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

<table>
<thead>
<tr>
<th>(1) Intra-alveolar Pressure ($P_{alv}$)</th>
<th>(2) Intra-pleural pressure ($P_{i.p}$)</th>
<th>(3) Transpulmonary pressure ($P_{alv} - P_{i.p}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>the pressure of air inside alveoli</td>
<td>the pressure inside the pleural space. It is always -ve in normal conditions</td>
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<tr>
<td>Values</td>
<td>1- During inspiration: (–1 mmHg) 2- During expiration: (+1 mmHg) 3- At the ends of inspiration &amp; expiration: (0 mmHg)</td>
<td>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</td>
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<tr>
<td>Functions</td>
<td>1- It helps lung expansion. 2- It helps venous &amp; lymphatic return to the heart</td>
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</table>

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- $\downarrow\downarrow$ venous return & lymph flow.