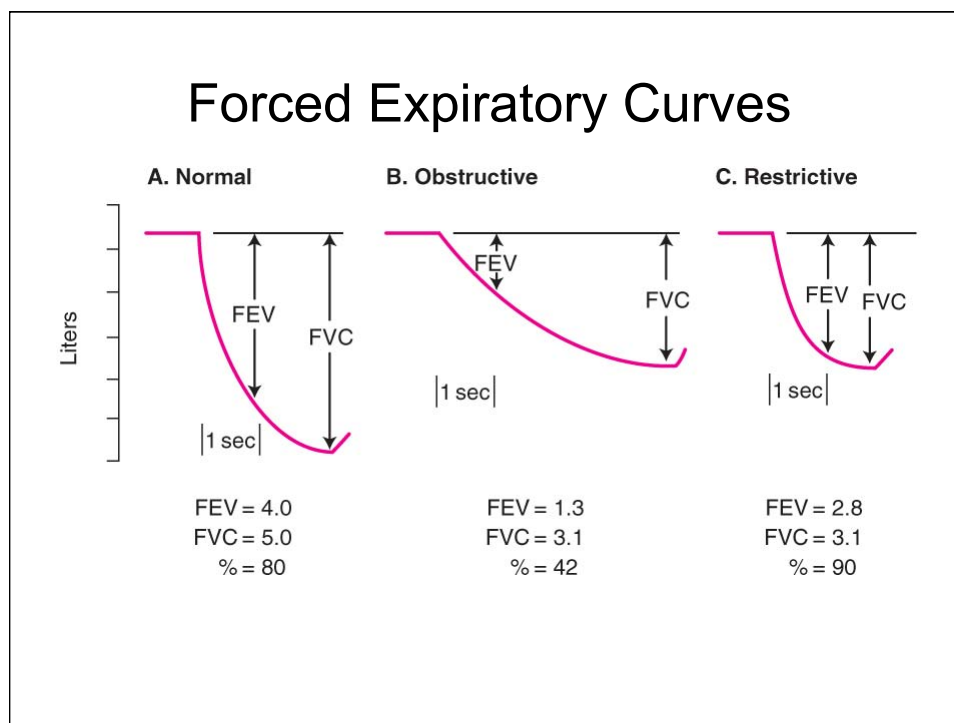


Causes of low FVC

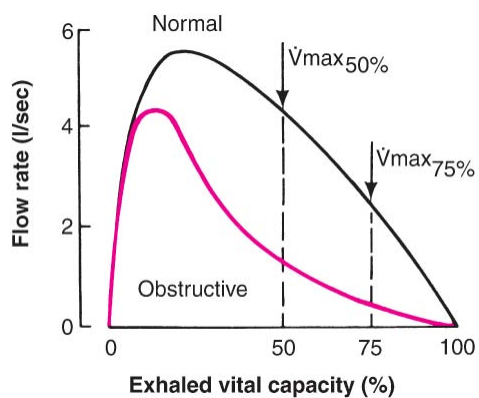
- Reduced lung volume
- Gas trapping
- Poor effort



Spirometry Definitions

- Obstructive ventilatory defect
 - $FEV_1/FVC < 0.70$
 - $FEV_1/FVC < \text{lower limit of normal}$
- Restrictive ventilatory defect
 - $TLC < \text{lower limit of normal}$

Flow Volume Loop



Respiratory System Mechanics

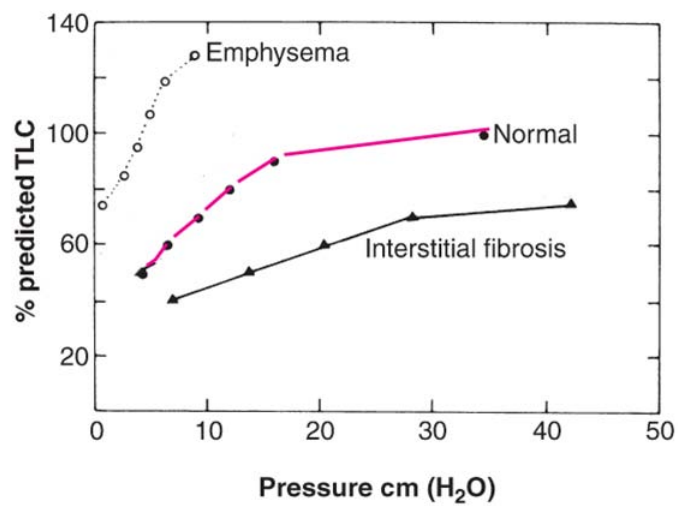
- Respiratory System Compliance
- Airway Resistance

Respiratory System Compliance

- Chest wall and Pleura compliance
- Lung compliance

$$\text{Compliance} = \frac{1}{\text{Elastance}} = \frac{\Delta \text{volume}}{\Delta \text{pressure}}$$

Pressure-Volume Curves



Airway Resistance during Laminar Flow

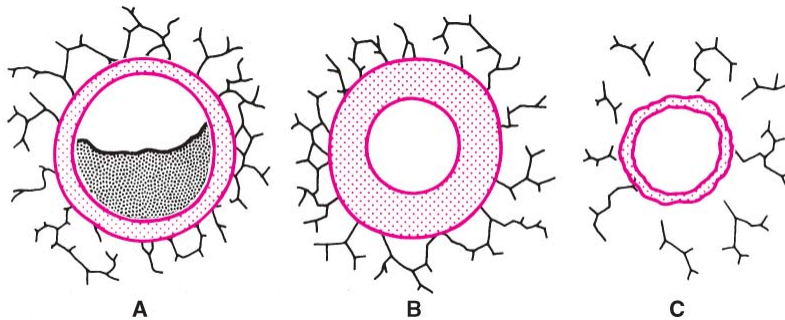
Ohm's Law

$$\dot{V} = \frac{\Delta P}{R}$$

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

\dot{V} = flow rate
 ΔP = driving pressure
 r = radius of the tube
 η = viscosity
 l = length of the tube

Mechanisms of airflow obstruction



Intraluminal:
e.g., Secretions

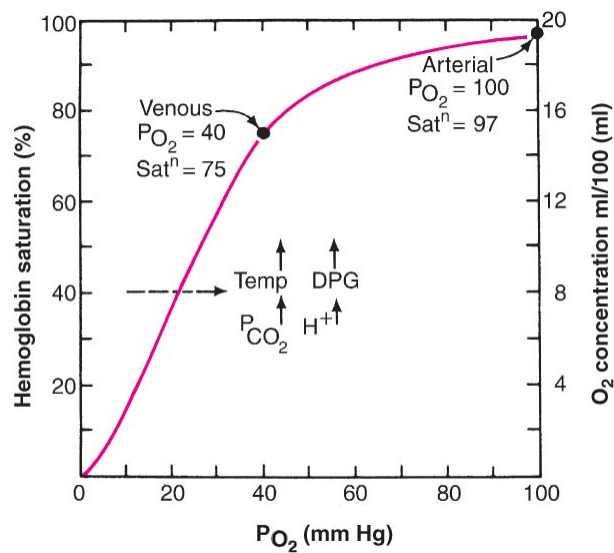
Intramural:
e.g., Edema

Extraluminal:
e.g., Loss of radial traction

Alveolar Gas Equation

$$P_A O_2 = P_I O_2 - \frac{P_A CO_2}{R}$$

Oxyhemoglobin Dissociation Curve



Causes of reduced DLCO

- Blood-gas barrier is **ABNORMAL** or **REDUCED** in size
 - Thickened in interstitial lung disease
 - Area is reduced in emphysema, pneumonectomy
- Alveolar capillary hemoglobin **REDUCED**
 - Volume reduced in pulmonary embolism
 - Concentration of red cells reduced in anemia

Alveolar Ventilation Equation

$$P_aCO_2 \propto \frac{\dot{V}_{CO_2}}{\dot{V}_A}$$

Some Causes of Hypoventilation

1. Depression of the respiratory center by drugs (e.g., barbiturates)
2. Diseases of the medulla (e.g., encephalitis, hemorrhage, neoplasms [rare])
3. Abnormalities of the spinal cord (e.g., following high dislocation)
4. Anterior horn cell disease (e.g., poliomyelitis)
5. Diseases of the nerves to the respiratory muscles (e.g., Guillain-Barré)
6. Diseases of the myoneural junction (e.g., myasthenia gravis)
7. Diseases of the respiratory muscles (e.g., muscular dystrophy)
8. Thoracic cage abnormalities (e.g., crushed chest)
9. Upper airway obstruction (e.g., tracheal compression by the thymoma)

