

Pulmonary ventilation

Forces for pulmonary ventilation

Air flows from an area of high pressure to one of low pressure

Bulk flow: movement of fluids or gases from higher pressure to lower pressure $F = \Delta P / R$

Boyle's law: for any gas in a container, the pressure $1/\alpha$ to the volume of the container

Pulmonary pressures

	(1) Intra-alveolar Pressure (P_{alv})	(2) Intra pleural pressure ($P_{i.p}$)	(3) Transpulmonary pressure ($P_{alv} - P_{i.p}$)
Definition	the pressure of air <i>inside alveoli</i>	the pressure <i>inside the pleural space</i> . It is always -ve in normal conditions	the pressure difference between intra-alveolar & intra-pleural pressure.
Values	1- During inspiration: (-1 mmHg) 2- During expiration: (+1 mmHg) 3- At the ends of inspiration & expiration: (0 mmHg)	1- At end of normal expiration = -4 mmHg. 2- At end of normal inspiration = -6 to -8 mmHg 3- During forced inspiration with the glottis closed (Muller's experiment) = -30 to -40 mmHg 4- During forced expiration with the glottis closed (Valsalva's experiment) = +50 mmHg	Transpulmonary pressure = $P_{alv} - P_{i.p}$ = 0 mmHg - (-4 mmHg) = 4 mmHg.
Functions		1- It helps lung expansion . 2- It helps venous & lymphatic return to the heart	It is the force that expands the lungs .

Causes of negativity of the intrapleural pressure

(1) **The recoil tendency of the lungs:** due to:

1- **Elasticity** of the lungs \Rightarrow "1/3" of the recoil tendency.

2- **Surface tension** of the fluid lining alveoli \Rightarrow "2/3" of the recoil tendency.

(2) **The expansion tendency of the chest wall:** due to elasticity of muscles & tendons.

Pneumothorax

Definition: presence of air in the intra-pleural space.

Types: (1) External (opened) pneumothorax:

Cause: stab wound or gunshot wound to the chest \Rightarrow opens the chest wall & pleural sac.

\Rightarrow Loss of the negative intrapleural pressure

(2) Internal (closed) pneumothorax:

Cause: lung disease e.g. pneumonia damages the wall of the visceral pleura

\Rightarrow air from inside the lungs enters the intrapleural space.

Effects: 1-The lungs collapse while the chest wall expands.

2- \downarrow venous return & lymph flow.

