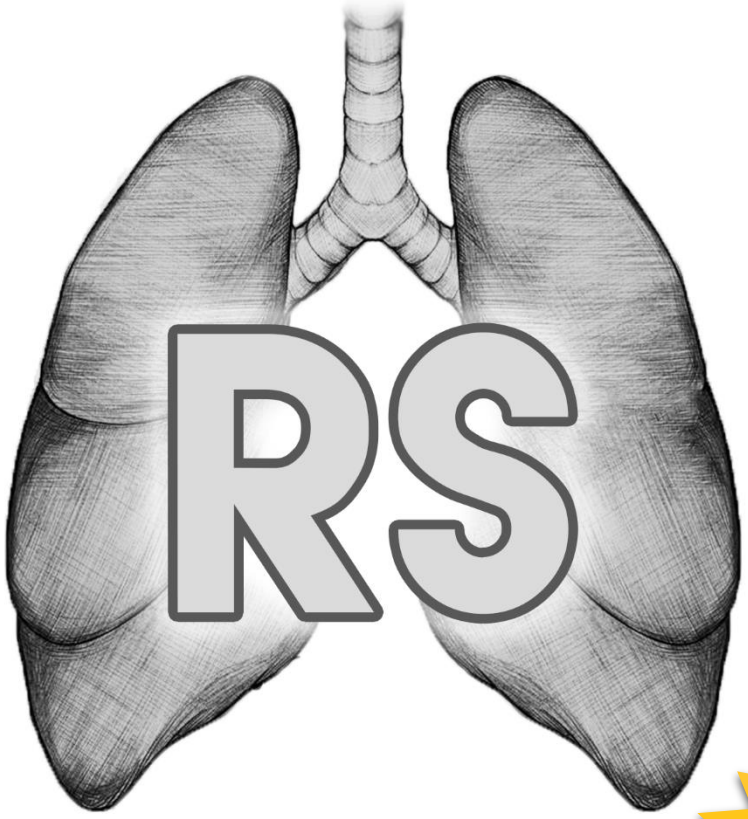

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PHYSIOLOGY

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Number

1

Subject

Spirometry

Done By

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Corrected by

Doctor

Date: **00/00/2016**

Price:

I. Spirometry

●***spirometry***: Is a test used to asses lung function, in order to *Screen for* /*diagnose*/ *monitor* lung diseases.

●Spirometry is an easy and practical procedure, so it's indicated to perform it for any patient that show respiratory problems, like:

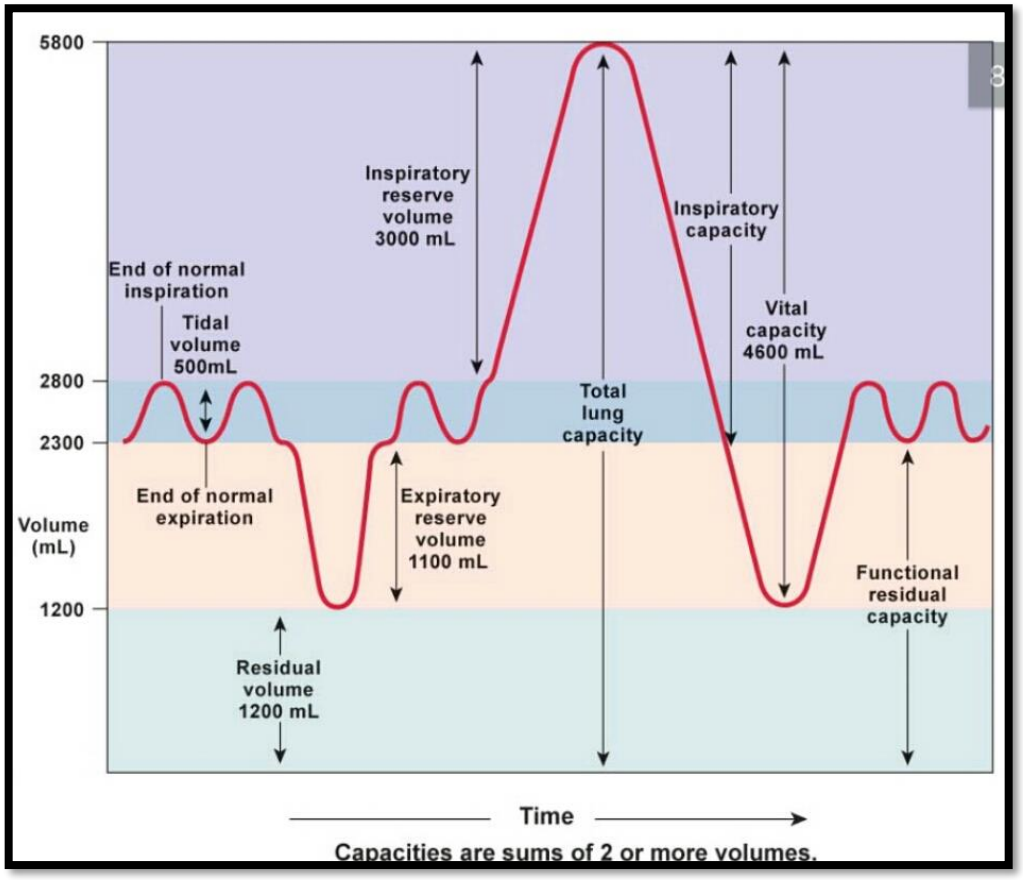
- ***Breathlessness, dyspnea and cyanosis***
- ***chest pain***
- ***Weakness and fatigue.***
- ***chronic cough***
- ***Pre-operative / post-operative***
- ***chronic inflammatory disorders (patients with RA or SLE may develop respiratory problems in late stages).***
- ***Or to monitor your patient response to treatment.***

II. Instructions for spirometry

1. Prior to testing, the patient's condition should be stable:
   - ***The patient have to stop any drug that may give false results*** (vasodilators, corticosteroids, etc…) unless the purpose of this test is to asses patient response to this drug.
   - ***Patient shouldn't eat heavy meals***, drink alcohol, smoke for at least 12 hours.
   - ***The patient should wear comfortable clothes***.
2. ***You have to take good history;*** (patient's name, age, sex, height, weight and ethnicity). These data are very important, as optimal values differ according these criteria, then you have to give these data to the device.
3. ***You have to teach your patient how to use this device***; you have to tell him to:
   - Breathe in maximally (Take deep inspiration).
   - Hold the mouthpiece between the teeth and then apply the lips for an airtight seal.
   - Breathe out as hard and as fast as possible. The patient should aim for maximal flow at the moment expiration starts.

- Keep breathing out until the lungs are 'empty'.
- Three satisfactory blows should be performed and best values taken for interpretation.

III. *Lung volumes and capacities* (you can skip it)



● ***Tidal volume (Vt)***: is the normal air flow we take in each time we inhale and it's around 0.5 Liters.

●***Inspiratory reserve volume (IRV):*** the amount of the air that you can take forcefully in addition to the normal tidal volume, that equals normally 3 L.

●***expiratory reserve volume (ERV):*** the amount of air that a person can still exhale forcefully and empty some of the air in the lungs, after exhaling the tidal volume. equals normally 1.1 L.

●***Residual volume (RV)***: the amount of air that remains in the lungs after forced expiration. equals normally 1.1 L.

●***Functional residual capacity (FRC):*** The volume of the air that's present in the lung just before taking the tidal volume. ERV + RV = FRC

● ***Inspiratory capacity***= Tidal volume + IRV.

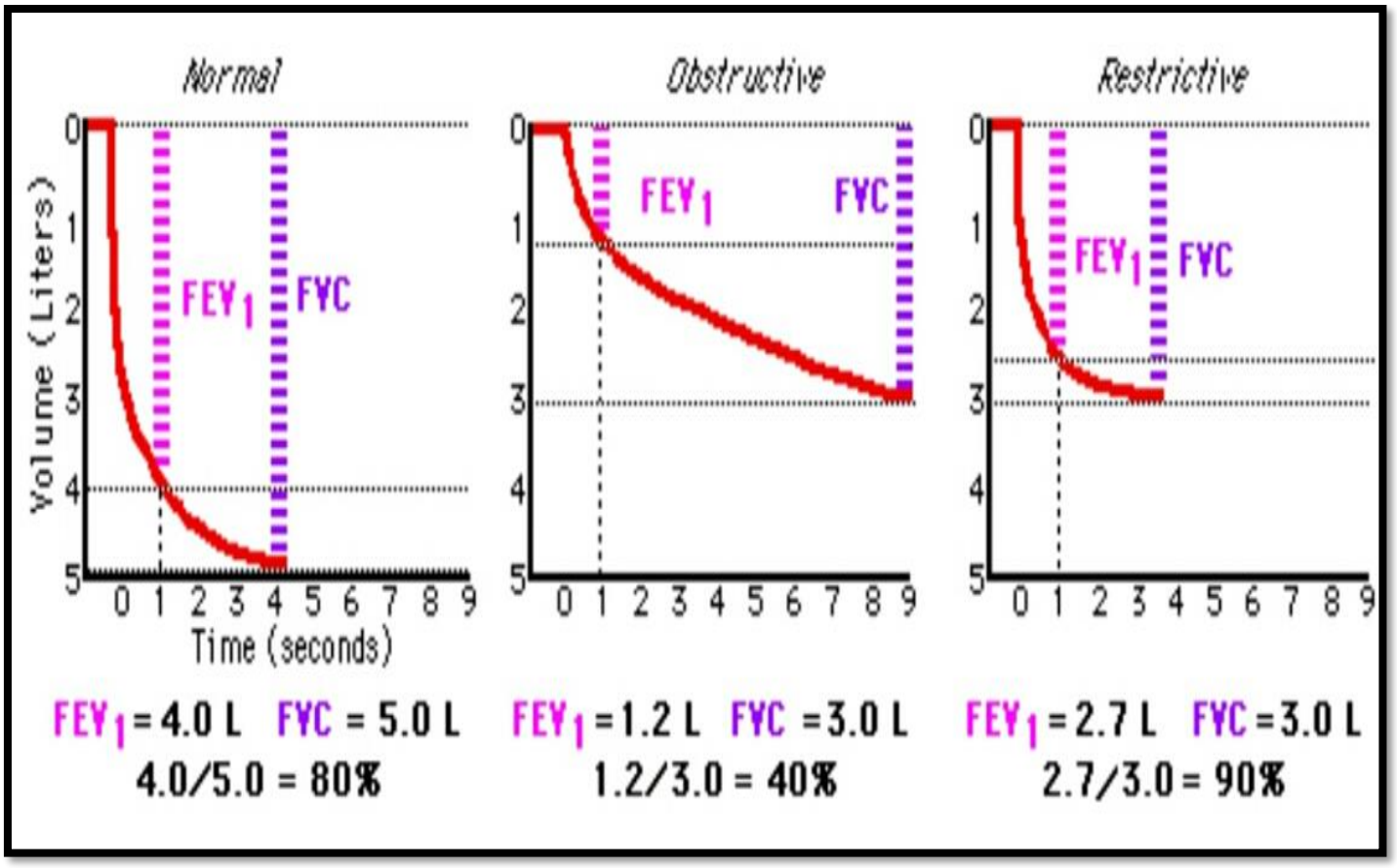
●***Forced Vital capacity***: is the volume of air which you can exhale forcefully following forceful inspiration, meaning you first fill your lungs to the maximum and second you empty your lung to the maximum. IRV + tidal volume + ERV= Vital capacity. ***This is the most important value in spirometry***

●***Total lung capacity (TLC)***: is the maximum volume of air that can be taken. IRV + tidal volume + ERV+ RV = Total lung capacity.

IV. Interpreting spirograms

●Spirometer gives you tow loops (Curves) that you can use to diagnose your patient from; Volume-time loop and flow-volume loop.

1- Volume-time loop.



●From this curve, we are concerned with ***FEV1***, ***FVC*** and ***FEV/FVC ratio***.

- Normally, when a normal person start to exhale forcefully, 80% of his FVC is exhaled in the first second, this is called FEV1.

●The device gives as the normal values for FEV1 and FVC for healthy persons that have similar criteria to our patient (optimal values) , plus our patient's actual values. Then we can Interpret these values, in normal conditions:

- Actual FEV1 is 80-120% of optimal FEV1.
- Actual FVC is 80-120% of optimal FVC
- FEV1/FVC ratio > 80%

●In obstructive lung disease, the patient faces a problem in exhaling air, so he Can't reach normal FVC.

- So for sure his FEV1 is reduced, it's less than 80%of the predicted value.
- His FVC will be reduced also, it's less than 80% of the predicted value.
- He can't exhale 80% of his FVC in the first second, so his FEV1/FVC is less than 80% also.

●In restrictive lung disease, the problem is in the lung, the patient can't fill his lungs completely, so:

- FEV1 value is less than 80% of optimal FEV1, but higher than patients with obstructive lung disease
- And also, FEV is less than 80% optimal value.
- However, his FEV1/FVC is 80% or higher !

2. Flow-volume loop (seen in the next page)

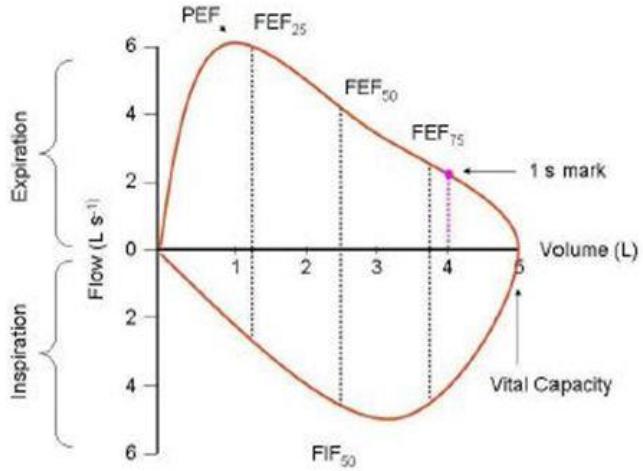
●The flow of the air in the airways depends on 3 factors; ***motive force***, ***resistance***, and ***the amount of the air.***

- When a normal person inhale and exhale forcefully, he is using maximum motive force and he has by now the maximum volume of air in his lungs (TLC), So maximum flow will occur; this is called ***peak expiratory flow (PEF) or maximum expiratory flow (MEF).***
- Then, as this person exhales the air, the volume of the air in his lungs is decreasing, so the flow decrease (in a linear way), until he reaches the residual volume, where no flow occur.

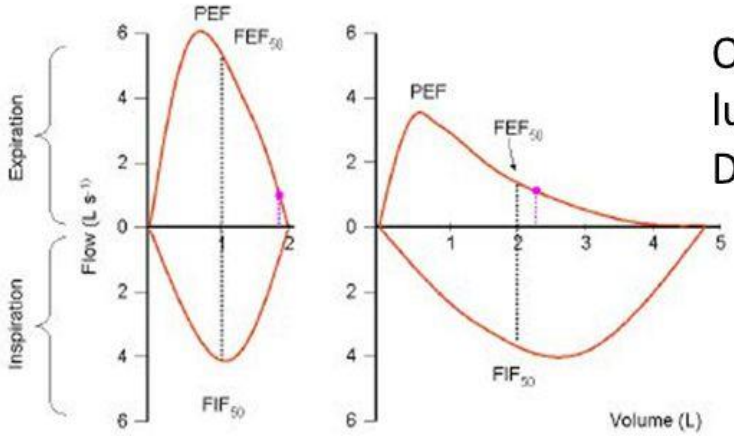
- The difference between his TLC and RV is his FVC.

Flow/Volume Spirometry

Normal pattern.



restrictive lung Disease.



Obstructive lung Disease.

●Now in patient with obstructive lung disease, the motive force is normal, his TLC is normal or higher, but his airway resistance is increased;

- So even if he exhale forcefully, the flow won't reach normal PEF, so his PEF is less than normal.
- Moreover, as he exhale the air from his lungs, the flow will decrease but the curve will be concave not linear.
- Also, his FVC may be decreased (not always)

•in restrictive lung disease, the patient has a very high motive force (decreased lung compliance→ higher collapsing forces), and normal airway resistance.

- So he may reach normal PEF (however in sever cases he can't reach normal PEF as he has few volume of air in his lungs)
- As he exhale the air from his lungs, the amount of air will decrease and thus the flow decreases (in a linear way with higher slope than normal value) until he reach his RV, his FVC will be decreased.

●***important note***: from flow-Volume loop, we can calculate FVC only, as other capacity that depends on RV can't be calculated.

●now if you suspected that your patient has an obstructive lung disease from spirometry, how can you know if it's COPD or asthma?

- You give your patient a vasodilator, and redo the test, if his values became normal, this is asthma, otherwise it's a chronic condition like COPD.

- ***Even when I lose, I'M WINNING :3***
- ***Best wishes***
- ***Mohammad Qussay Al-Sabbagh***

● The end :D :D :D