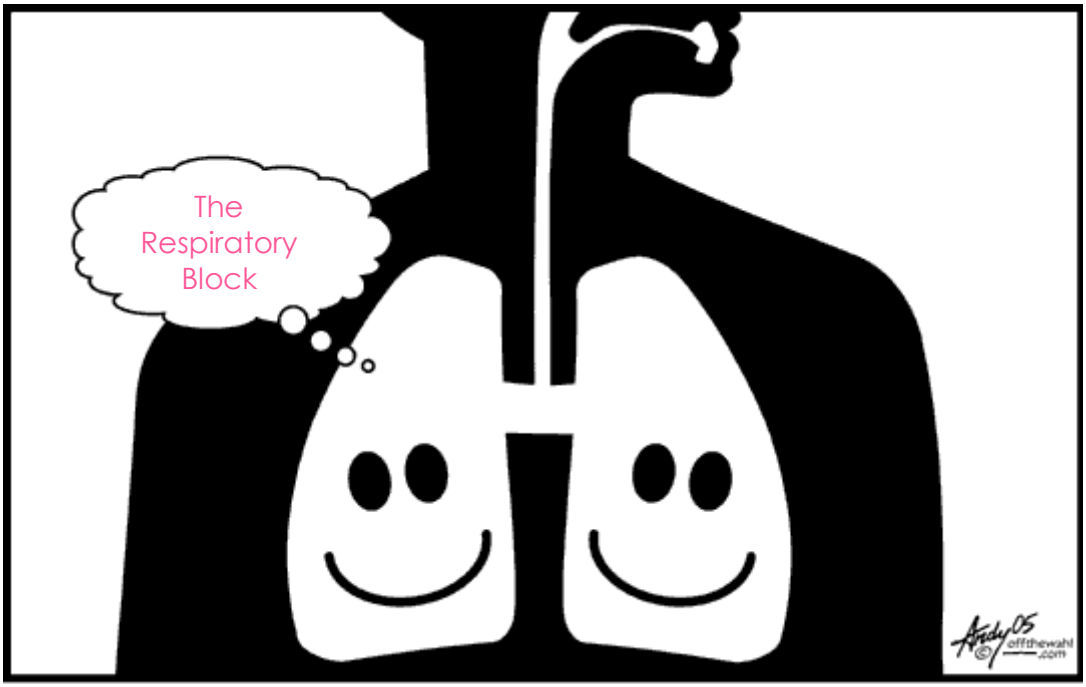
# The Physiology Team




Amna Baljoun
Maha Balharth
Hanan Al Harthy
Maitha Al Mousa
Najd Al Shamlan
Somia Al Amri
Afnan Al Tamimi
Ameera Al Jaber
EditedBy: Nourhan Elshamma'

هذه المذكرة للمذاكرة قبل الاختبار وهي تقريبا شاملة لكل شيء في المحاظرة

We did our best and I hope our best is enough

# Respiratory Ventilation

- if we want to evaluate the function of the lung we have to measure its' volumes and capacities .

We measure them by the spirometre.

## The Lung Volumes:

1. **Tidal volume** → is the air we inhale or exhale in normal inspiration or expiration = 500 ml
2. **Inspiration reserve volume** →amount of air forced in the lung after relaxed inspiration (( above the TV)) = 3000 ml
3. **Expiratory reserve volume →** amount of air forced out of the lung after relaxed expiration (( above the TV )) = 1100 ml
4. **Residual volume** → is the amount of air remaining in the lung after deep expiration = 1200 ml

## The lung capacities :

The sum of 2 or more volumes

1. ***Inspiratory capacity*** → volume of air starting from resting level with deep inspiration → TV + IRV = 3500 ml
2. ***Functional residual capacity*** → the amount of air stayed in the lung after normal expiration → RV +ERV = 2300 ml
   - it has some important functions
   - ✓ 1- gas exchange between the breaths → prevent the fluctuation of gases concentration in blood between breaths.
   - ✓ 2-prevent collapsing of the alveoli
3. ***Vital capacity*** → volume of air that could be expired by force expiration after forced inspiration starting from resting level → TV+IRV+ERV = 4600

4.***Total lung capacity*** → amount of air inside the lung after forced inspiration starting from resting level → TV+IRV+ERV+RV =5800 ml

- ✓ All lung volumes and capacities are higher in males, athletes and in altitudes.
- ✓ *the RV can't be measured by the normal spirometry so we add some helium with the air.

We chose the helium because our bodies can't absorb it and it will be trapped inside the lung.

We wait till the amount of air is balanced between inside and outside the lung, then we measure it by this equation

**$C_1 \times V_1 = C_2 \times V_2$**

C1= initial conc. Of helium

C2= the conc. At the end

V1 = the volume of air in the spirometry

V2 = the functional residual capacity (FRC) <<< this is what we want to measure

* FRC = (ci He / cf He) -1

## ***Air Flow :***

- it depends on the pressure gradient ( from high to low)

Increase in the pressure difference → increase of flow

***two Types of Flow:***

1- Turbulent flow → in the big air ways
2- Laminar flow → after passing the air ways

## ***Factors affecting ventilation :***

1- Lung compliance → elasticity and surface tension
2- Airway resistance

- it depends on → type of flow, the diameter "cross section" and the viscosity of the gas

*Resistance =pressure difference / rate of flow

- increase in the diameter → decrease in resistance (( trachea has more resistance than the bronchioles))
- increase in the lung volume → decrease in the resistance " increase in diameter "

## *Timed vital capacity (forced vital capacity1 )*

It is the vital capacity but the expiration is performed as rapidly and as forcibly as possible into a spirometer which measure the maximum amount of air determination that can be expelled in a given number of seconds.FEV1 is the percentage of the vital capacity that can be exhaled in the first second.

*the changes in the duration and the variation due to the diameter of the airways could be physiological and could be pathological

* The people who have asthma have problem with the expiration because of the airway resistance the patient cannot expired passively which make the FVC prolong.

## FEV1 / FVC Ratio :

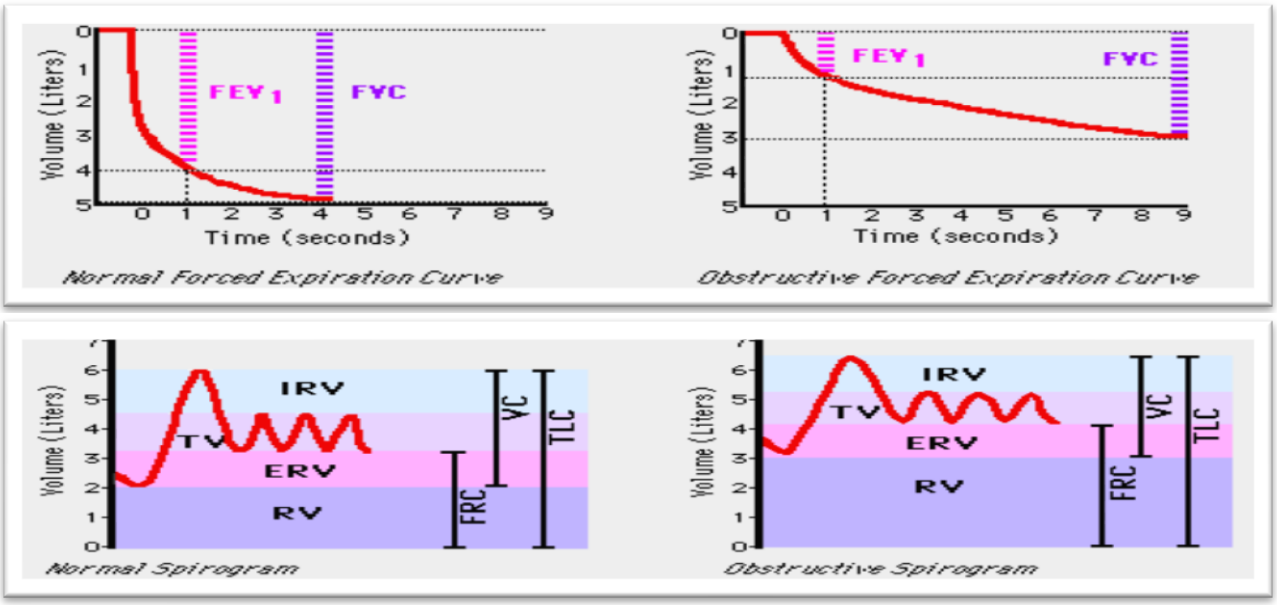
Normally it is 80% but it may changes due to lung diseas.

* Measurement of FEV1 / FVC ratio is used to detect obstructive & restrictive disorders.

*In restrictive lung disease* **(**e.g. pulmonary fibrosis, pleural effusion,and lung tumors)which decrease the surfaces area and then the total lung volume , the vital capacity is reduced below normal. The problem is in the inspiration ( increased of lung volume)because the fibrosis tissue ; however the expiration is not affected FEV1/FVC% will be normal so **FEV1 / FVC ratio is normal**

***In obstructive lung disease*** (e.g., acute asthma, emphysema, bronchitis), the vital capacity is usually normal because lung tissue is not damaged, but expiration is more difficult and takes a longer time due to the resistance to air flow by airways.

So there will be significantly **decrease in the FEV1 /FVC ratio** below 80%, with increased residual volume




## Respiratory minute volume (or minute ventilation ) :

It is the volume of air which can be inhaled or exhaled from a person's lungs in one minute

- ***MRV = Respiratory rate x Tidal volume***
- ***= RR X TV***
  ***= 12 X 500 = 6L/min.***

***it could rise to 200 L/min or more than 30 times normal if RR = 40 TV=*** 4600 ml in young adults man ***and athlets.***

## Alveolar ventilation:

Rate of alveolar ventilation per min
not all of TV reach the respiratory unite. 150 ml go to the conductive zone{ dead space volume} and 350 ml they will do the gas exchanges (alveolar air per breath)

*Alveolar ventilation per min= 350* RR= 4200ml/min this is the total volume of new air entering the adjacent gas exchange area each minute.

## Dead spaces :

1-*Anatomical* → is the volume of air present in the conductive part of the respiratory passages= 150 ml
2-*physiological space* (it is related to the function of the alveoli)
On occasion some of the alveoli are none functioning or partially functioning due to absent or poor blood flow by the pulmonary capillaries so no gas exchange can occur.

* Under normal conditions, alveolar dead space equals zero and when it increase can Indicates lung diseases.

## Work of breathing :

require energy) present mainly in inspiration
* it is divided to 3 parts :
1- **Compliance work or elastic work** (it is related to the elastic fibers) change in lung volume and pressure against the elastic force of lung and chest ..
**2-Tissue resistance work** ( related to proteins like collagen fibers ) to overcome the viscosity of the lung and chest wall structures.
**3-Airway resistance work** (related to airway diameter )required to overcome airway resistance during the movement of air in the lungs..

## The Energy Required

3-5% of total energy expended by the body **and it may rise to** 50 folds during heavy exercise.
During pulmonary disease it will increase in all types of work.
*decrease in the work of breathing can be due to decrease in the surfactant