RESPIRATION PRACTICALS

SPIROMETRY

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Objectives

- Use a spirometer and determine lung volumes and capacities
- Define and provide values for the various lung volumes and capacities
- Recognize the physiological and some pathological factors that modify lung volumes and capacities

What is spirometry ?

Spirometry is a pulmonary function test that measures lung volumes and capacities

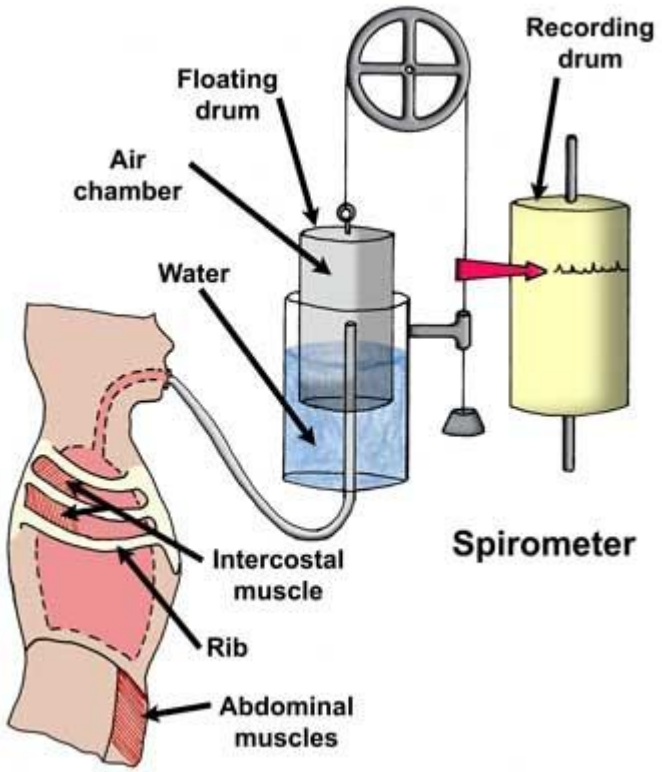
Why a spirometry test ?

- To determine the cause of shortness of breath.
- To rule out any kind of obstructive or restrictive disease.
- To diagnose and monitor lung problems.
- To monitor how well medications for lung problems are working .

Simple Spirometer

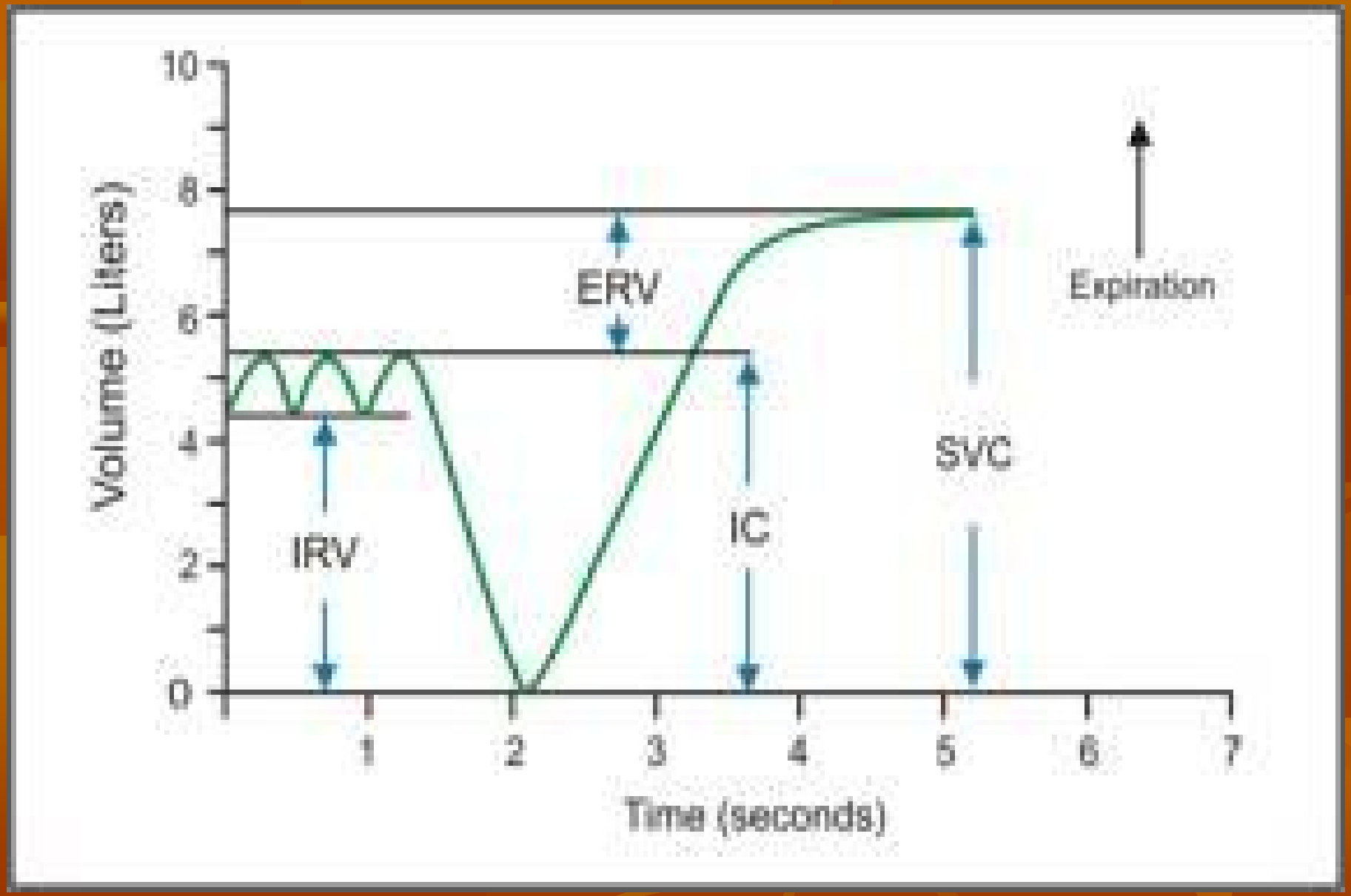
- Drum inverted over a chamber of water with the drum counterbalanced by a weight
- In the drum is air or Oxygen
- A Tube connects the mouth with the gas chamber
- When one breathes in and out of the chamber, the drum rises and falls and an appropriate recording is made on a moving paper

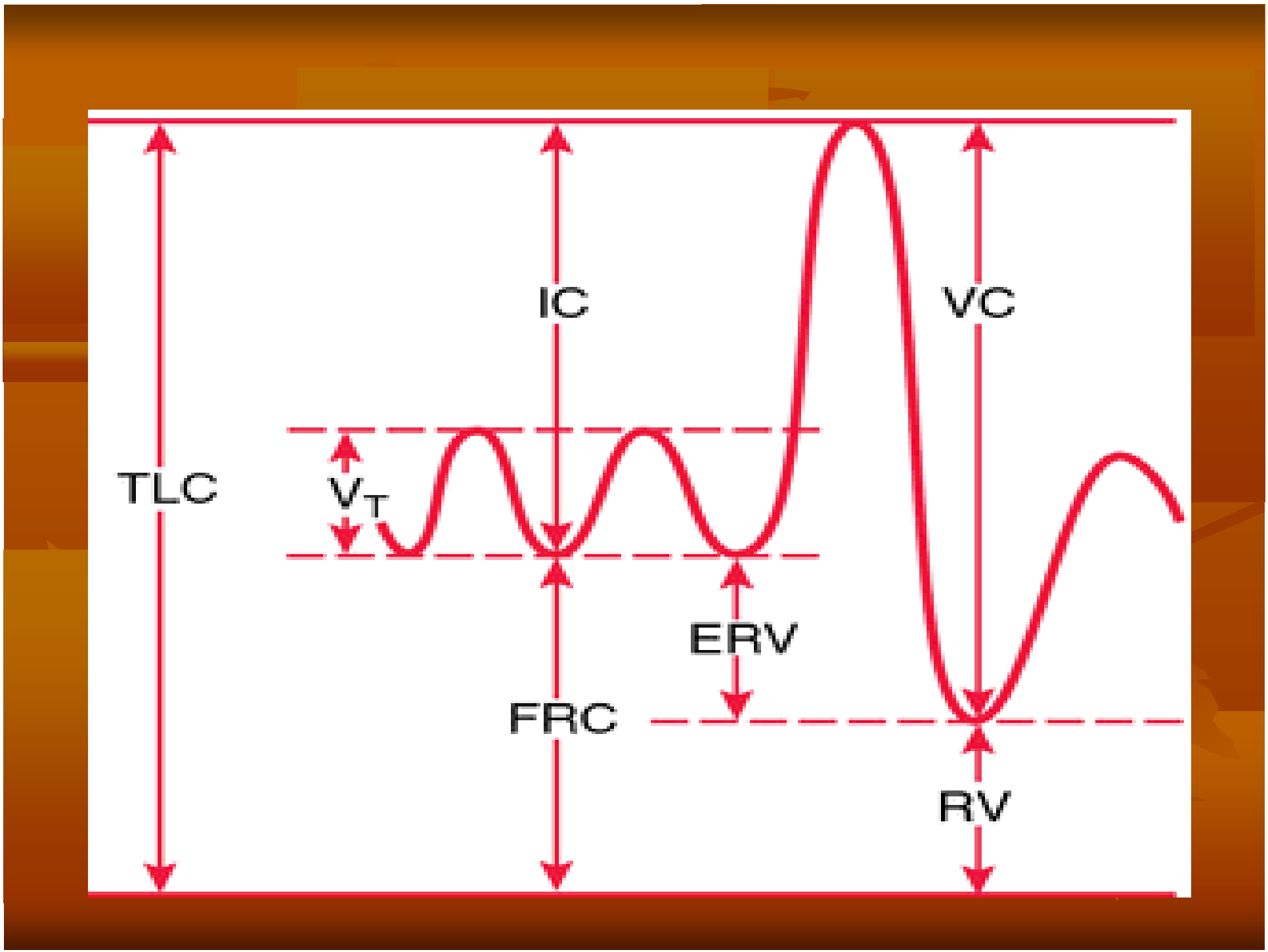
Spirometer

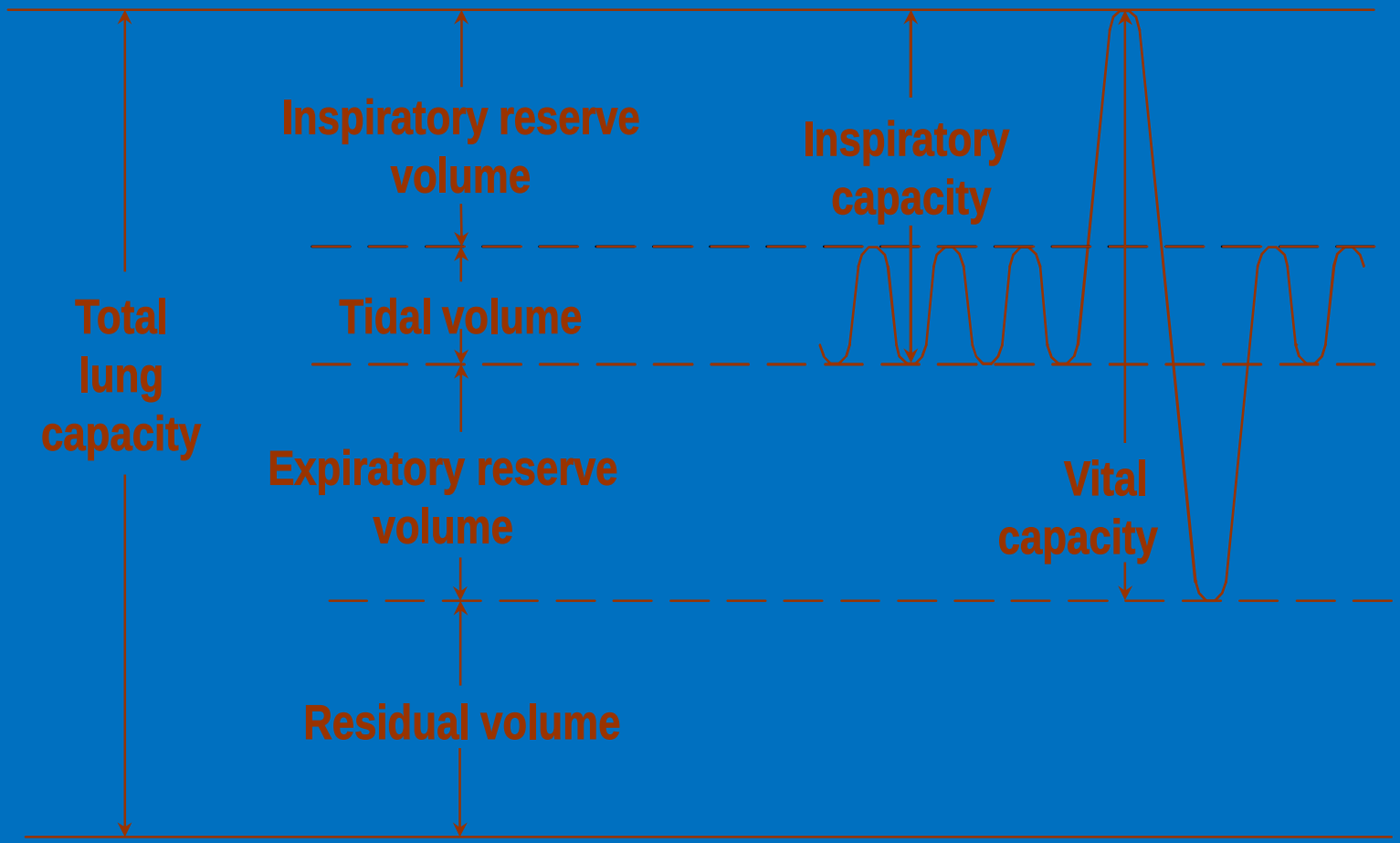

Recording drum
Floating drum
Air chamber
Water
Intercostal muscle
Rib
Abdominal muscles
Spirometer

Method

- Insert a sterilized mouthpiece
- Close the nose with the nose clip
- Take a normal breath through the mouthpiece for a short time then take a deep inspiration to fill the lungs completely, then breathe normally for a short time.
- Expire, forcibly as completely as possible, then breathe normally for a short time.
- Take a deep forceful inspiration and immediately expire forcibly and as completely as possible, then breathe normally.
- The spirogram is recorded on a moving drum


Volume (Liters)
10
8
6
4
2
0
ERV
IRV
IC
SVC
Expiration
1
2
3
4
5
6
7
Time (seconds)


IC
VC
TLC
V_T
ERV
FRC
RV


Inspiratory reserve volume
Inspiratory capacity
Total lung capacity
Tidal volume
Expiratory reserve volume
Vital capacity
Residual volume

The air in the lungs can be subdivided on this diagram into 4 volumes and 4 capacities:

Lung volumes

- Tidal volume:

The amount of air that moves into the lungs with each inspiration (or the amount that moves out with each expiration) = 500ml.

- Inspiratory reserve volume:

The extra volume of air that can be inspired above the normal tidal volume = 3000ml

- Expiratory reserve volume:

The volume expelled by an active expiratory effort after passive expiration (after the end of a normal tidal expiration) = 1100ml

- Residual volume:

The air left in the lungs after the most forceful expiration = 1200ml

Lung Capacities

- **The inspiratory capacity :**

IC= TV+IRV

The amount of air a person can breathe beginning at the normal expiratory level and distending the lungs to the maximum amount = 3500ml

- **The functional residual capacity :**

FRC= ERV+RV

The amount of air that remains in the lungs at the end of normal expiration =2300ml

- **The vital capacity**:

VC= IRV+TV+ERV

The maximum amount of air a person can expel after maximal inspiration = 4600ml

- **The total lung capacity**:

TLC= VC+RV

The max volume to which the lungs can be expanded with the greatest possible inspiratory effort = 5800ml

Physiological factors influencing lung volumes and capacities

- **Sex: female 20-25% less**
- **Age: ↓ VC**
- **Obesity: ↓ VC**
- **Height: ↑VC**
- **Athletes: ↑ VC**

Pathological factors

Vital capacity is decreased with :

- ↓lung volume:

eg: surgical removal of lung tissues
large tumors

- Restrictive lung disease: inability to fully expand the lungs.

eg: Pneumonia, pulmonary edema, broken ribs

- Obstructive lung disease

eg: Chronic bronchitis, asthma, foreign body

- Loss of elastic recoil

eg: emphysema

THANK YOU...