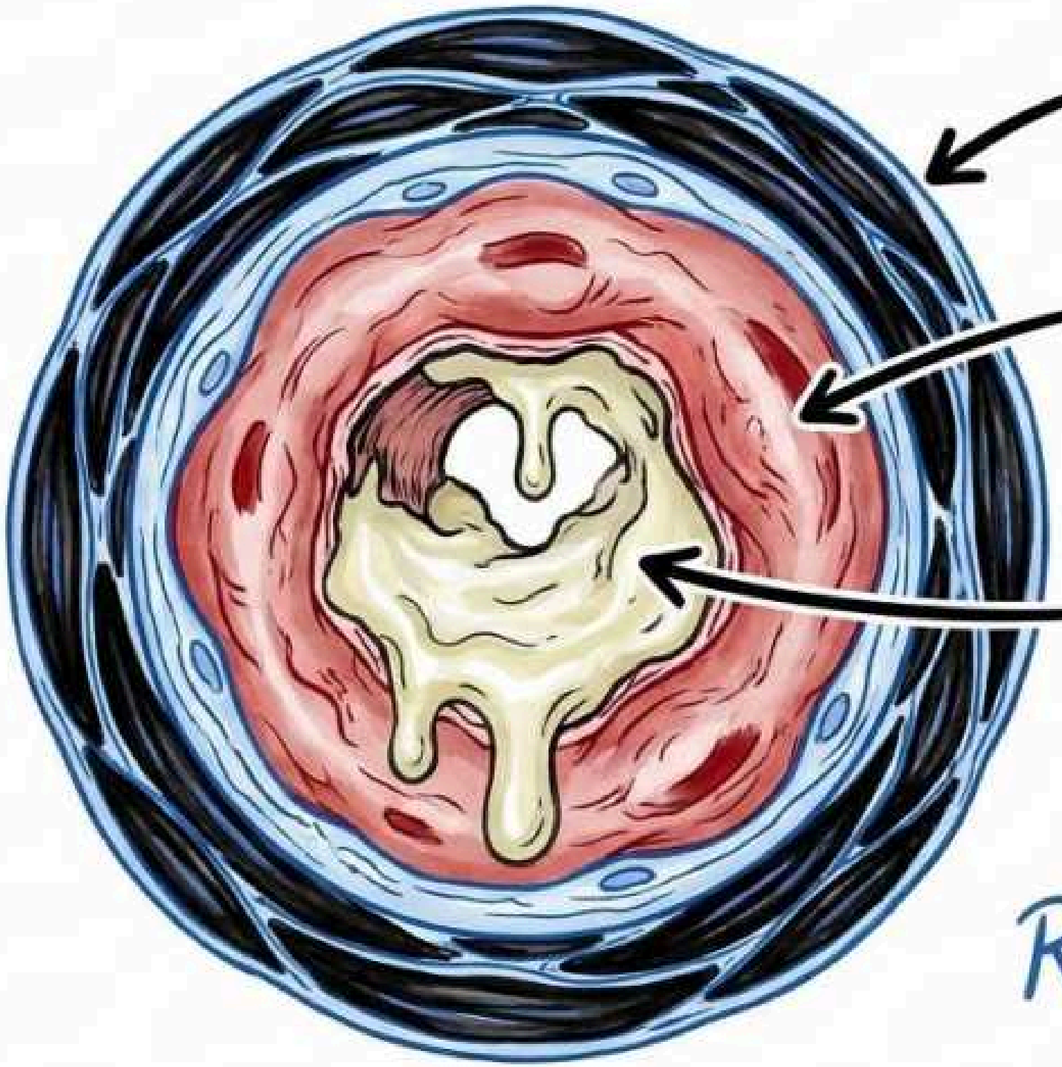


Variable & Reversible

Reverses on its own or with treatment.

The Triad of Airway Narrowing

¶ 3.2



Smooth Muscle Tightening

Mucosal Swelling

└ Eosinophils & allergy-linked cells

Thick Mucus Plugging

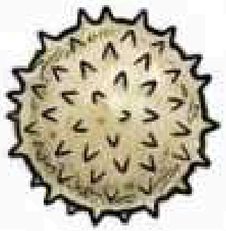
$$Raw = \frac{8\eta l}{\pi r^4}$$

Hyper-responsive airways narrow too easily—even a tiny decrease in radius (r) causes an exponential spike in resistance.

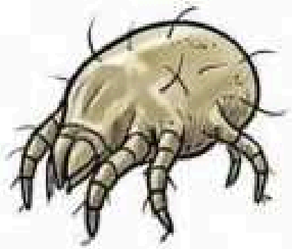
The Asthmatic Trigger Web

¶ 3.3

Allergens



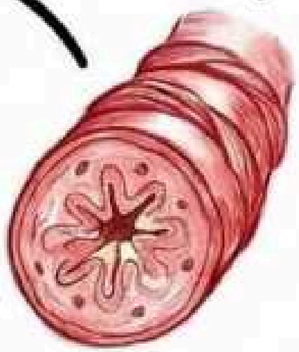
Pollen



House dust mite

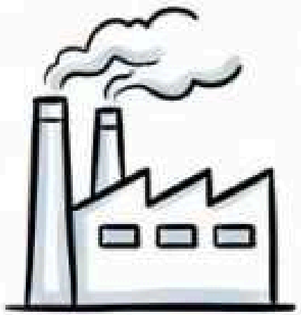


Animal dander



Environmental & Physical

- ☑ Viral colds
- ☑ Cold air
- ☑ Exercise
- ☑ Tobacco smoke
- ☑ Air pollution



Occupational

Occupational asthma from workplace substances.

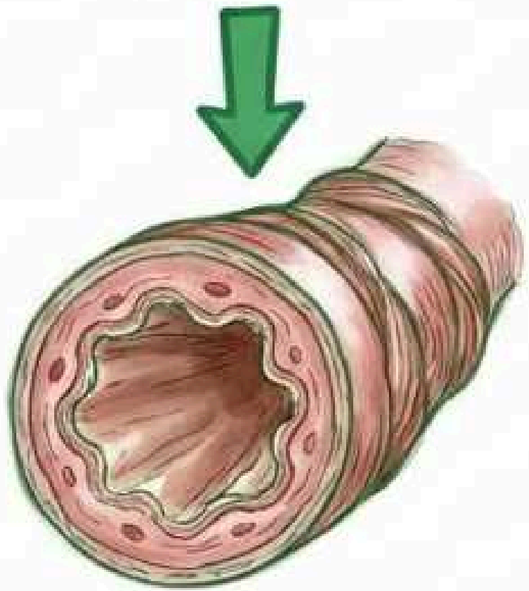
Recognising and avoiding a person's triggers is fundamental to good care.

Dual Therapeutic Axes in Asthma

¶ 3.4

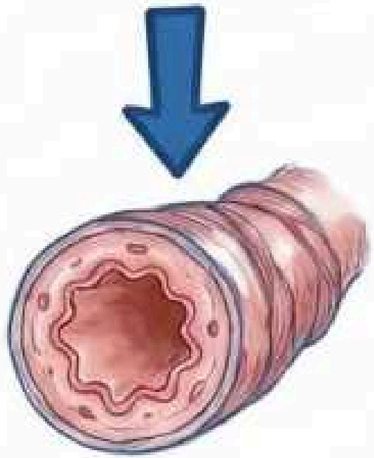
Inhaled Bronchodilators

Goal: Relieve Symptoms (Quick Relief)



Inhaled Corticosteroids

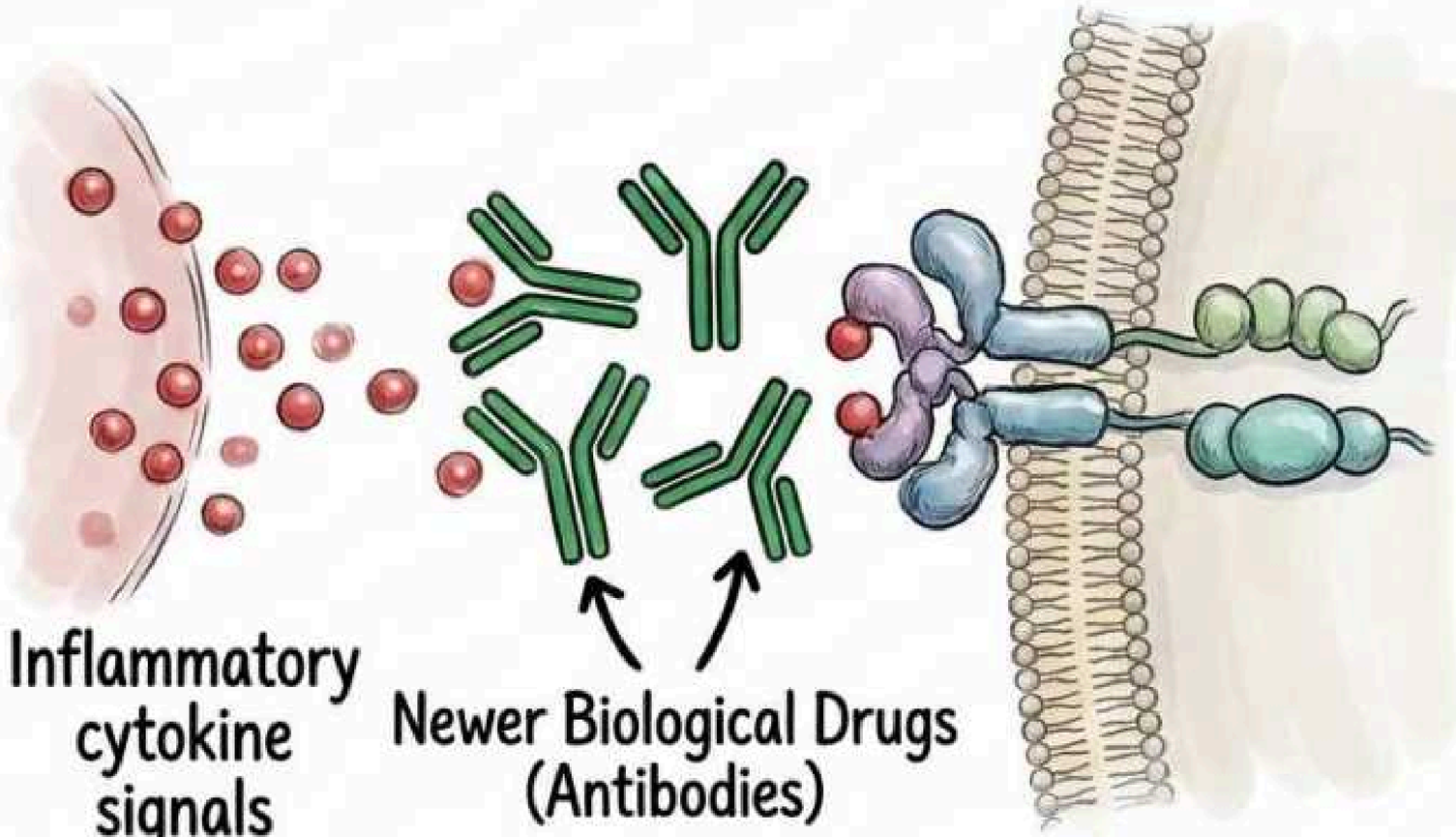
Goal: Control Underlying Inflammation



Taken regularly to prevent attacks and reduce risk of death.

Modern guidelines emphasize anti-inflammatory treatment (Controllers) rather than relying on relievers alone.

Escalation: Severe Asthma & Targeted Biologics ¶ 3.5



Greatly reduces attacks in suitable patients whose severe asthma is not controlled by inhalers.

EMERGENCY:
A severe asthma attack that does not respond to the usual reliever requires immediate emergency intervention.

The COPD Paradigm & Global Etiology

Chronic Obstructive Pulmonary Disease (COPD)

Persistent airflow obstruction | NOT fully reversible | Worsens slowly over years

One of the leading causes of death in the world.



Wealthy Nations

Primary cause: Smoking.



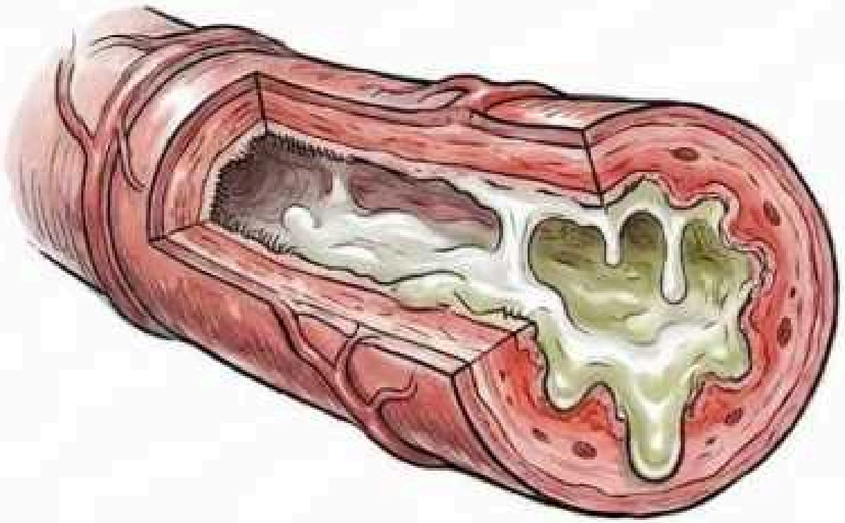
Worldwide / Developing Nations

Primary cause: Smoke from cooking fires burning wood or dung indoors.

The Dual Processes of COPD

¶ 3.7

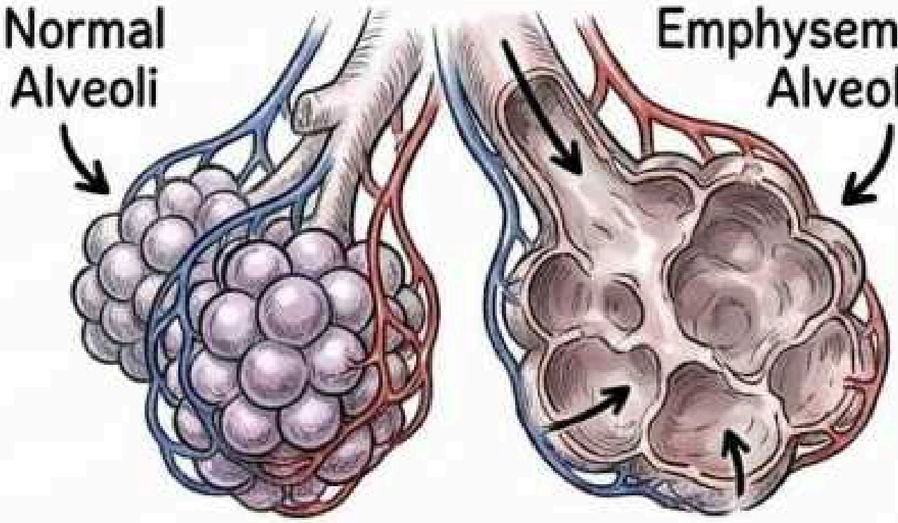
Chronic Bronchitis



Pathology: Airway inflammation with excess mucus production.

Clinical Definition: Cough producing sputum for months in successive years.

Emphysema



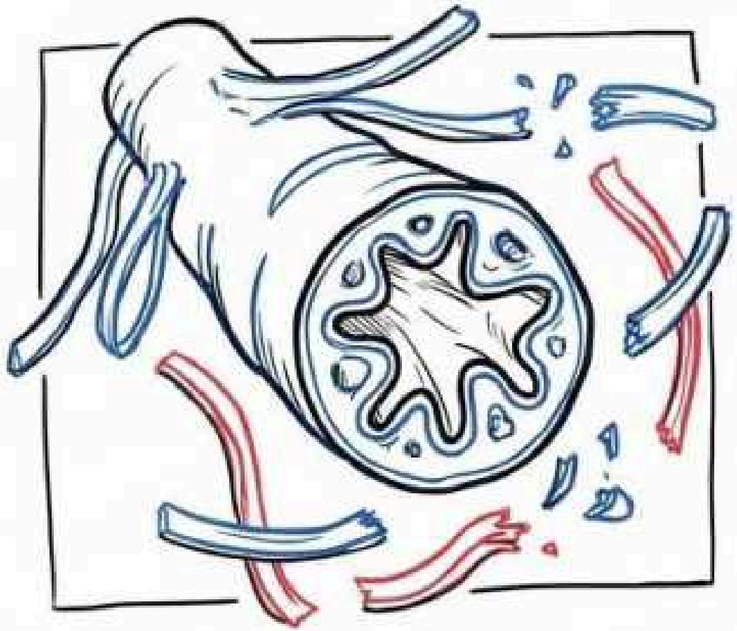
Pathology: Destruction of alveolar walls. Spaces become larger and less efficient.

Mechanical Failure: Loss of elastic recoil (which normally helps hold small airways open).

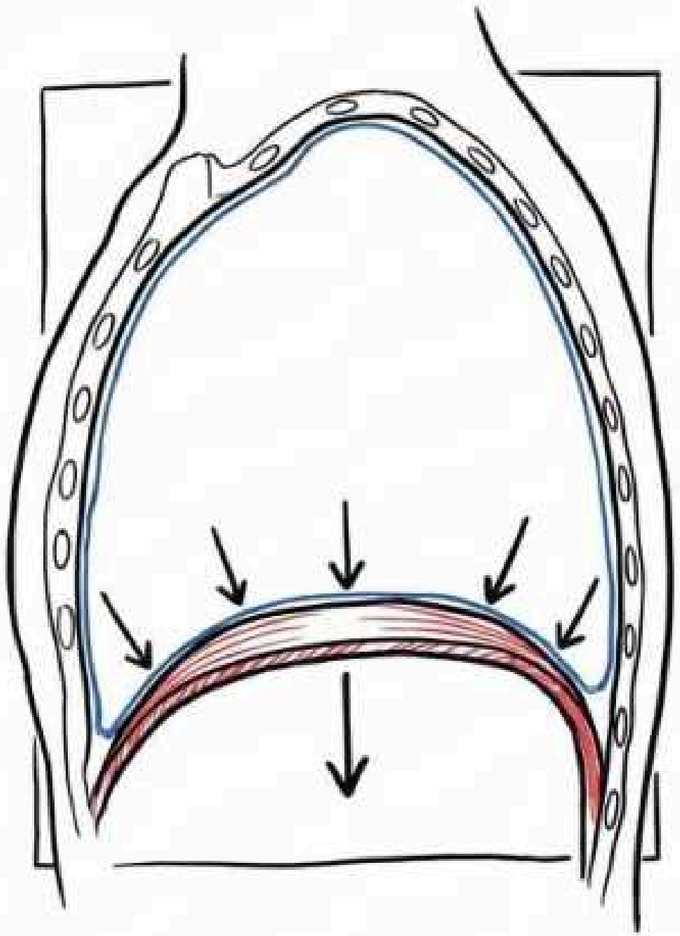
COPD combines these two processes in varying degrees.

The Physics of Emphysema & Air Trapping

¶ 3.8



Loss of elastic tissue causes small airways to collapse during expiration, trapping air.



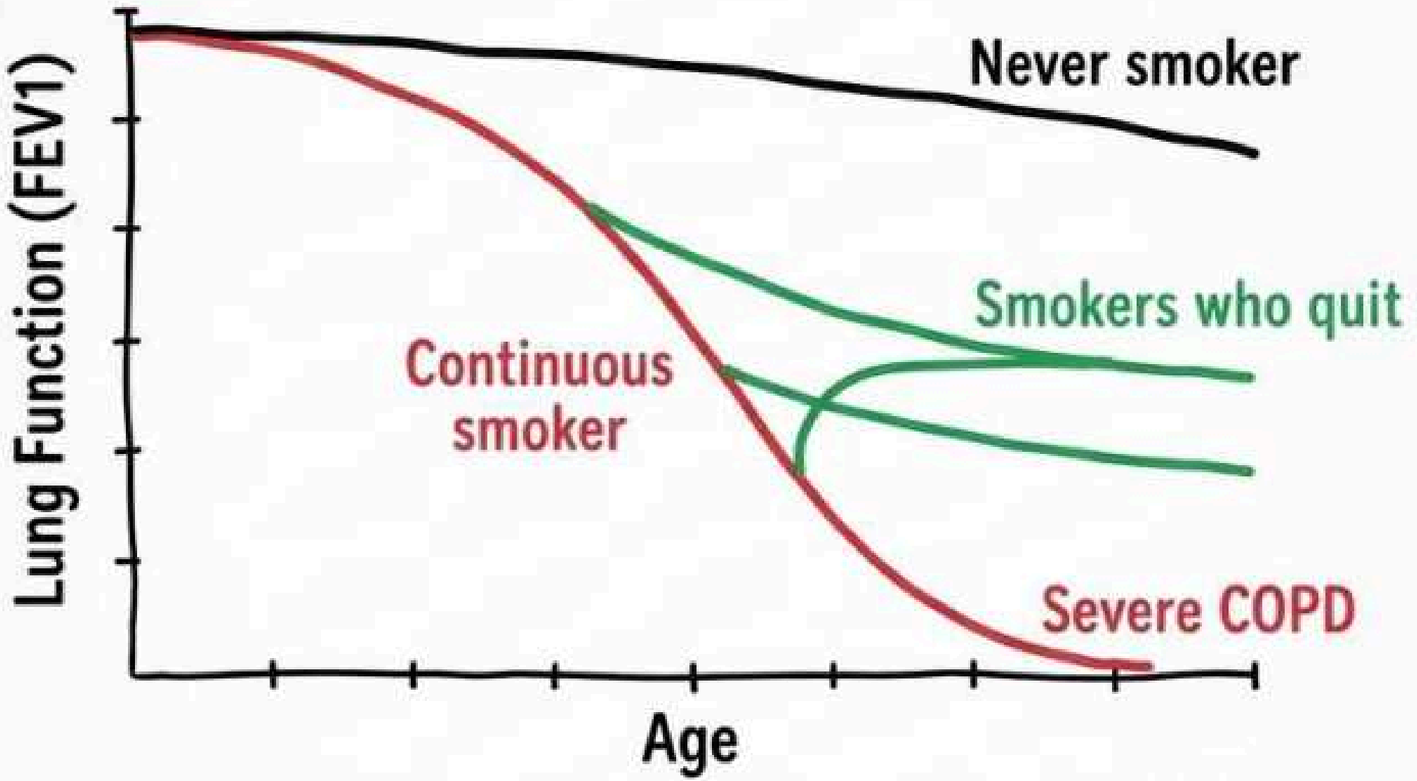
Lungs become over-inflated; flattened diaphragm works at a mechanical disadvantage.

$$P_A = P_{el} + P_{pl}$$

↖ Decreased elastic recoil pressure (P_{el}) leads to airway collapse.

Rare inherited form: Lack of alpha-1 antitrypsin (a protein that protects lungs from white blood cell enzymes).

Disease Trajectory & The Fletcher-Peto Curve



Only a minority of smokers develop severe COPD, but risk rises with amount smoked. (Fletcher & Peto, 1977).

Quitting is the single most effective treatment for COPD.

Multimodal Management of COPD

Pharmacology



Inhaled Bronchodilators (widen airways) & Inhaled Corticosteroids (help some patients).

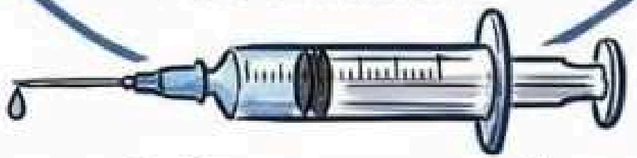
Goal: Relieve symptoms & reduce flare-ups.

Pulmonary Rehab



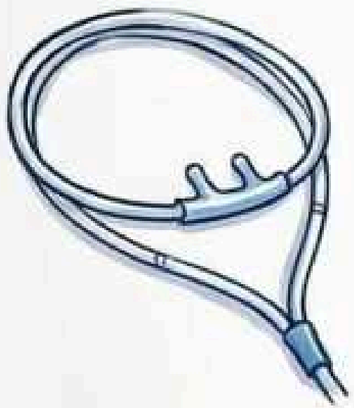
Exercise and education programme. Considerably improves breathlessness and quality of life.

Vaccinations

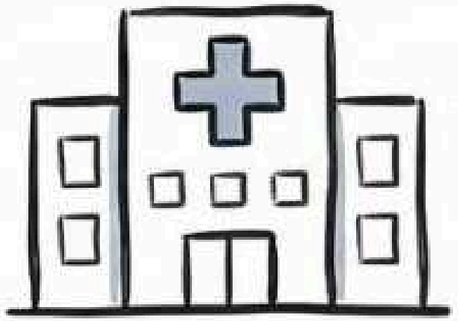


Influenza & Pneumococcal vaccines.
Crucial to reduce dangerous chest infections.

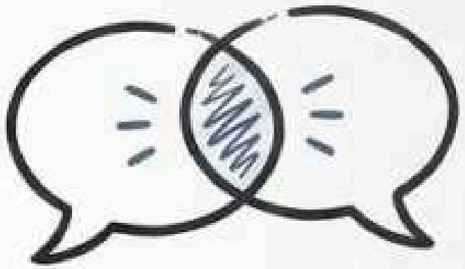
Advanced Disease Trajectory



Very low oxygen levels require Long-Term Oxygen Therapy (LTOT) for many hours a day to prolong life.



Flare-ups (exacerbations) triggered by infections. Require steroids, antibiotics, or hospital care.



As with heart failure, honest discussion of prognosis and end-of-life goals is important in later stages.

The Grand Synthesis: Obstructive Lung Diseases

Core Similarity: Both conditions obstruct airflow.

ASTHMA

- **Obstruction:** Variable.
- **Reversibility:** Largely reversible.
- **Primary Etiology:** Allergens, genetics, environmental triggers.

COPD

- **Obstruction:** Persistent.
- **Reversibility:** Progressive (Not fully reversible).
- **Primary Etiology:** Usually caused by smoke (tobacco or biomass).

Next: Transitioning from obstructive diseases to diseases that restrict the lungs' ability to fill.