Introducing Health Sciences: COPD
Living with COPD

Doctor

Right Sheila. We're going to do a test today that's just going to tell us a little bit about how your lungs –

Presenter

In the respiratory clinic there are two very simple routine tests that measure the rate of airflow out of the lungs, using an instrument called a spirometer. These tests can evaluate an individuals lung function and help to diagnose COPD.

Doctor

Basically all it is you blow as hard as you can as long as you can into a tube. We get two measurements out that. The first is the amount of air you can blow out in one second, which we call the FEV1. The second measurement we get is the vital capacity, which is the total amount of air you can blow out altogether. Most people can blow out most of the air in their lungs er within the first second. So you expect the FEV1 to be eighty per cent or more of the vital capacity. In people with COPD the obstruction part of the COPD means that is hard to get the air out. So in the first second people might only get thirty or forty per cent of their lung capacity out. And they'll keep breathing out and keep breathing out and keep breathing out and it maybe very difficult for them to reach their true vital capacity because they just run out of breath before they get there and have to take another breath then.

'Really, really hard that time. Okay. Well done.'

Presenter

Here the spirometer results are displayed as a flow volume curve. The rate at which air is expelled in litres per second is plotted on the vertical axis and the total volume of air exhaled in litres is plotted on the horizontal axis. This is a more dynamic representation of what happens during an exhalation than the spirograms that you studied in the text, which only showed total volume of air exhaled against time. The predicted exhalation of a person with healthy lungs is shown by the green line. It starts with a steep, upward slope showing that the air is being expelled very rapidly during the first second. The rest of the air is expelled at a lower and lower rate as the lungs empty. You can see this as a steady downward slope. The vital capacity, the total volume of air exhaled, is about 3.2 litres. This can be read from the point at which the end of the green exhalation curve meets the horizontal axis of the graph.

Sheila's airflow is shown by the red line. You can immediately see that this curve is a completely different shape. The reason for this is that Sheila has COPD. She cannot expel the air in her lungs quickly. The flow of air in litres per second is much lower than the green curve, even during the first second and the curve angle is quite sharply inwards on the way down. It's difficult to identify Sheila's vital capacity, which we've indicated by extending a dashed red line along the horizontal axis because her airflow was very low at the end. She had to stop to take a breath before her exhalation was fully completed.

'The next thing we want to do today is to give you some spray to see if that helps –'

Presenter
In people with COPD the lung damage is permanent so airflow readings won't vary much between visits to the respiratory clinic. In contrast people with asthma experience episodes of temporary muscular contractions in the walls of their airways. This is often triggered by allergies or exercise and the reduced air flow rate during an asthma episode may look similar to COPD. To differentiate between the two conditions the patient is asked to inhale a bronchial dilator, a drug which relaxes the airway muscles. If Sheila's condition was due to asthma you might expect to see an improvement in airflow when she retakes the test. The red curve should adopt the shape closer to that of the green curve. The spirometer test is repeated after inhaling the bronchial dilator to see if airflow improves. Observe the display on the spirometer. The flow volume curve from the first test is still visible as a dotted line and the second test is the solid line.

Doctor
It's important to tell the one from the other because the treatments er – the causes indeed as well – are radically different and it's important to differentiate those two out. So with a simple test we can say is there airflow obstruction at all? Is it in that family of diseases? And if it is in that family of diseases we can examine the data further to say what type of obstructive disease is it. Is it more in the COPD category or is it something more in the category of asthma?

'Right Sheila. The next test -'

Presenter
The second type of test is a gas transfer test. This measures the transfer of gases from the lungs across the walls of the alveoli and in to the blood. The patient inhales air from the gas transfer detector. The inhaled air has been mixed with a very small safe amount of carbon monoxide. The breath is held for a period and then exhaled back in to the machine. The amount of carbon monoxide in the exhaled air is then measured to determine how much has been taken up by the blood.

Doctor

The measurement’s complementary to spirometry. All the spirometer tells you is about air going in and out of the lungs and how efficiently it does that. It doesn’t tell us what happens to the air once it's got into the lungs. Gas transfer works the other way round. It doesn’t really tell us terribly much about the air getting in and out of the lungs, not the dynamic process. It tells us the total amount that gets in there but it tells us importantly what happens to it when it's there. Do you breathe the air in and then do you breathe it out again without terribly much happening or do you breathe it in and have efficient gas transfer from the lungs and into the blood?