

: By

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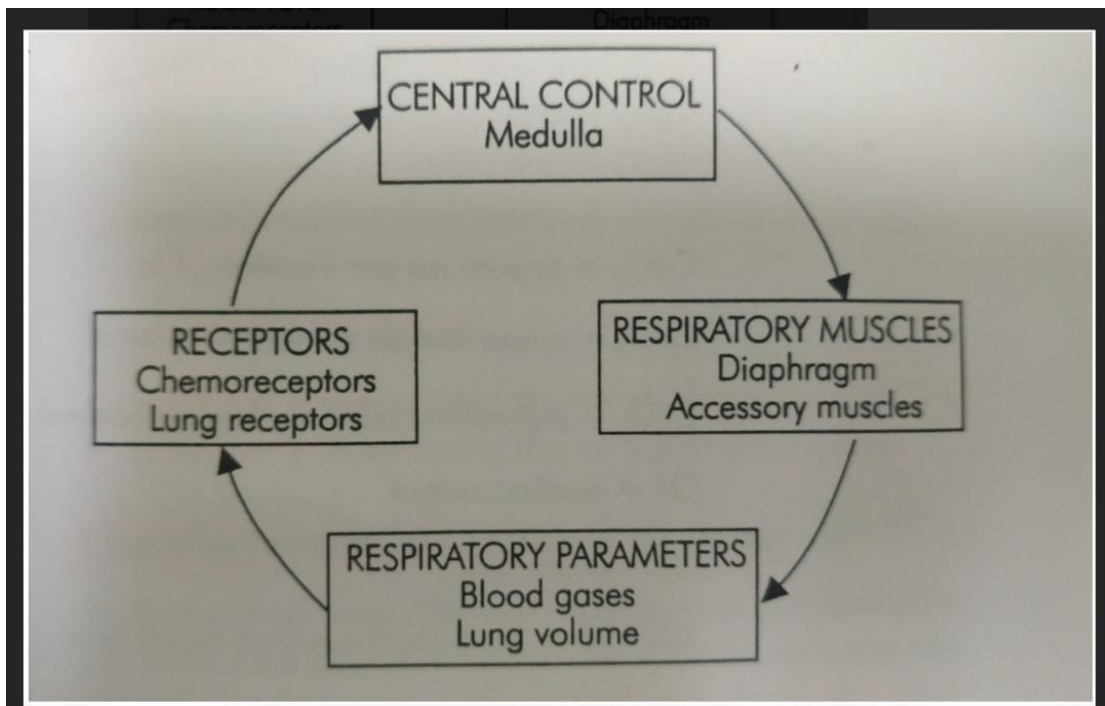
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Respiration

The respiratory gas exchange need mechanics of breathing that need

1. central control of breathing(brain).
2. mechanical properties of lung & thoracic cage, (compliance, volume, capacity muscle contraction of diaphragm & inter costal muscles).
3. blood circulation pulmonary circulation.
4. air pressure gradient (difference).

:central control



Pressure gradient (difference) -

*Intrathoracic pressure = Intrapulmonary pressure & intrapleural pressure.

***atmospheric pressure** (pressure of environment).

All the mechanism of breathing depends on pressure gradient between inside the lung & the outside (our environment).

Atmospheric pressure: weight of air volume column on earth & it is measured on sea level.

Compliance:

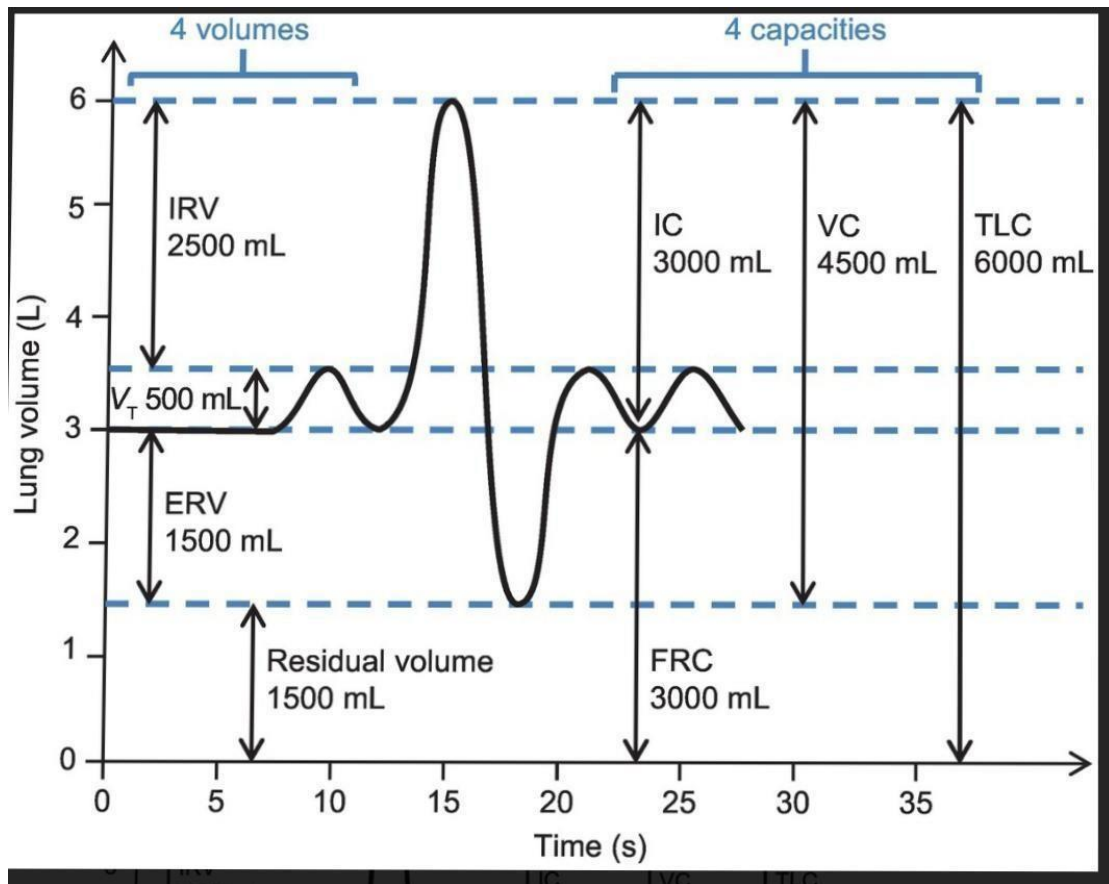
Lung compliance & thoracic cage compliance. The compliance is the change in volume according to applied force, So when the muscles contract, the thoracic cage increase in size by its

compliance, so any injury in diaphragm, ribs fracture, lungs injury or disease can cause decrease compliance & limits the respiratory mechanics

The 4 lung volumes:

Tv , Irv , Erv , Rv

Tv (tidal volume): its volume of air that is inhaled & exhaled at each single breath .



Irv (inspiratory reserved volume) : volume of air that can be inhaled forcefully after normal tv .

Erv (expiratory reserved volume) : its volume of air that can exhaled after normal tv .

Rv (residual volume) : volume of air that is remain in lung after maximum exhalation .

Lung capacities:

$$\mathbf{TLC = Tv + Irv + Erv + Rv}$$

$$\mathbf{VC = Tv + Irv + Erv}$$

$$\mathbf{IC = Tv + Irv}$$

Functional residual capacity : FRC :Its small volume of air that stay in the alveolar sac after end of each respiratory cycle that keep small airways & alveoli opened & prevent its collapse .

Factors affect Frc :

1. Age increase
2. Sex : female less than male 10%
3. Posture:) position)
4. upright>sitting>prone>lateral>supine
5. Obstructive lung disease : increase
6. Restrictive lung disease : decrease
7. Restriction of lung compliance (pneumonia) or (fluid in lung) ,
8. Diaphragm tearing or on GA all decrease frc

GA: general anesthesia has more than reason to cause decrease in frc :

Paralysis of diaphragm , supine position , relax of inter costal muscles & others

Increase intra abdominal pressure :

Decrease frc : pregnancy , obesity , ascites

Positive end expiratory pressure (PEEP)

It's a +ve pressure applied at end of expiration ,to prevent collapse of alveoli & small air way during mechanical ventilation

What's the difference between PEEP & FRC :

Frc is a normally volume of air present in the alveoli at end of expiration , while **PEEP** is applied by anesthesiologist during mv because frc decrease during GA & mechanical ventilation .

You applied it by data on ventilator ; maximum 3-5 cmH₂o . &this is the Externisc PEEP .

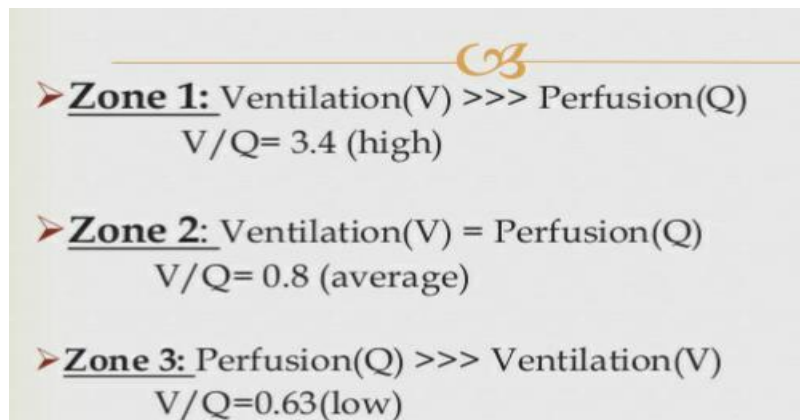
Internisc PEEP ; auto PEEP : it is created in especial lung diseases that lead to the expiratory time shorter than normal ; in complete expiration .

So air trapped inside alveoli & build a +ve pressure that lead to serious complications (pneumothoracic); like in obstructive lung disease : asthma .

Alveolar ventilation : gas exchange between environment & alveoli .

Alveolar perfusion : gas exchange between alveoli & blood .

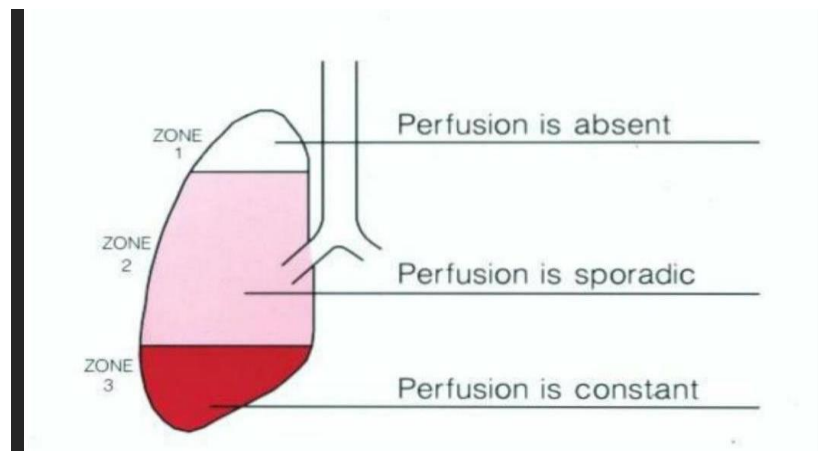
V/Q ratio = 0.8



The diagram illustrates three zones of the lung based on the ventilation-perfusion (V/Q) ratio. It features a decorative flourish at the top center. The zones are listed as follows:

- Zone 1:** Ventilation(V) >>> Perfusion(Q)
V/Q= 3.4 (high)
- Zone 2:** Ventilation(V) = Perfusion(Q)
V/Q= 0.8 (average)
- Zone 3:** Perfusion(Q) >>> Ventilation(V)
V/Q=0.63(low)

Perfusion (blood supply) : of the lung it affected by gravity into 3 zones , according to blood supply



Dead space : is the area in the respirator system that not share in gas exchange ; it is :

physiological dead space = anatomical + functional

Anatomical dead space : parts of respiratory systems not share in gas exchange (conducting system).

Functional dead space : parts of alveoli that not have gas exchange because of less or no perfusion .

Common causes of increase dead space

age ,pulmonary disease , smoking ,GA :

long breathing circuit or wrong one

Physiologic Dead Space

