TEST

Plethysmography

Plethysmography is a breathing test that measures lung volumes and resistance to airflow.

WHAT IT MEASURES
Lung volumes and resistance to airflow during breathing

SAMPLE
None

FASTING NEEDED?
No, unless combined testing requires it

HOW LONG IT TAKES
About 30 to 60 minutes

RESULTS IN
Same day to several days, varying by clinic

USED FOR
Diagnosing and monitoring lung conditions

MAIN LIMITATION
Leaks or incorrect breathing technique can distort measurements

Overview

Plethysmography is a group of tests that measure changes in volume. The most common type is body plethysmography , also called lung or pulmonary plethysmography. It measures how much air your lungs can hold and how difficult it is for air to move through your airways.

The test takes place in a clear, enclosed booth. You breathe through a mouthpiece while pressure sensors record small changes inside the booth. During part of the test, a shutter briefly blocks the mouthpiece while you continue making gentle breathing movements.

These measurements can detect air that remains trapped in the lungs. This makes body plethysmography different from spirometry, which mainly measures how much air you can blow out and how quickly you can do it.

Other types include limb, venous and penile plethysmography, which measure changes in blood volume. Their preparation and procedures are different. This article focuses on body plethysmography for lung testing.

Why the test is ordered

Plethysmography is often ordered when spirometry does not provide enough information about how your lungs are working. It may help explain breathlessness, ongoing cough, wheezing or an unusual spirometry result.

The test may be used to:

An obstructive pattern means air has difficulty leaving the lungs. A restrictive pattern means the lungs hold less air than expected. Plethysmography can identify these patterns, but it does not usually identify their cause by itself.

- Measure the total amount of air your lungs can hold
- Check whether air remains trapped after you breathe out
- Help distinguish restrictive and obstructive breathing patterns
- Measure resistance to airflow through the airways
- Monitor changes in a known lung condition
- Assess lung function before certain operations or specialist treatments

Who should have the test

A healthcare professional may recommend plethysmography if your symptoms, examination, imaging or other breathing tests suggest that lung volume measurements would be useful.

It is commonly included in a full set of pulmonary function tests for people being assessed for conditions affecting the airways, lung tissue, chest wall or breathing muscles. It may also be repeated to monitor an established condition or response to treatment.

The laboratory should know if you have severe claustrophobia, use supplemental oxygen, have a current chest infection or recently had chest, abdominal or eye surgery. Certain unstable heart or lung problems may mean the test should be delayed or adapted. These issues do not automatically prevent testing, but they require individual assessment.

How to prepare

Fasting is not usually needed. Avoid a very large meal shortly before the appointment because a full stomach can make deep breathing uncomfortable.

Wear loose clothing that does not restrict your chest or abdomen. Tell the testing team if you use inhalers, tablets or other medicines that affect breathing. Some medicines may need to be

paused before specific pulmonary function tests, but you should not stop them unless the service arranging the test gives you clear instructions.

You may be asked to avoid smoking, vaping, alcohol or strenuous exercise for a period before testing. Requirements differ according to the measurements being performed.

Bring your inhalers and a list of your medicines. If you develop an acute respiratory infection or feel much less well than usual, contact the testing service before attending.

What happens during the test

You will sit in a transparent booth about the size of a small shower cubicle. The door is closed during measurements, but staff can see and speak with you throughout the test.

You will wear a nose clip and seal your lips around a mouthpiece. The technician will guide you through several breathing patterns. These may include normal breathing, gentle panting and breathing in or out as fully as possible.

For a few seconds, a shutter closes inside the mouthpiece. No air passes through during this brief period, but you continue making small breathing movements. Changes in pressure at your mouth and inside the booth allow the equipment to calculate the volume of gas in your chest.

The test usually requires several repeated measurements. Repetition helps show that the result is consistent rather than caused by a leak or an unusual breath. Spirometry or a test before and after an inhaled bronchodilator may be performed during the same appointment.

Understanding your results

Your report may include several measurements.

Total lung capacity , or TLC, is the amount of air in your lungs after the deepest possible breath. A lower-than-expected TLC supports a restrictive breathing pattern. A higher value may occur when the lungs are unusually expanded.

Residual volume , or RV, is the air remaining after you breathe out as far as possible. A raised value may suggest air trapping.

Functional residual capacity , or FRC, is the air left in the lungs after an ordinary, relaxed breath out.

Airway resistance describes how much opposition there is to airflow. Increased resistance can occur when airways are narrowed, but the measurement does not show the cause on its own.

Results are compared with predicted values based on factors such as age, height and sex.

Ranges and interpretation vary by laboratory, age, sex, pregnancy status, medicines and clinical context. A result outside the expected range is not a diagnosis. It must be considered alongside your symptoms, spirometry, medical history and any imaging or other tests.

What affects the results

Body plethysmography depends heavily on breathing technique. The equipment may work correctly while the reported number is still misleading.

Important influences include:

Age, body size, sex and pregnancy affect expected lung volumes. Recent surgery, chest wall differences and muscle weakness can also affect what you can physically perform.

In severe airflow obstruction, pressure measured at the mouth may not perfectly represent pressure throughout the lungs. This can make the calculated volume appear higher than it truly is. Staff reduce technique-related errors by watching each attempt and repeating acceptable measurements.

- Air leaking around the mouthpiece
- Not following the panting rhythm or breathing instructions
- Coughing, swallowing or closing the throat during a measurement
- Failing to breathe fully in or out when asked
- Holding the cheeks loosely instead of supporting them
- Fatigue, pain, anxiety or severe breathlessness
- Smoking, recent strenuous exercise or a large meal
- Inhalers and other medicines that alter airway opening
- An acute chest infection or recent worsening of breathing
- Incorrect height measurement or poorly fitting dental appliances

Accuracy and limitations

Plethysmography is particularly useful for measuring gas trapped behind narrowed or closed airways. Gas dilution tests, which estimate lung volume using helium or nitrogen, may miss some trapped gas and report a volume that is too low.

Plethysmography can also be wrong in the opposite direction. Leaks, rapid panting, throat

closure or poor pressure matching can produce falsely high values. Good-quality testing therefore requires trained staff, calibrated equipment and several similar attempts.

There is no single rate for how often the test misses a condition or incorrectly suggests one. Accuracy differs with the condition being investigated, the equipment, breathing technique and the quality rules used by the laboratory. A normal result can miss intermittent airway narrowing or a problem that does not change lung volumes. An abnormal result can indicate a breathing pattern without identifying its cause.

Spirometry is usually better for measuring forced airflow. Gas dilution may be used when a booth is unavailable or unsuitable. Chest imaging is better for showing lung structure, while exercise testing may be more useful when symptoms mainly occur during activity.

Risks and complications

Plethysmography is noninvasive and does not use radiation. Deep or repeated breathing can briefly cause dizziness, coughing, tiredness or breathlessness, and the enclosed booth may feel uncomfortable if you have claustrophobia.

Tell the technician immediately if you feel unwell. The test can be paused, the booth opened and the procedure adjusted if necessary.

What happens next

A respiratory specialist or the professional who ordered the test will review whether the measurements are technically reliable and how they compare with your other results. Routine follow-up may include discussing the report, repeating part of the test, adjusting an existing treatment plan or arranging spirometry, imaging or another lung test.

Small differences between repeat tests do not always represent a meaningful change. Technique, medicines and how well you felt that day can influence the measurements.

Seek urgent medical help if you develop severe or rapidly worsening shortness of breath, chest pain, fainting, blue or grey lips, or confusion during or after the appointment. These are not expected effects of plethysmography and should not wait for routine follow-up.

Common questions

Can I drink coffee before plethysmography?

Coffee is usually allowed for body plethysmography alone. If the appointment includes an airway challenge or another specialised breathing test, the service may ask you to avoid caffeine. Follow the instructions in your appointment letter.

Does the time of day matter?

Time of day usually has little effect on lung volume measurements. For repeated monitoring, testing at a similar time can make comparisons easier, especially if inhaler timing changes during the day.

Can I exercise beforehand?

Avoid strenuous exercise shortly before testing if your clinic asks you to do so. Exercise can temporarily change breathing and airway tone. Ordinary walking to the appointment is generally not a problem.

Can I use my inhaler before the test?

Use it as directed unless the testing service specifically asks you to pause it. The answer depends on whether the test is measuring your usual treated lung function or your response before and after a bronchodilator like albuterol or salmeterol .

What if I am claustrophobic?

Tell the service before the appointment and remind the technician when you arrive. The booth is transparent, staff remain nearby and the door can be opened quickly. If you cannot tolerate the booth, a different lung-volume method may be considered.

Is plethysmography painful?

No needles or instruments enter the body. The mouthpiece and nose clip may feel awkward, and the breathing exercises can be tiring, but the test should not be painful.

Sources

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