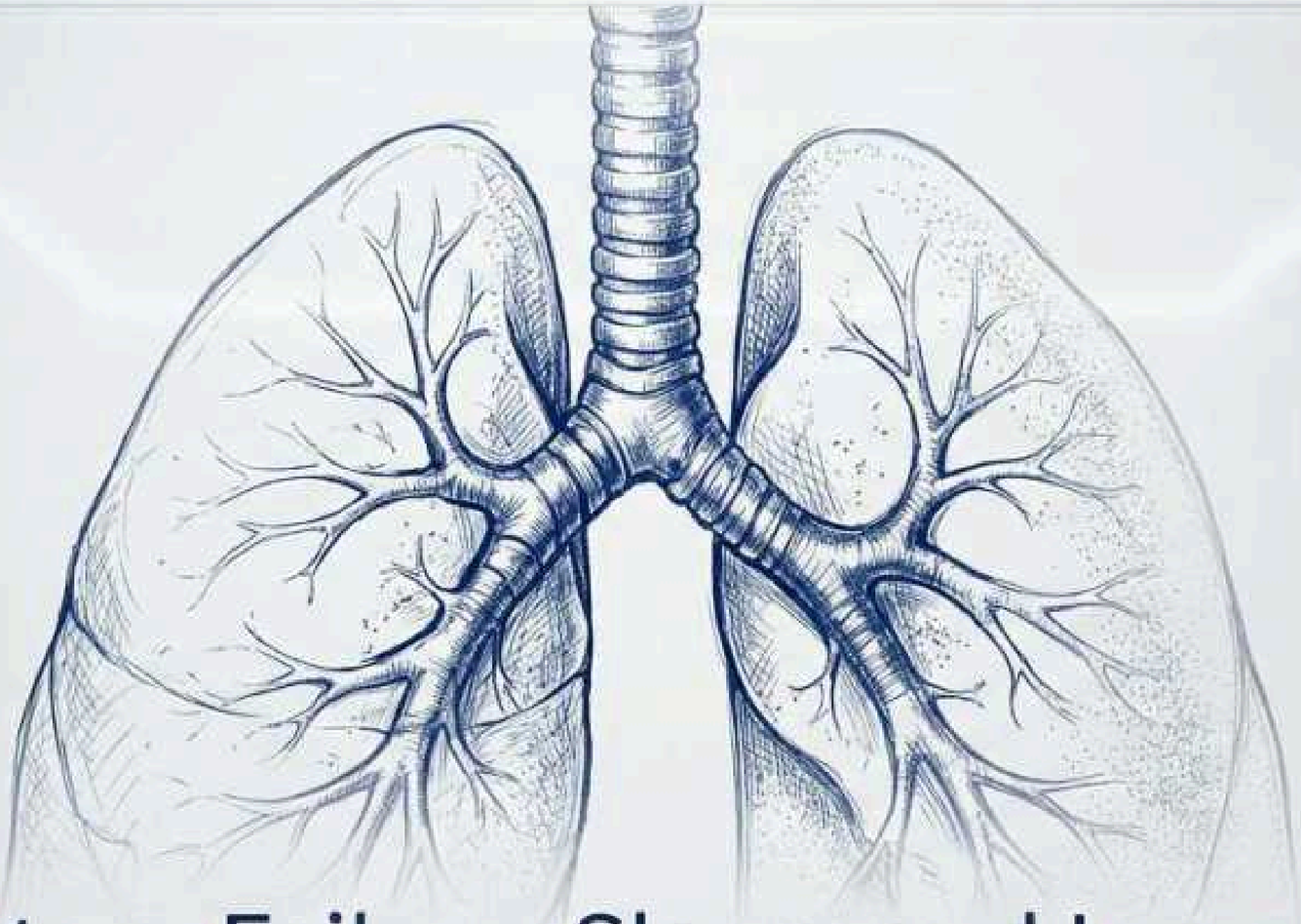
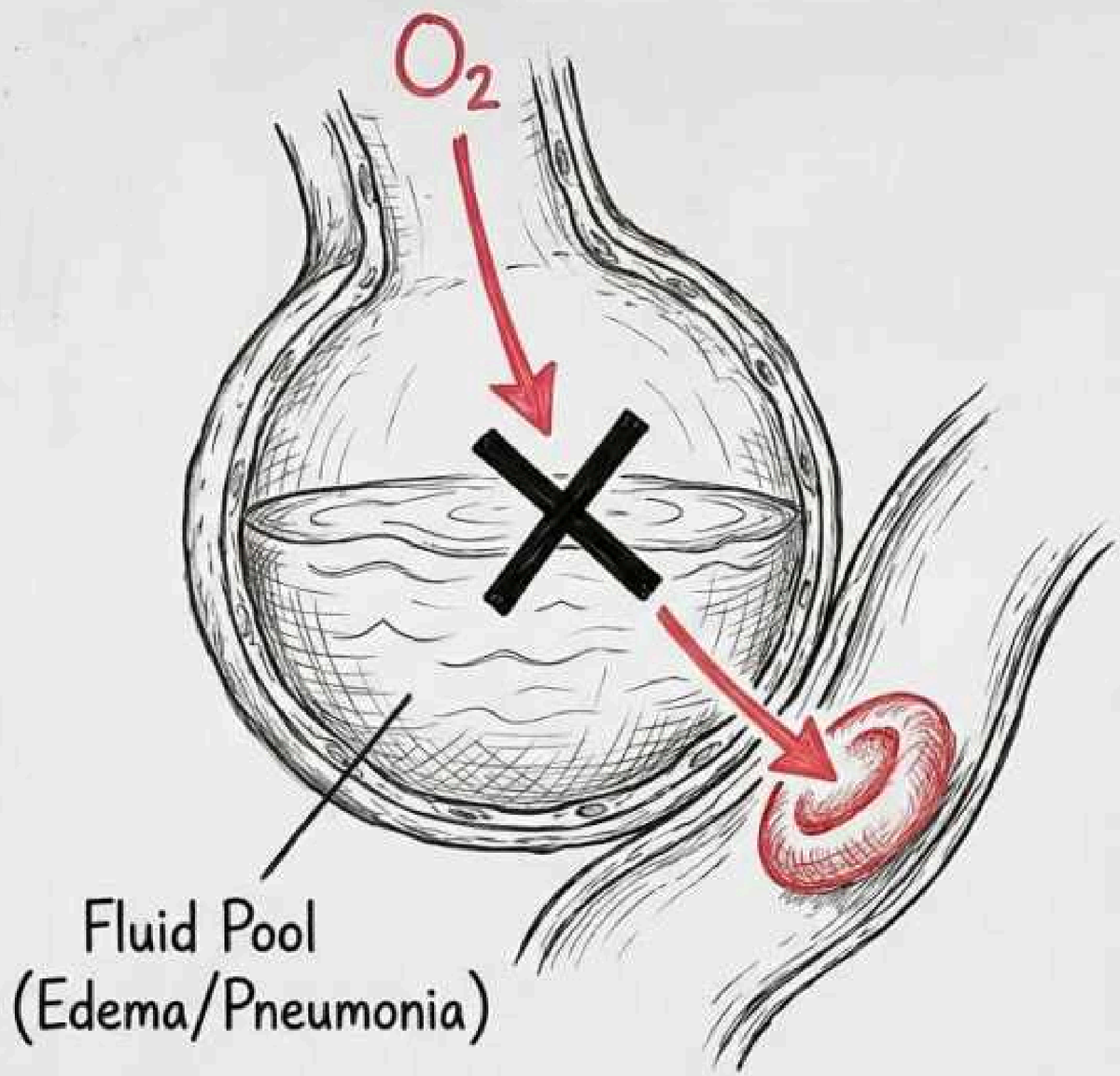
Lecture 6



# Respiratory Failure, Sleep, and Lung Cancer

MED 522 B | Lecture 6

A clinical overview mapping the spectrum of pulmonary pathology—from acute gas exchange failure to population-level disease prevention.



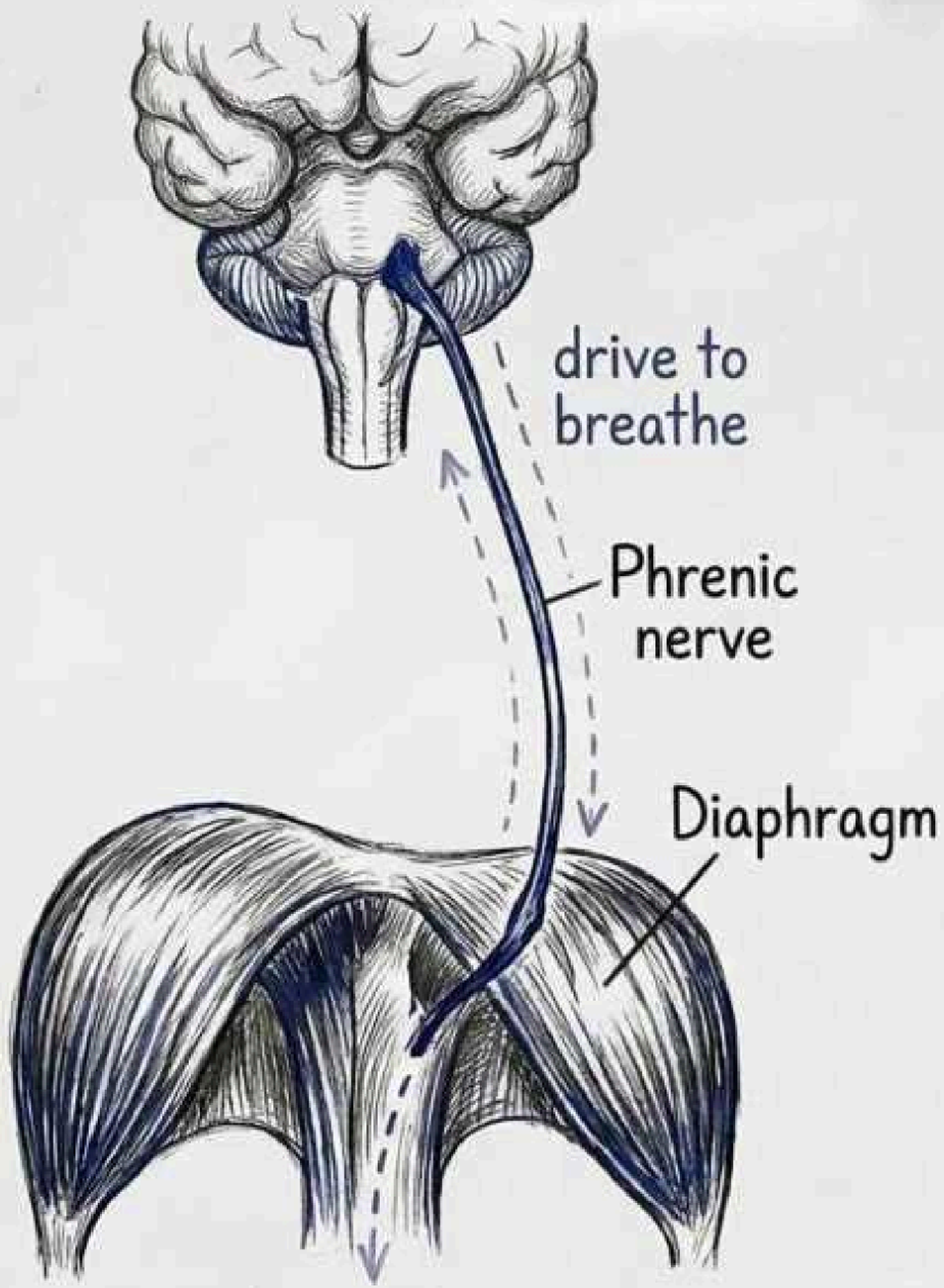

# $P_aO_2 \downarrow$ (Low Oxygen)

# $P_aCO_2 \approx$ or $\downarrow$ (Normal/Low Carbon Dioxide)

Core Definition: Respiratory failure occurs when the lungs cannot keep blood oxygen and carbon dioxide within safe limits.

Type 1 Mechanism: Gas Exchange Failure.

Etiologies: Pneumonia, fluid in the lungs (edema), pulmonary embolism.




$$P_aO_2\downarrow + P_aCO_2\uparrow \Rightarrow pH\downarrow$$

(Blood becomes acidic)

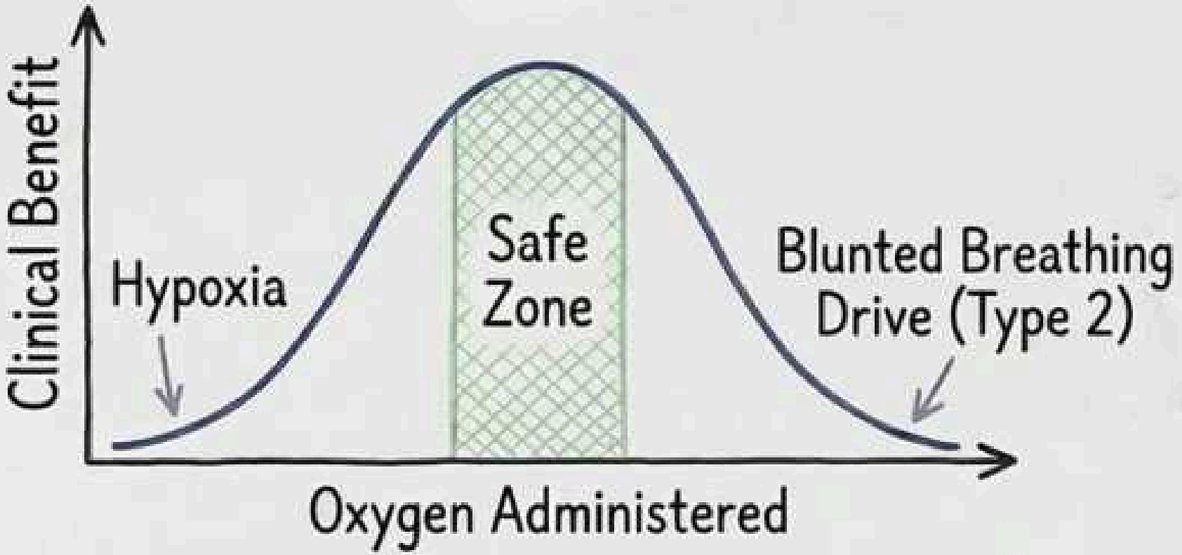
Type 2 Mechanism: Ventilation Failure (patient is not moving enough air).

Etiologies: Severe COPD, breathing muscle weakness, chest wall disease, brainstem-suppressing drugs.

Rising $CO_2$ → Drowsiness → Confusion → Coma



"Goldilocks" Activation Curve

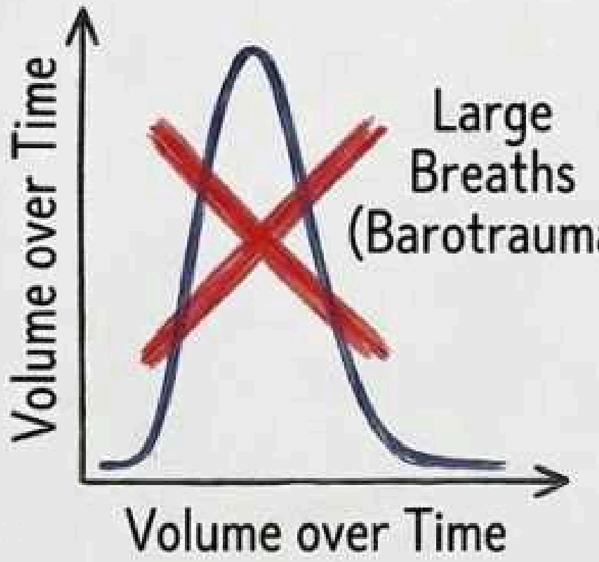


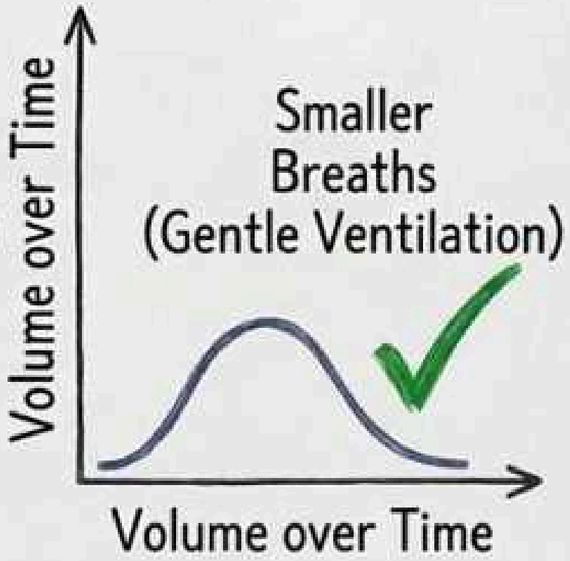

- Support Principle: Support the lungs while addressing the root cause.
- Oxygen Protocol: Target safe, not maximal, $O_2$ levels (crucial to preserve breathing drive in Type 2 patients).
- Non-Invasive Ventilation (NIV): Machine-connected tight-fitting mask; vital for COPD flare-ups; successfully reduces the need for invasive support.

¶6.4



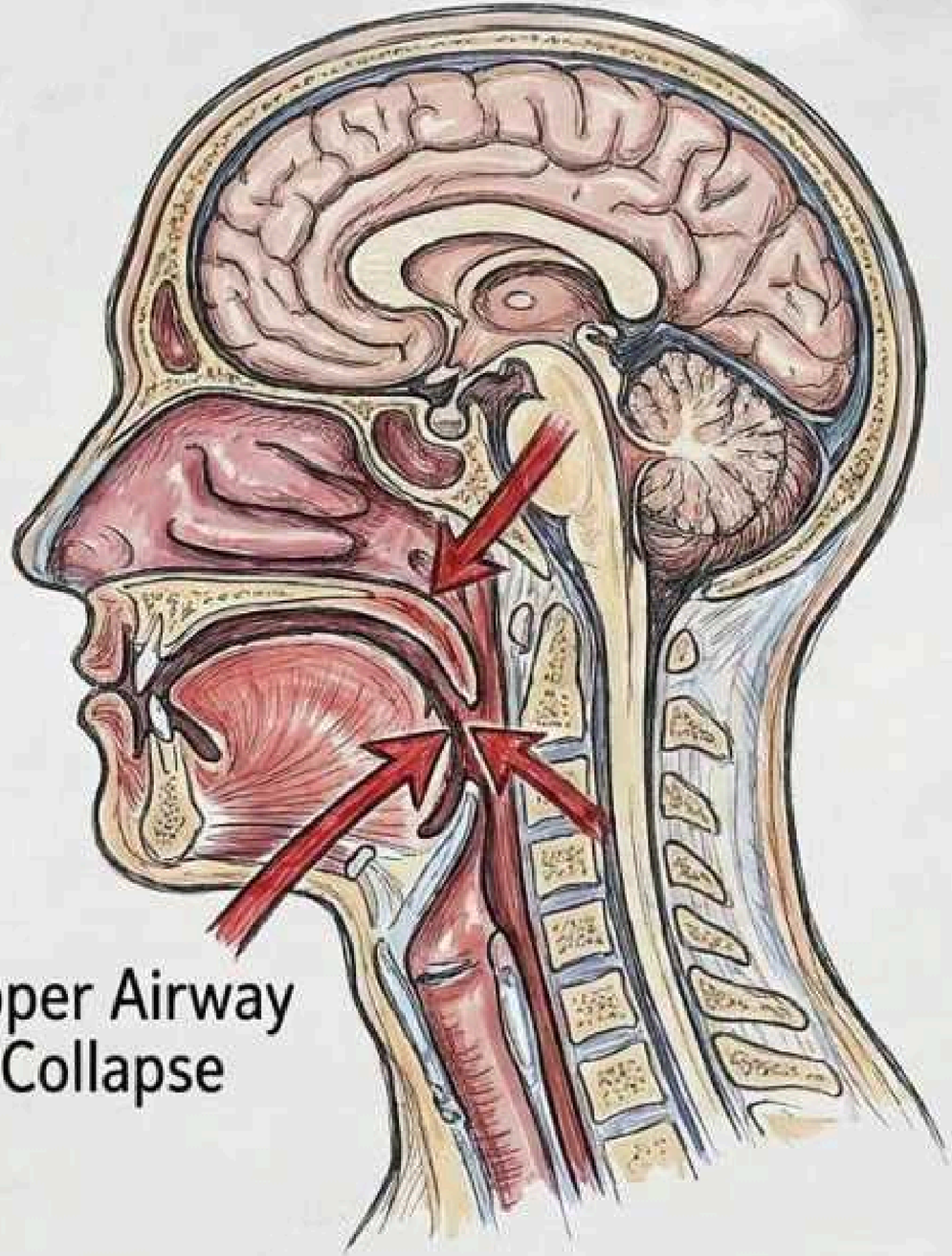
Acute Respiratory Distress Syndrome (ARDS) - Capillary Leak



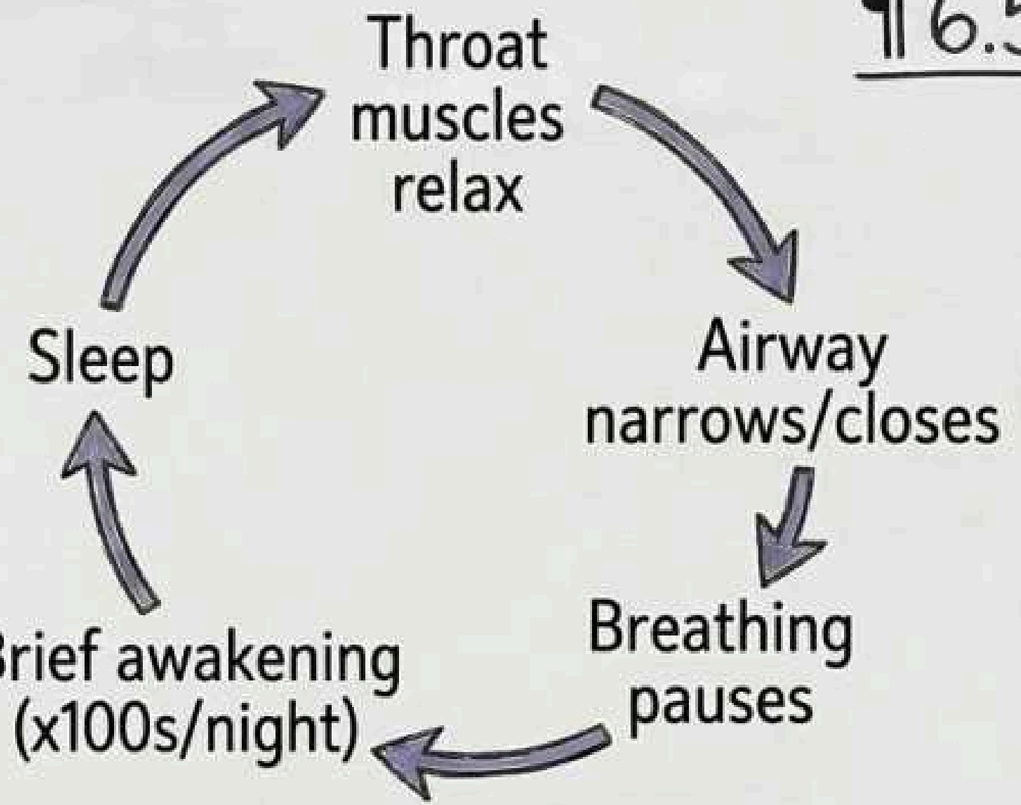




- Intensive Care: Endotracheal intubation in the windpipe for the most severely ill.
- ARDS Pathophysiology: Severe lung injury where alveoli fill with fluid following major insults (Sepsis, Severe Pneumonia, Major Trauma).
- Evidence-Based Protocol: Gentle ventilation minimizes pressure injury and saves lives.

¶6.5



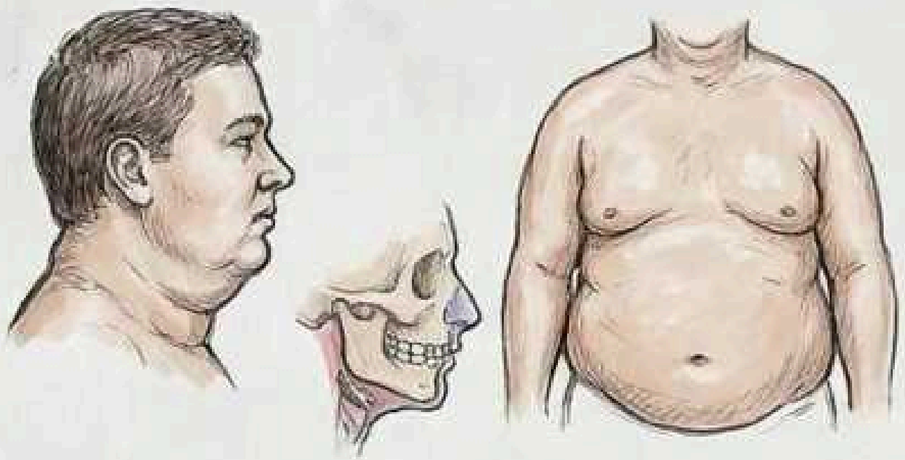
Upper Airway Collapse




- Epidemiology: Obstructive Sleep Apnoea is very common and often unrecognised.
- Diagnostic Triad:
  - Loud snoring
  - Observed breathing pauses
  - Daytime sleepiness

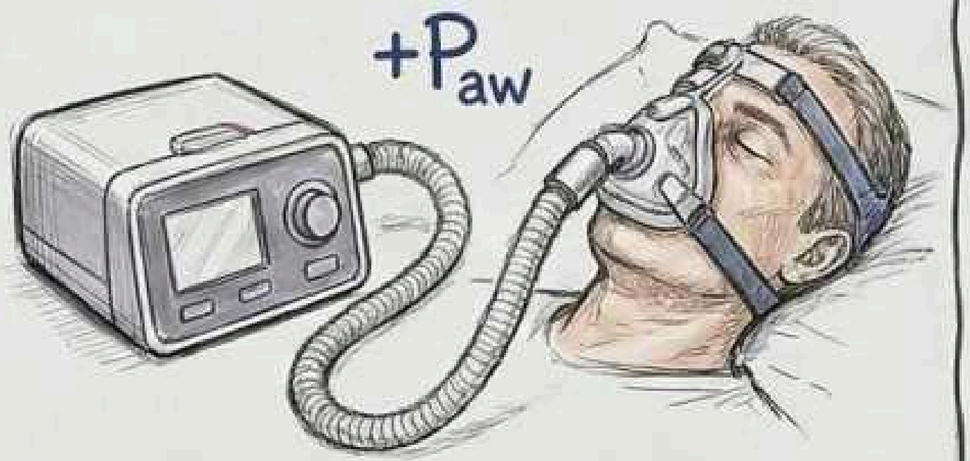
Diagnosis:
Formal sleep study.

## Inputs/Risks



Risk Factors: Obesity, large neck, specific jaw/throat shapes.

## Clinical Solution




Treatment: Continuous Positive Airway Pressure (CPAP) keeps airway stented open. Paired with weight loss.

## Outputs/Consequences

- High Blood Pressure
- Heart Disease
- Increased Road Accidents

Lifestyle changes to norweick

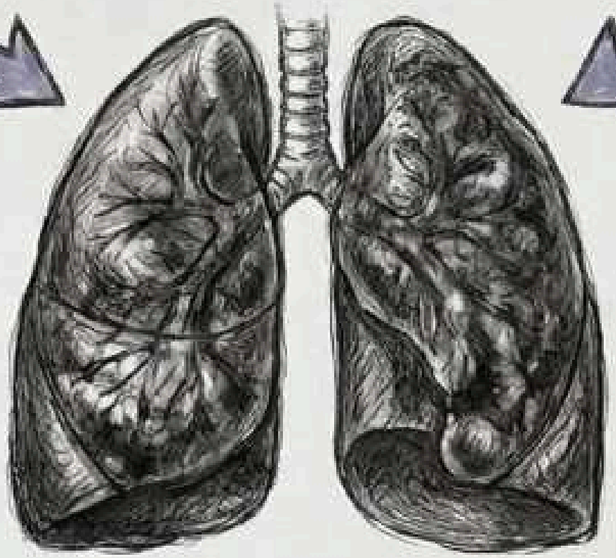
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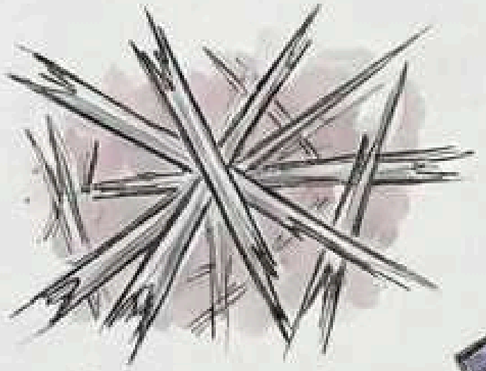


Smoking
(Primary Culprit - Doll & Hill)

$^{222}Rn$

Domestic Radon Gas





Asbestos Fibers



Air Pollution &
Second-hand Smoke

Global Burden: The leading cause of cancer death worldwide.
Shifting Demographics: A growing share of cases now occurs in people who have never smoked.

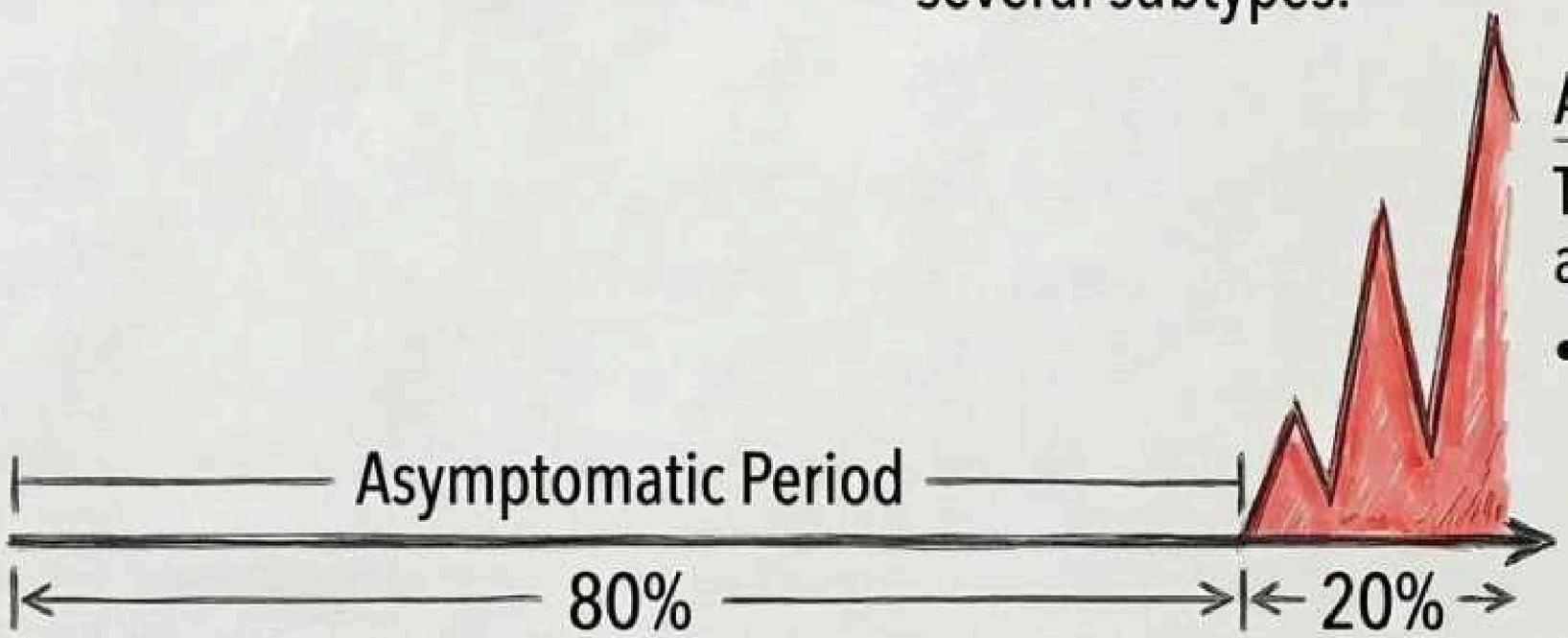
# Lung Cancer

## Small Cell (SCLC)

Grows and spreads rapidly; strongly linked to smoking.

## Non-Small Cell (NSCLC)

More common; encompasses several subtypes.




## Advanced Disease

The Clinical Catch: Symptoms appear only when advanced.

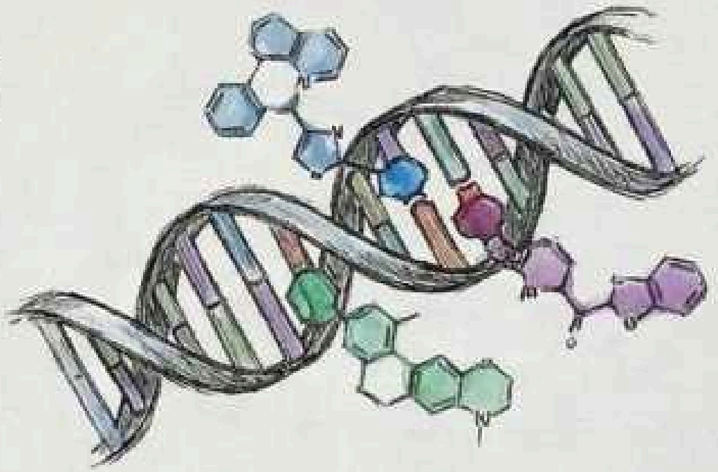
- Red Flag Symptoms:
  - Persistent cough
  - Hemoptysis (coughing blood)
  - Weight loss
  - Breathlessness

¶6.9

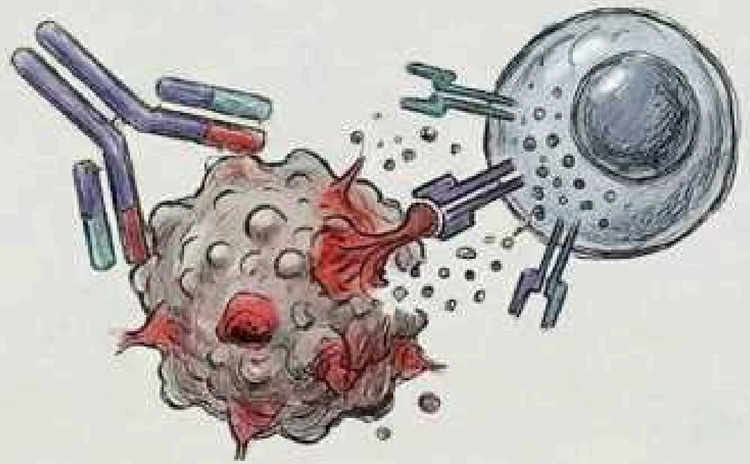
## Early Stage

- Potentially curable via surgery or targeted radiotherapy.

## Advanced NSCLC Revolution



1. Targeted Drugs: Attack specific genetic tumour mutations.

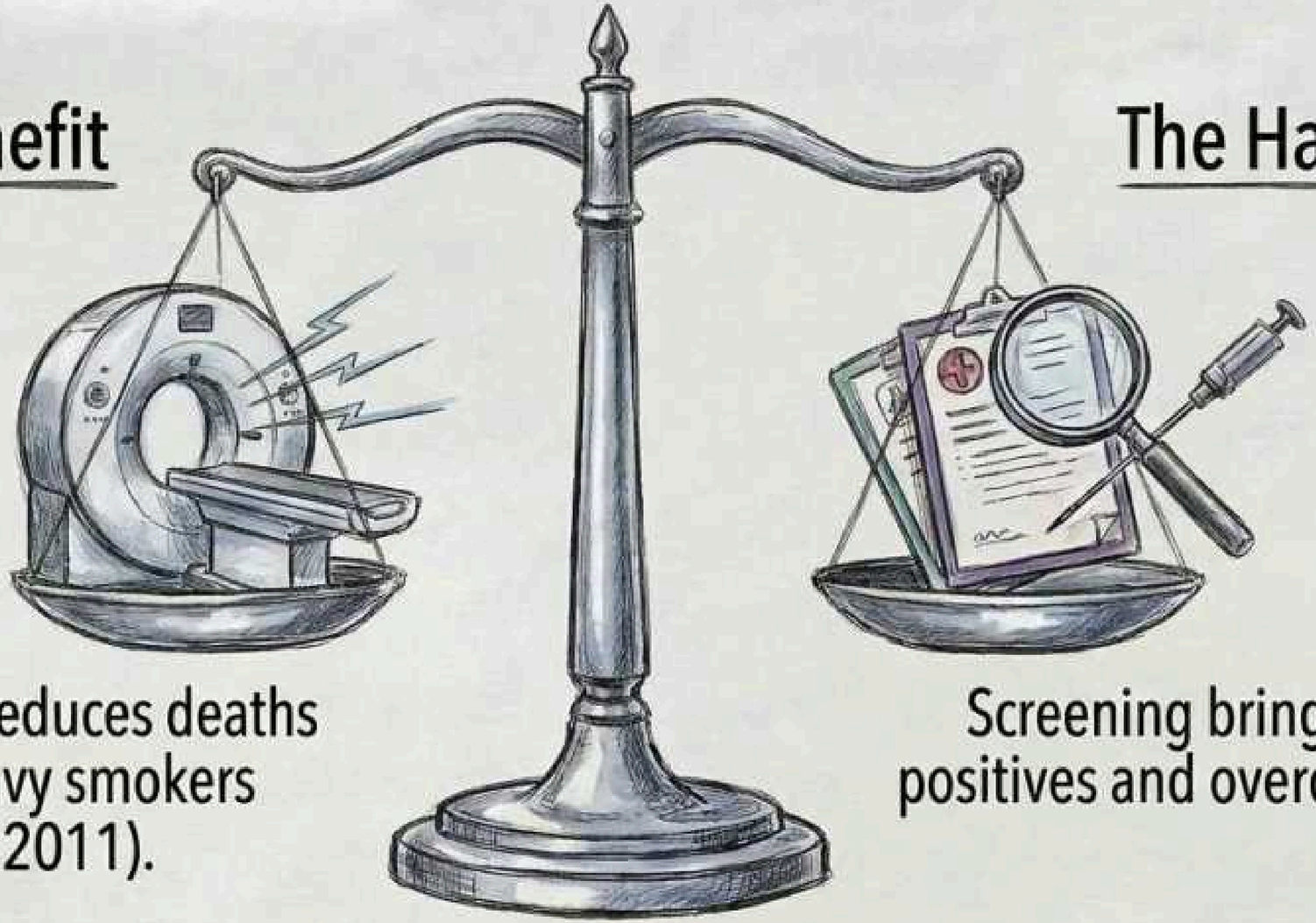


2. Immunotherapy: Equips immune system to attack cancer.

**Modern Standard of Care**: Tumour genetic testing is now mandatory to guide all treatment.

## The Benefit

## The Harm

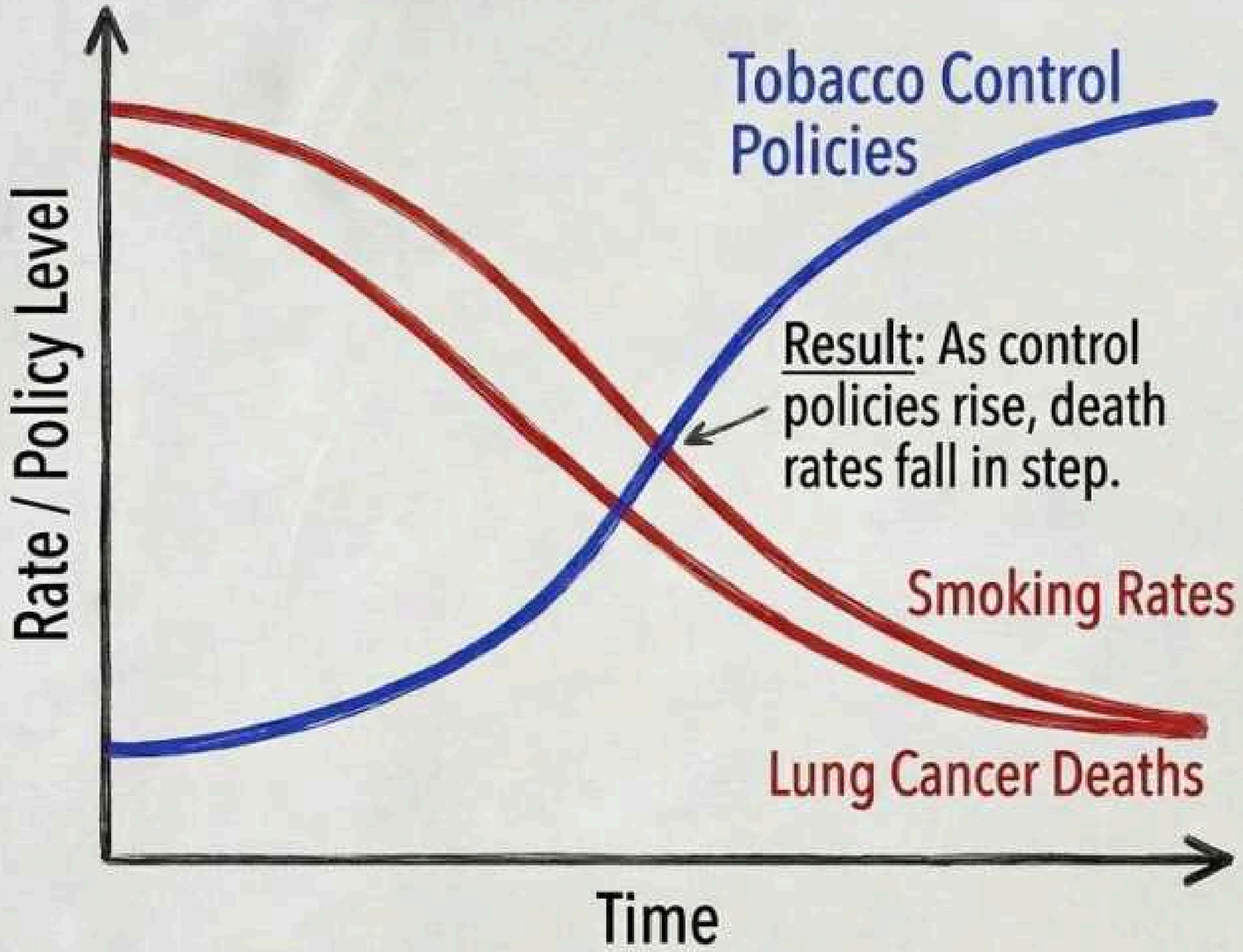


Low-dose CT reduces deaths among heavy smokers (NLST, 2011).

Screening brings false positives and overdiagnosis.

**The Targeted Approach**: Screening must be strictly restricted to high-risk populations.

**The Mandatory Pairing**: Screening programmes must explicitly include smoking cessation support.

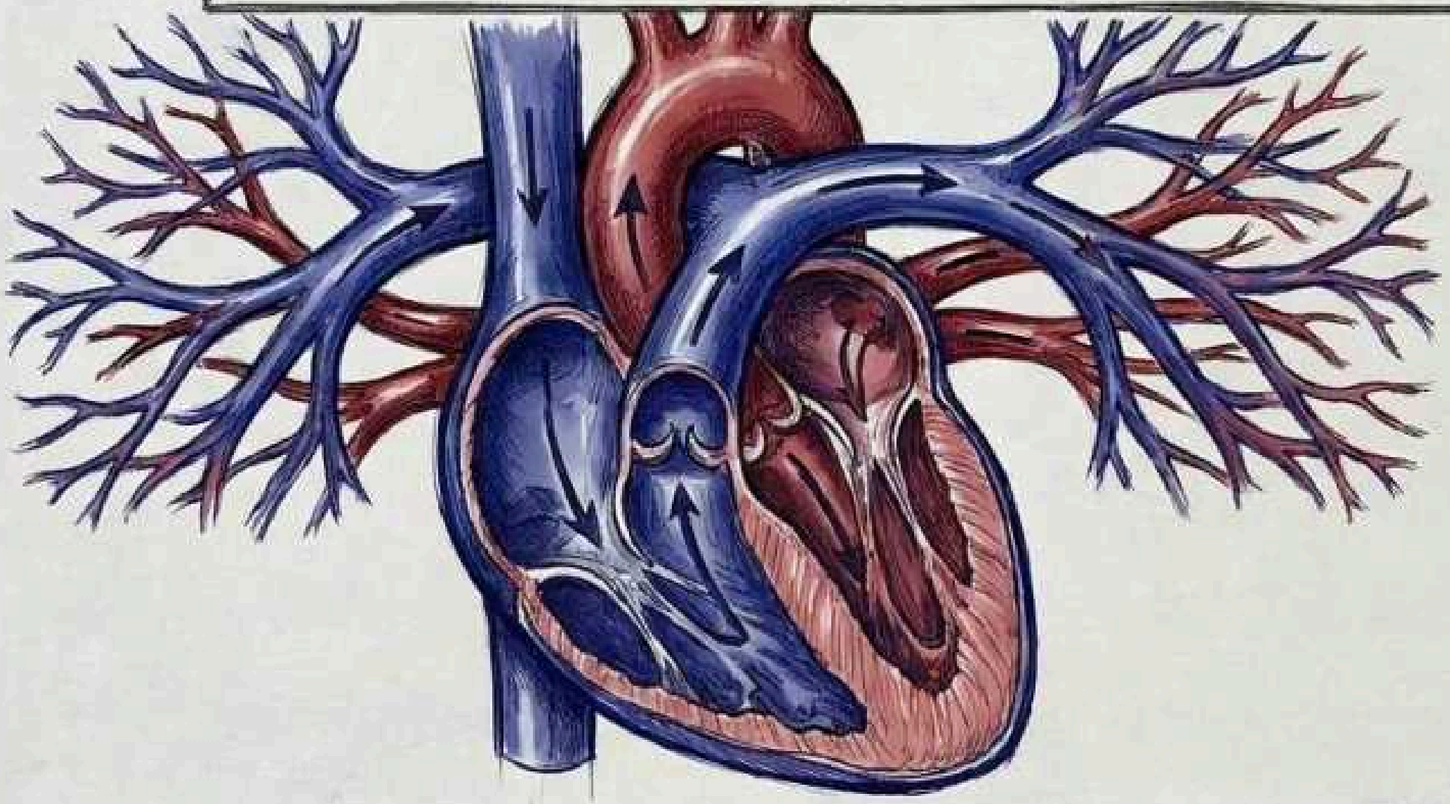



## Public Health Pillars

- **The Foundation:** Tobacco control (taxes, smoke-free laws, advertising bans, cessation help).
- **Environmental Action:** Cleaner air, safer workplaces, cleaner cooking fuels.
- **Biological Shield:** Vaccination against respiratory infections.

¶6.12

| Obstruction | Restriction | Impaired Gas Exchange |
| --- | --- | --- |
| | | |
| Differentiate using: Spirometry \| Gas Transfer \| Blood Gases \| Imaging | | |



**The Anatomical Rule:** Never forget the right heart and the pulmonary circulation.

**The Final Word:** Most lung disease is preventable.

**Questions/Feedback:**
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