Physiology lab (last one 5)

Respiration function test

Or

Pulmonary function tests (PET)

Pulmonary function tests – PFTs

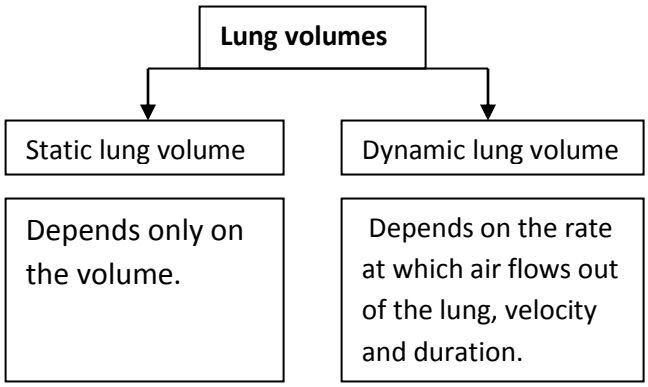
PFTs: pulmonary function tests: are a wide variety of tests that evaluates one or more aspects of respiratory system, example: Spirometry.

What are the purposes of PFTs?

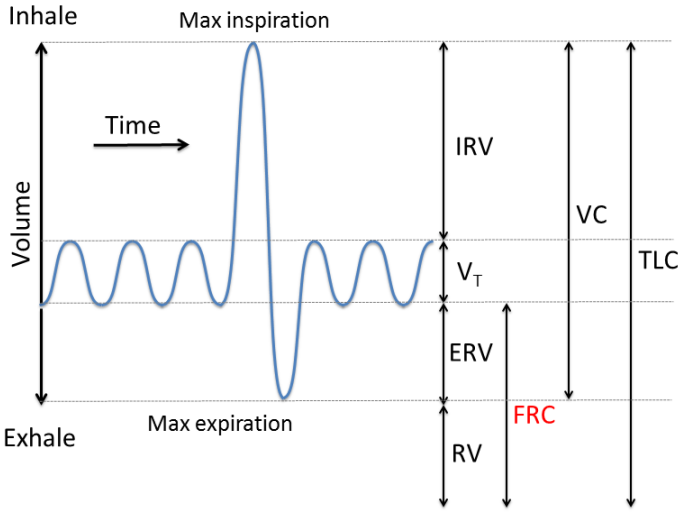
- Assessment and diagnosis of pulmonary disease.
- Evaluate extent and monitor course of disease.
- Aid in determining of the necessary course of treatment.
- Determine lung volume and air flow rate.

Lung volumes and capacities:

Volumes are integral unit whereas capacities are the summation of two or more volumes .



1-The Static lung volume and capacities:



V_T= TV Figure 3 on manual is more clear.

FOUR VOLUMES:
TV/ IRV/ERV/RV.

FOUR CAPACITIES:
TLC/VC/IC/FRC

**Static lung volumes:-

1*Tidal volume (TV): volume of air inspired and expired during normal quiet breathing. About 500ml =0.5 L

2*Inspiratory reserve volume (IRV): the volume of the air that exceeds the tidal volume during a deep inspiration. About 205-305 L

3*Expiratory reserve volume (ERV): the volume of air that exceed the tidal volume during a deep expiration.

4*Residual volume (RV): (residual; remaining) volume of air remaining in the **lungs** after a **maximum expiration**. About 1 L

**Static lung capacities:-

1* Total lung capacity (TLC): total amount of air that can hold in the lungs after a deep inspiration.
**ask the patient to take a deep breath and hold the air in.

TLC=TV+IRV+ERV+RV

2*Vital capacity (VC): volume of air that can be exhaled from the lungs after a maximum inspiration.
**ask the patient to take a deep inspiration and then forceful deep expiration.

VC=IRV+TV+ERV

3*Inspiratory capacity (IC): maximum amount of air that can be inhaled from the end of a tidal volume.
**ask the patient to do normal breathe then to take a deep inspiration.

IC=TV+IRV

4*Functional residual capacity (FRC):volume of air remaining in the lungs at the end of a tidal volume expiration.

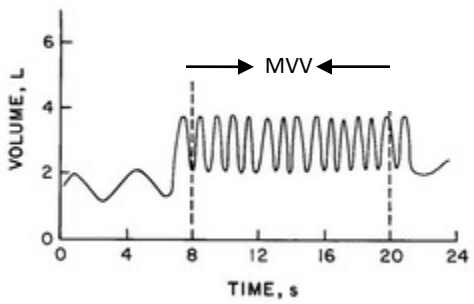
FRC=ERV+RV

2-The Dynamic lung volumes:-

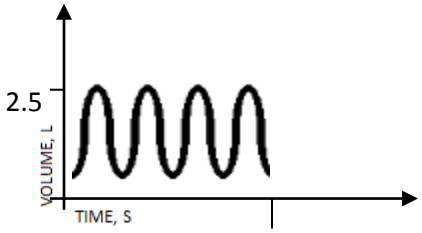
1* Maximum voluntary ventilation (MVV): maximum volume of air which can be moved on expiration while breathing as deeply and as rapidly as possible.

MVV= Tidal volume * Respiratory rate in one minute
MVV=TV* RR

in MVV tidal volume will be more than the normal tidal volume which is 0.5.



For example:-



RR = 4 apex → 10 second

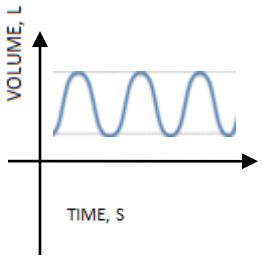
X → 60 second

RR=4*60/10= 24

MVV=TV*RR=205*24=60liter.minute

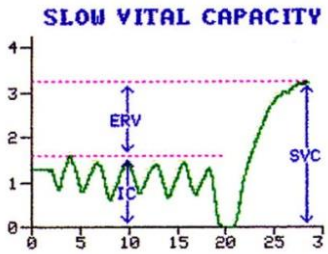
The doctor said that it is just an example, and she didn't know if it is important or not. I think that it isn't important :P

2* minute ventilation (MV): volume of expired air in liters per minute measured over a minimum of one minute.
#MV = TV, and less than MVV.Of course the different between MV and TV is that MV is a dynamic lung volume and TV is a static lung volume.
#RR for MV = 12-15. (It's a constant rate; because it is a normal respiration)

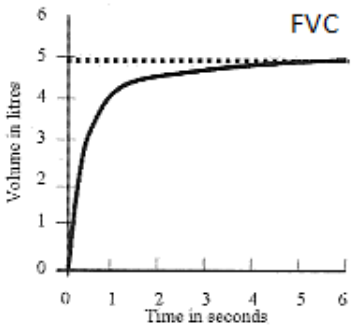


3*slow vital capacity (SVC):lung volume measured from complete expiration following deep inspiration.
**ask the patient to take a deep inspiration and then to take a deep expiration as deep and slow as possible.

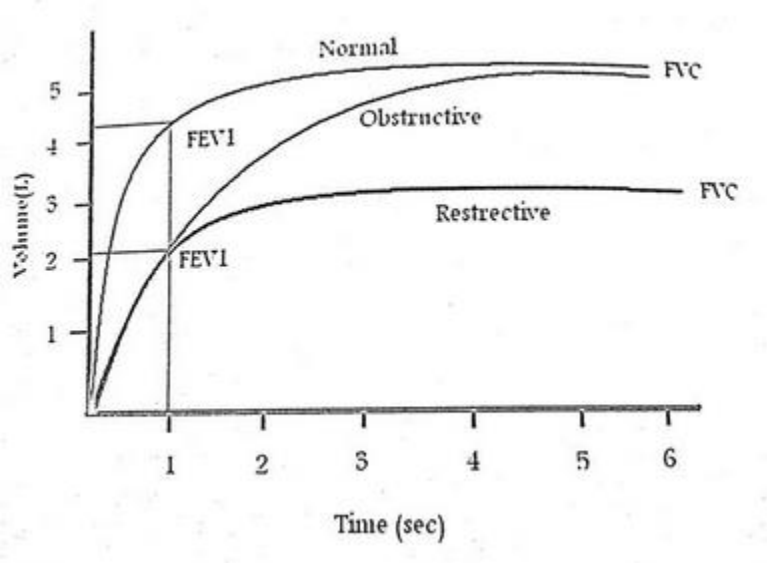
#SVC test appears all the static lung volume except RV and FRC, but in specific time.



4* forced vital capacity (FVC) {VERY IMPORTANT}: total volume of air that can be exhaled forcefully –as quickest as possible – after maximum inhalation.
**ask the patient to take a deep inspiration and then deep expiration as quick as possible.
FV1/FVC= (75%)can be exhaled in first second in normal people.
#FVC=VC, but it measure in high fast velocity.
#the curve represents the relation between FVC and FEV1; forced expiratory volume in the **first second.**



#the results of FVC for normal, obstructive and restrictive patients:



- **Obstructive disease: (**obstruction; تضيق في المجاري التنفسية)an obstruct in respiratory pathway lead to narrowing the airway therefore a smaller volume over the time course of the FVC test than would be expected in normal healthy individual. Example: asthma.
  # FEV1/FVC**<**70% ⟶ low/ normal= low %
- **Restrictive patients**: restriction in the lung tissue leads to problems in breathing therefore the lung function low.
  # FEV1/FVC approximately =75% ⟶ low/low= normal or little low %

Quick revision

Pulmonary function test; Spirometry

STATIC VOLUMES FUNCTION TESTS

We can measure: TV/IRV/ERV and all the capacities except TLV.MMV and MV.

DYNAMIC VOLUMES FUNCTION TESTS

we can measure :FVC/SVC/

BUT THE IMPORTANT QUESTION; in which device these diagram appears?

Spirometry: is the measurement of the pattern of air movement into and out of the lungs during controlled ventilator maneuvers.

Spirometer:is an instrument that assists the pulmonary function test.

Technique: - have a patient seated comfortably.

- Closed-circuit technique:

- Place nose clip on.
- Breathe on mouthpiece.
- Take a normal breathe.
- Take a deep breath as fast as possible.
- Blow out as hard as possible.

Components: 1. O_2 source.

2. CO_2 sinks.

3. Drum; detect the changes in the volume by writing waves.

The result: the **spirogram**; is a diagram that will be used to calculate the different static lung volume and capacity.

In this test we can't measure RESIDUAL VOLUME AND FUNCTIONAL RESIDUAL CAPACITY; because we can't expire all air from our lungs.

Some notes to end this lab =)

* the function of the lung is exchanging CO_2 and O_2.

*Inspiration (inhalation) ⟶ active process; need energy to occur.

Expiration(exhalation) ⟶ passive process, can become active.

*factors that affect lung volumes: Age, sex, height, weight, race and disease.

* spirometer can do " Spirogram, FVC, SVC, MVV and MV"

TEST YOU SELF:

A. All the lung volumes can be measured by Spirometry except ------

B. The sum of the four primary lung volumes (tidal volume, inspiratory reserve volume, expiratory reserve volume, and residual volume) equals ------

C. VC = ------ RV

D. volume of air remaining in the lungs at the end of a tidal volume expiration ---

Answers : A.residual volume.

B.TLC

C. TLC

D. FRC

Don’t forget to study the details in manual =)

Forgive me for any mistake I make.