

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

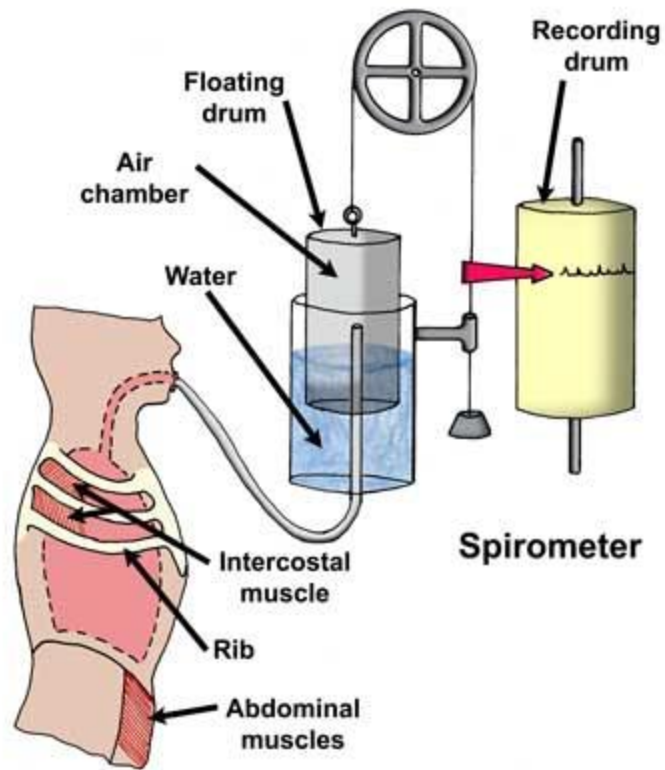
Why a spirometry test ?

- 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

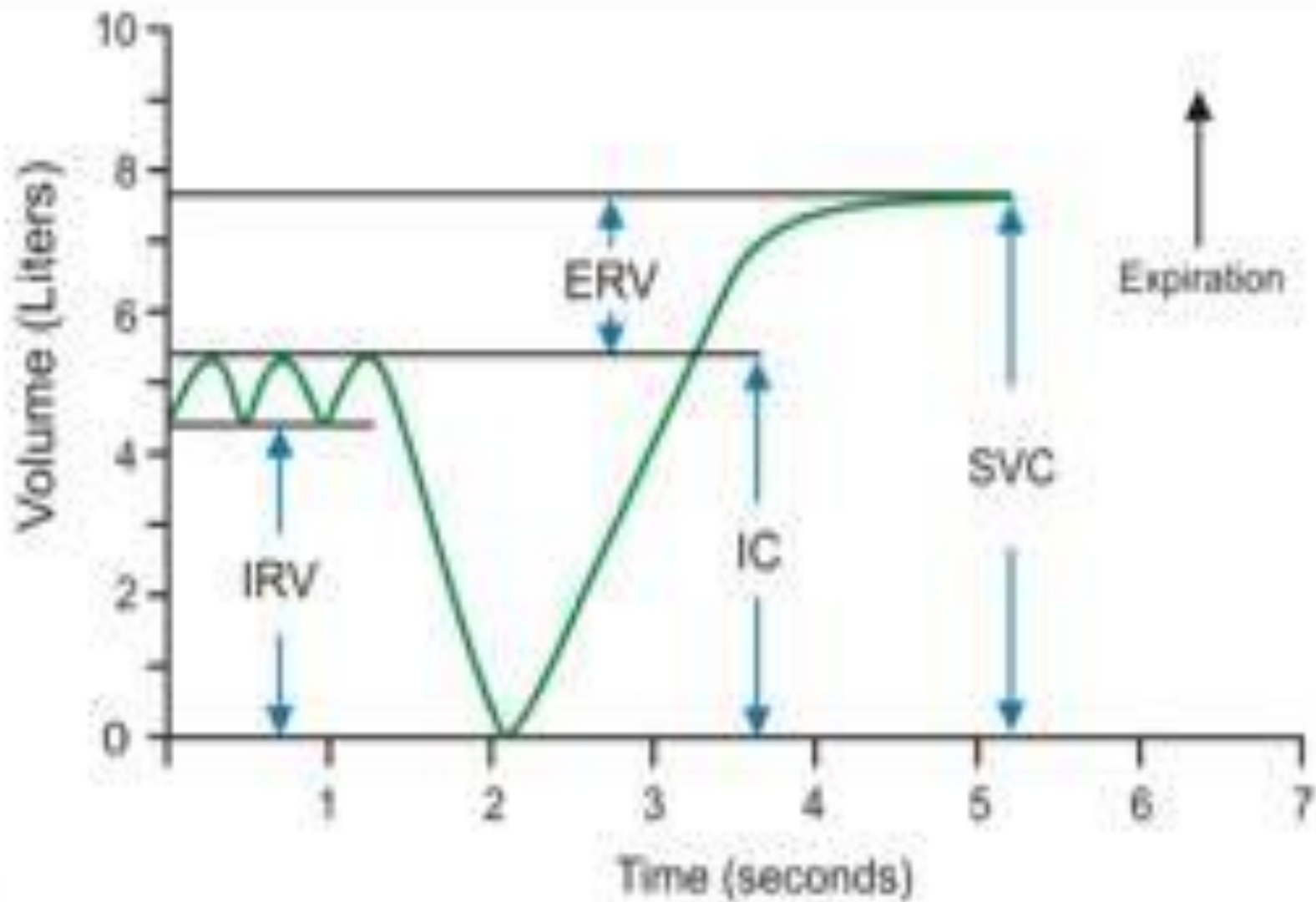
- Drum inverted over a chamber of water with the drum counterbalanced by a weight
- In the drum is air or Oxygen
- A Tube connects the mouth with the gas chamber
- When one breathes in and out of the chamber, the drum rises and falls and an appropriate recording is made on a moving paper

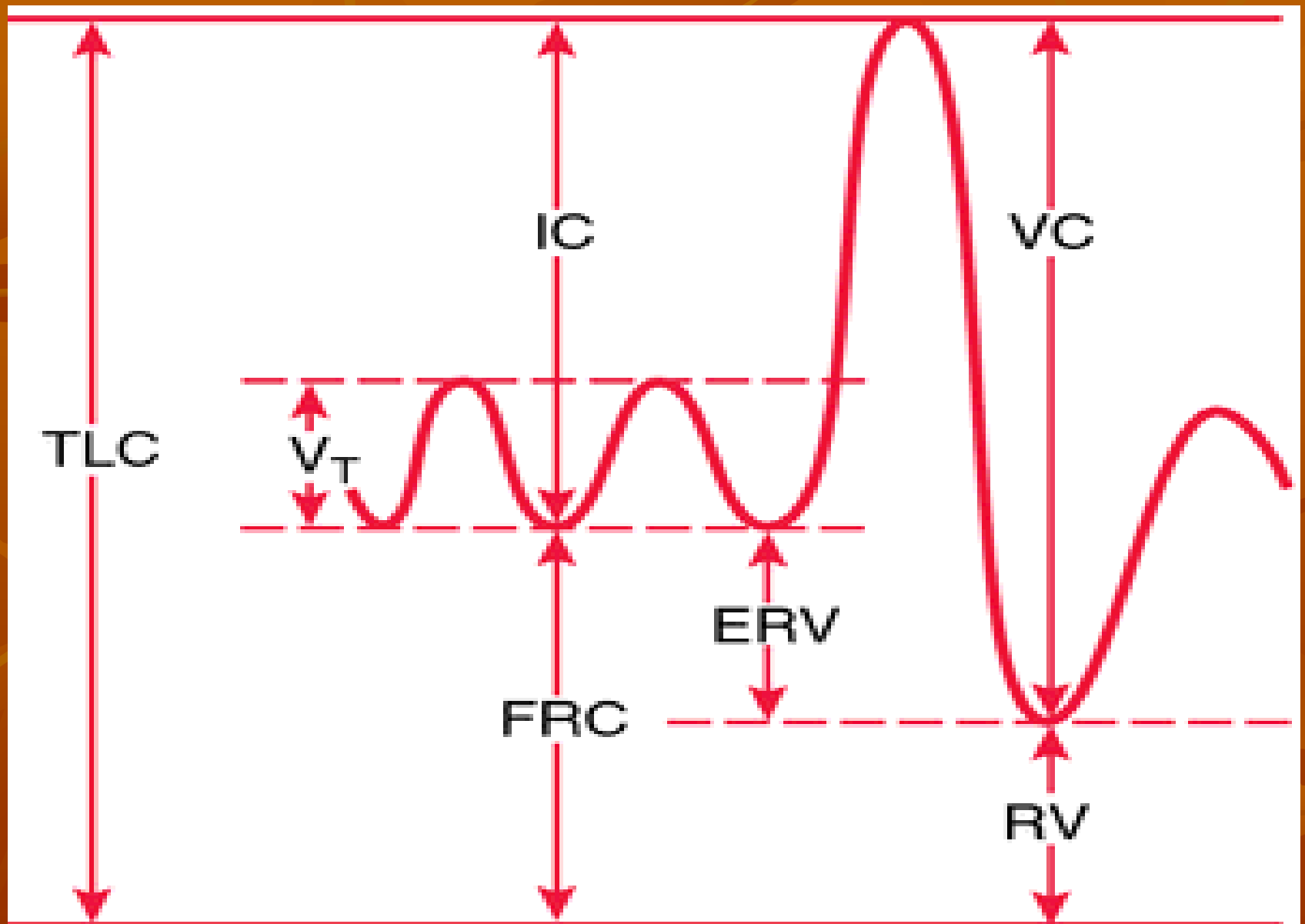
Spirometer



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





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 :**

$$\text{IC} = \text{TV} + \text{IRV}$$

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 :**

$$\text{FRC} = \text{ERV} + \text{RV}$$

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

🍷 **The vital capacity:**

$$\mathbf{VC = IRV + TV + ERV}$$

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

🍷 **The total lung capacity:**

$$\mathbf{TLC = VC + RV}$$

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...