Respiratory Examination for Physiotherapy students. Part 1: simple spirometry

Available at: https://youtu.be/TJBViJZuOSk?si=x5yM5hA0lusoNBsa

Authors: María Dolores Mauricio Aviñó; Eva Serna García; Antonio Alberola Aguilar; Vannina González Marrachelli; Víctor Manuel Víctor González; Solanye Guerra Ojeda.

In this video, we are going to explain what spirometry is, how it is done and how to interpret a simple spirometry test.

Etymologically, the word comes from the Latin *spirare* "to blow" and the Greek *metria* "to measure". Therefore, it is a test that measures the volume of air that the patient mobilizes when breathing in and out. The procedure is not invasive and makes it possible to diagnose respiratory diseases and assess the effectiveness of a treatment.

On the x-axis, we have the time in seconds and, on the y-axis, we represent the volume of air in the lungs measured in litres.

We begin by asking the patient to breathe in and out normally and the volume of air entering and leaving the lungs will be recorded.

Next, we ask the patient to take a deep breath and then to expel all the air, trying to empty their lungs.

Afterwards, the patient can continue to breathe normally.

The volume of air mobilized in each relaxed respiratory cycle is the tidal volume, which is usually 0.5 litres. The maximum volume of air the patient can inhale is the inspiratory reserve volume, which is usually around 3 litres. The volume of air the patient exhales after a deep inspiration is the expiratory reserve volume, which is approximately one litre. These values apply to the standard subject in physiology.

If we add the inspiratory reserve volume and the tidal volume, we get the inspiratory capacity.

If we add the three volumes, we get the vital capacity.

There is a volume of air that always remains in the lungs after a forced expiration, because the lungs are not collapsed. This is the residual volume and cannot be measured by spirometry. It is usually 1.2 litres.

The total lung capacity is the sum of the vital capacity plus the residual volume.

The vital capacity is usually 4.5 litres, depending on the characteristics of the patient. It is affected by age, weight, height, sex, ethnicity or if the patient is a smoker. Based on these

characteristics, the computer program calculates what the vital capacity should be for that specific patient, that is, his or her ideal vital capacity. If the spirometry result indicates a vital capacity equal to or greater than 80% of the ideal vital capacity, the result is normal.

Now let's see this with a real example:

-Good morning

The first thing we should do is to write down the patient's data.

- Now I'am going to explain the test to you.

We have to explain what the test consists of to the patient and give them the following instructions:

• You must be sitting up straight.

• You must not wear a belt or a tight bra.

• You must not have taken medication that affects breathing in the 6 hours prior to the test.

• You must not have smoked or consumed caffeine or something similar in the last few hours.

• The patient is warned that they will receive vigorous instructions during the procedure.

A clip is placed on the nose to prevent the entry or exit of air through this way.

The nozzle is placed in the spirometer and then the patient must put it in their mouth in such a way that they don't draw air through the corners of their lips.

Breathe in and out normally.

Excellent!

That's the tidal volume.

In the next cycle, I want you to breath in as much air as you can.

Come on, take a deep breath, as much as you can.

Keep going, keep going, keep going... Ok and now, breathe out, keep going, keep going. Empty your lungs! Well done!

At the end of the test, the program gives us the results. The ideal vital capacity for this patient calculated according to the parameters introduced in the program is 3.76 litres. She managed to mobilize 3.58 litres in the real test, which is 95% of the ideal value. Therefore, the result is physiological.