TEST

ACTH stimulation test

An ACTH stimulation test checks how well your adrenal glands produce cortisol when stimulated.

WHAT IT MEASURES
Cortisol rise after synthetic ACTH stimulates the adrenal glands

SAMPLE
Blood

FASTING NEEDED?
Usually no; follow your clinic's specific instructions

HOW LONG IT TAKES
About one hour

RESULTS IN
Same day to several days, varying by laboratory

USED FOR
Diagnosing adrenal insufficiency

MAIN LIMITATION
Cortisol cutoffs differ by assay and clinical context

Overview

The ACTH stimulation test checks whether your adrenal glands can make enough cortisol when prompted. Cortisol helps maintain blood pressure, blood sugar, metabolism, and the body's response to illness or physical stress.

ACTH, or adrenocorticotropic hormone, is normally made by the pituitary gland beneath the brain. It signals the adrenal glands above the kidneys to release cortisol.

During the test, you receive cosyntropin, a manufactured form of ACTH. Blood samples taken before and after the injection show how your cortisol responds.

The test is mainly used to investigate adrenal insufficiency. This may be primary, caused by an adrenal gland problem, or central, caused by reduced ACTH production from the pituitary or hypothalamus.

Why the test is ordered

Your healthcare professional may order the test if symptoms, medical history, or earlier results suggest low cortisol production. Reasons include:

These findings have many possible causes. The test must be interpreted with your history and other results.

- Unexplained tiredness, weakness, weight loss, or low blood pressure
- Repeated nausea, vomiting, or abdominal discomfort
- Low sodium or high potassium
- A low or uncertain morning cortisol result
- Pituitary disease, surgery, radiation treatment, or head injury
- Current or previous corticosteroid use
- Monitoring after treatment affecting the pituitary or adrenal glands

Who should have the test

The test is generally used when there is a reasonable possibility of adrenal insufficiency. It is not usually a routine screening test without symptoms or risk factors.

Testing may be appropriate for people with adrenal or pituitary conditions or after prolonged or high-dose corticosteroid treatment, which can suppress the body's ACTH and cortisol production.

If adrenal crisis is suspected, urgent treatment must not be delayed for testing. Adrenal crisis is a medical emergency caused by severe cortisol deficiency.

How to prepare

Most people do not need to fast and can usually drink water, but follow your clinic's instructions. Testing is often arranged in the morning because cortisol changes during the day.

Tell the clinic about every medicine you use, including tablets, injections, inhalers, creams, nasal sprays, and joint injections. This is especially important for corticosteroids such as hydrocortisone, prednisolone, prednisone, dexamethasone, and methylprednisolone.

Do not stop corticosteroids or other prescribed medicines on your own. Stopping suddenly can be unsafe. Your clinic will explain whether any dose should be delayed or changed.

Also tell the clinic if you:

Avoid unusually strenuous exercise shortly before the appointment unless advised otherwise. Allow time to sit quietly before the first sample.

- Are pregnant or use an estrogen-containing medicine
- Have recently been seriously ill or had surgery
- Have liver, kidney, or pituitary disease
- Take biotin, particularly high-dose supplements
- Have previously reacted to cosyntropin or another injected medicine

What happens during the test

A healthcare professional takes a baseline blood sample, often through a small intravenous cannula that remains in place. Cortisol is measured, and ACTH may also be checked.

You then receive cosyntropin through the cannula or into a muscle. Further blood samples are commonly taken after 30 minutes, 60 minutes, or both. Protocols vary.

You usually remain seated or resting. The test takes about an hour, although registration and observation may lengthen the visit.

Understanding your results

The laboratory measures your cortisol before cosyntropin and how high it rises afterward. An adequate rise means the adrenal glands can respond to ACTH. A lower-than-expected response may support adrenal insufficiency.

There is no single cutoff for every laboratory. Interpretation depends on the measurement method, protocol, pregnancy status, medicines, and clinical context. Newer assays may produce lower values than older methods.

Baseline ACTH can help locate the problem. Low cortisol with high ACTH may indicate an adrenal gland disorder. Low cortisol with low or inappropriately normal ACTH may suggest reduced pituitary or hypothalamic signalling.

Your healthcare professional will consider the result alongside symptoms, sodium and potassium levels, previous cortisol tests, and medication history.

What affects the results

Corticosteroids like prednisone or hydrocortisone can suppress the cortisol system, and some may be mistaken for cortisol by certain laboratory methods. Their effects depend on the medicine, dose, route, timing, and assay.

Pregnancy and estrogen-containing medicines increase cortisol-binding globulin, raising measured total cortisol. Severe liver disease, major illness, low blood protein, or kidney protein loss can reduce binding proteins and make total cortisol appear low.

Other influences include:

With recent central adrenal insufficiency, the adrenal glands may still respond temporarily, producing a reassuring result even though the stress response is impaired.

- Recent serious illness, surgery, pain, poor sleep, or major physical stress
- Vigorous exercise shortly before testing
- Medicines affecting cortisol production, breakdown, or pituitary signalling
- High-dose biotin interference with some assays
- Differences in cosyntropin dose, sample timing, and laboratory method
- Testing soon after pituitary surgery, injury, or sudden ACTH loss

Accuracy and limitations

The test performs well for established primary adrenal insufficiency. It may miss central adrenal insufficiency, particularly soon after pituitary or hypothalamic disease begins.

A falsely low result may occur when cortisol-binding proteins are reduced, an unsuitable cutoff is used, or samples are collected at the wrong times.

Low-dose and standard-dose tests are not interchangeable. Low-dose testing requires careful preparation because dilution or administration errors can affect the dose.

If results remain uncertain, a specialist may recommend repeat morning cortisol testing or another dynamic test. Some alternatives carry greater risks and require close supervision.

Risks and complications

Blood sampling may cause brief discomfort, bruising, or light-headedness.

Cosyntropin can cause short-lived flushing, nausea, headache, dizziness, or a change in heart rate. Serious allergic reactions are rare, and testing staff are equipped to respond.

What happens next

If cortisol rises adequately, established primary adrenal insufficiency is less likely. Further assessment may still be needed after recent pituitary disease, significant corticosteroid exposure, or when central adrenal insufficiency remains strongly suspected.

If the response is low, your healthcare professional may review the test timing and method, repeat testing, or check ACTH, sodium, potassium, renin, aldosterone, or other pituitary hormones. Imaging is used only when the overall findings support it.

Arrange routine follow-up for an unclear result, medication planning, or ongoing non-severe symptoms.

Seek urgent medical help for severe weakness with repeated vomiting or diarrhea, confusion, collapse, severe abdominal pain, or signs of very low blood pressure. If you already have adrenal insufficiency, follow your emergency steroid plan and seek care as instructed.

Common questions

Can I drink coffee before an ACTH stimulation test?

Fasting is often unnecessary, but caffeine may affect cortisol. Follow your clinic's instructions; water is usually the safest choice.

Does the time of day matter?

It can. Baseline cortisol is usually highest in the morning, so many centres test then.

Can I exercise beforehand?

Routine movement is unlikely to matter, but vigorous exercise can affect cortisol. Avoid unusually hard exercise unless your clinic says otherwise.

Can I take my usual medicines?

Do not change medicines without instructions. Corticosteroids may suppress cortisol production or interfere with its measurement.

Will I feel different after the injection?

Many people notice nothing. Others briefly experience warmth, flushing, nausea, dizziness, or a mild headache.

Can the test confirm why my cortisol is low?

Not always. Baseline ACTH, your history, and sometimes further tests are needed to distinguish an adrenal problem from reduced pituitary signalling.

Sources

- Bornstein SR, et al. Diagnosis and Treatment of Primary Adrenal Insufficiency: An Endocrine Society Clinical Practice Guideline. The Journal of Clinical Endocrinology & Metabolism . 2016;101(2):364-389.
- National Institute for Health and Care Excellence. Adrenal insufficiency: identification and management. NICE guideline NG243. 2024.
- DailyMed. CORTROSYN-cosyntropin injection prescribing information. US National Library of Medicine.
- Javorsky BR, et al. New Cutoffs for the Biochemical Diagnosis of Adrenal Insufficiency after ACTH Stimulation using Specific Cortisol Assays. Journal of the Endocrine Society . 2021;5(4):bvab022.
- Husebye ES, et al. Consensus statement on the diagnosis, treatment and follow-up of patients with primary adrenal insufficiency. Journal of Internal Medicine . 2014;275(2):104-115.
- Arlt W, Society for Endocrinology Clinical Committee. Emergency management of acute adrenal insufficiency in adult patients. Endocrine Connections . 2016;5(5):G1-G3.