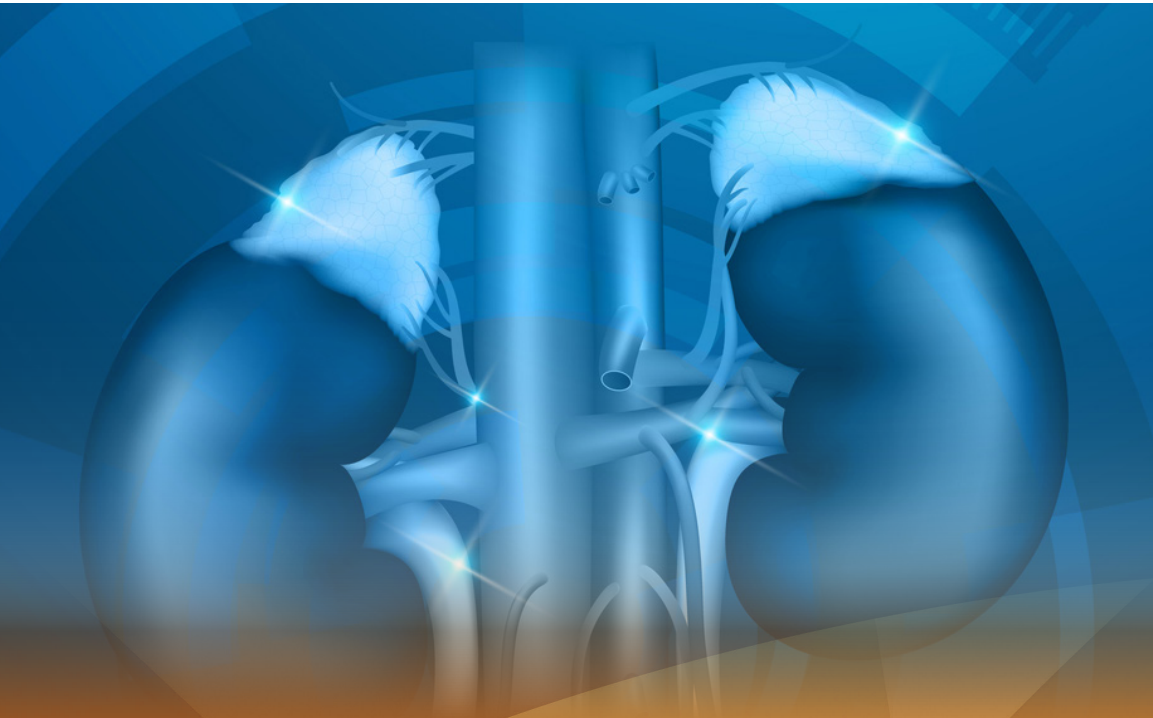
Society for Endocrinology



Adrenal Insufficiency

Patient Booklet

This information sheet provides an introduction to the causes and symptoms of adrenal insufficiency and the tests used to diagnose this condition.

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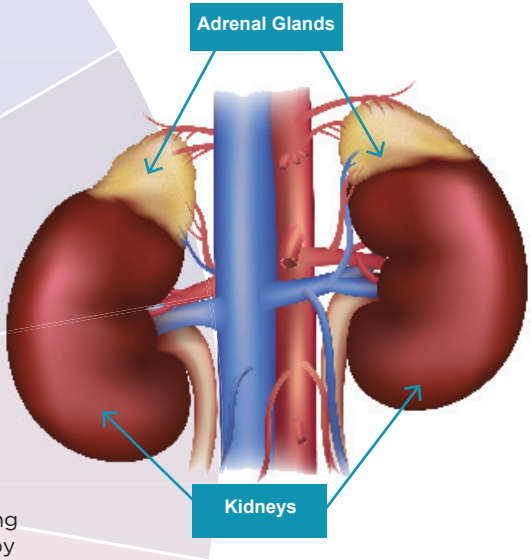
What are the adrenal glands?

The adrenal glands sit at the top of the kidneys, one on each side of the body, and have an inner core (known as the medulla) surrounded by an outer shell (known as the cortex). The inner medulla produces adrenaline, the "fight or flight" stress hormone. While the absence of the adrenal medulla does not cause disease, the cortex is more critical. It produces the steroid hormones that are essential for life: cortisol and aldosterone. Cortisol mobilises nutrients, enables the body to fight inflammation, stimulates the liver to produce blood sugar and also helps control the amount of water in the body. Aldosterone regulates salt and water levels which affect blood volume and blood pressure. The adrenal cortex also produces sex hormones known as adrenal androgens; the most important of these is a hormone called DHEA (dehydroepiandrosterone).



What is adrenal insufficiency?

Adrenal insufficiency is caused by failure of the adrenal glands to produce sufficient (or any) amounts of cortisol and aldosterone. Prolonged lack of cortisol leads to severe fatigue, chronic exhaustion, depression, loss of appetite and weight loss. Lack of aldosterone leads to a drop in blood pressure, particularly when standing up quickly, and to disturbed salt levels in the blood. Sometimes patients also describe a craving for salty food. Loss of DHEA production by the adrenals results in loss of hair in pubic and underarm areas and also potentially reduced sex drive and low energy levels in women affected by adrenal insufficiency. A specific dark pigmentation of the skin is also sometimes observed, particularly in areas where the clothes rub against the skin and in areas exposed to increased friction, such as the creases of the hands.

Cortisol is important for life and its production by the adrenal glands is especially important at times when the body experiences intense 'stress', such as surgery, trauma or serious infection. If the adrenal glands cannot produce enough cortisol, the body might not be able to cope with this kind of major stress, which can be life-threatening. This situation is called adrenal crisis and is a medical emergency. Possible signs and symptoms of adrenal crisis are low blood pressure, abdominal pain, vomiting, nausea, severely abnormal salt levels in the blood that may affect the function of the heart and sometimes also fever and confusion.

What are the causes of adrenal insufficiency?

Adrenal insufficiency arises if the adrenal glands are destroyed, absent or cannot function. Failure of the adrenal glands themselves is called primary adrenal insufficiency or Addison's disease after Thomas Addison, who was the first to make the connection between disease of the adrenals and the clinical signs and symptoms described above.

Addison's disease is most often caused by autoimmune disease where the body's immune system mounts an attack against its own adrenal cells. However, it can also be caused by infection, most importantly by tuberculosis. Sometimes both adrenal glands are surgically removed for various reasons; this is called a bilateral adrenalectomy and is another cause of primary adrenal insufficiency.

There are also inborn causes of adrenal insufficiency which are caused by spelling errors in the genetic code. This includes the disruption of hormone production in the adrenals by different variants of congenital adrenal hyperplasia (CAH). In CAH, there is a spelling error in the gene responsible for the production of the protein that helps to generate cortisol in the adrenal; as a result cortisol and often also aldosterone levels are low. Another inborn cause of adrenal insufficiency is a condition called X-linked adrenoleukodystophy (ALD) or adrenomyeloneuropathy (AMN) that affects boys and men and can cause both adrenal insufficiency and neurological symptoms.

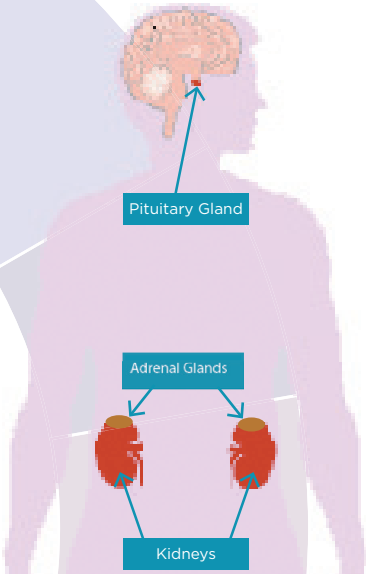
Another important cause of adrenal insufficiency is disease affecting the pituitary gland, an endocrine gland located behind the nose at the bottom of the brain. The pituitary is the master gland that tells all other glands in the body what to do. This includes not only the adrenals but also the thyroid and the gonads (testes or ovaries). The pituitary gland produces a hormone called ACTH (adrenocorticotropic hormone), which travels in the blood stream to the adrenal glands. Here it acts as a signal, causing the adrenal glands to produce more cortisol. ACTH is also responsible for the extra pigmentation found in primary Addison's disease.

Loss of the pituitary gland's ability to produce ACTH is most often caused by a tumour in this area. If this happens and the pituitary gland stops making ACTH, this means that cortisol production by the adrenals is no longer controlled properly and a condition called secondary adrenal insufficiency arises. In this case, DHEA production usually declines as well. In most cases of secondary adrenal insufficiency, however, aldosterone is still produced, as its production is stimulated by other hormonal regulatory systems, involving the kidneys rather than the pituitary. This means that patients with secondary adrenal insufficiency usually have fewer problems with low blood pressure and disturbed salt levels in the blood. People with secondary adrenal failure also do not experience the extra pigmentation found in primary Addison's disease.

Importantly, patients who receive treatment with synthetic steroid medications that have a similar action to cortisol, such as prednisone, prednisolone and dexamethasone, may also be at risk of developing adrenal insufficiency. This sometimes also applies to patients who receive steroids in the form of inhalers or by injection into a joint; speaking to your doctor can help to clarify if this applies to you.

Adrenal insufficiency arises if the adrenal glands are destroyed, absent or cannot function

The presence of synthetic steroids in the blood leads the pituitary gland to 'believe' that enough cortisol is produced by the adrenals. The pituitary therefore decreases its production of ACTH and subsequently the adrenals also stop producing cortisol and go into a state of deep sleep, like a hibernation. This is not a problem as long as the tablets with the synthetic steroids continue to be taken at the correct dose. However, if they are suddenly stopped, life-threatening adrenal crisis could arise. Therefore, if synthetic steroids are no longer needed, (eg for the treatment of asthma or rheumatoid arthritis), their doses need to be gradually reduced over several weeks or months to ensure that the adrenal glands wake up again and start producing cortisol. These changes in medication should be only undertaken under close supervision of your doctor.



What are the symptoms of adrenal insufficiency?

Clinical signs and symptoms of adrenal insufficiency usually develop gradually and can include severe fatigue and weakness, loss of weight, increased pigmentation of the skin, faintness and low blood pressure, often with a particular drop in blood pressure shortly after standing up. Other symptoms include nausea, vomiting, salt craving and painful muscles and joints.

Because of the rather non-specific nature of these symptoms and their slow progression, they are often missed or ignored until, for example, a relatively minor infection leads to an abnormally long convalescence which prompts an investigation. Frequently, it is not until a crisis is precipitated that attention is turned to the adrenal glands.

To establish the diagnosis of adrenal insufficiency with confidence, a short synacthen test (SST) needs to be performed

How is adrenal insufficiency diagnosed?

Signs and symptoms associated with adrenal insufficiency, such as exhaustion, fatigue, muscle weakness and weight loss, are often unspecific. Adrenal insufficiency may cause changes in the blood salt levels, eg. low serum sodium and high serum potassium. Often there is borderline low red blood cell counts ("anaemia") as well. However, these findings are relatively unspecific and can be found in the context of several conditions other than adrenal insufficiency.

To establish the diagnosis of adrenal insufficiency with confidence, a short synacthen test (SST) needs to be performed. This test is also known as an ACTH stimulation test or a cosyntropin test. The short synacthen test measures the ability of the adrenal glands to produce cortisol in response to ACTH, the pituitary hormone that regulates adrenal cortisol production. When carrying out this test a baseline blood sample is drawn before injecting a dose of ACTH, followed by drawing of a second blood sample 30-60 min after the ACTH injection. If the adrenal glands are healthy, cortisol production in the second sample will exceed a certain level, commonly 500-550 nmol/L. By contrast, failing adrenal glands will not be able to produce this amount of cortisol. It is important that this test is carried out under the supervision of an endocrinologist, a doctor specialising in hormone-related diseases.

The short synacthen test is a very reliable instrument in diagnosing adrenal insufficiency arising from both adrenal and pituitary disease. Where adrenal insufficiency arising from pituitary disease is suspected and the short synacthen test results do not match the clinical suspicion and symptoms persist, then your doctor may consider to perform an alternative test to assess adrenal function, such as an insulin tolerance test.

Drawing only baseline blood samples for cortisol, without injecting ACTH to stimulate cortisol production, is only of very limited value in the diagnosis of adrenal insufficiency as this does not reflect the ability of the adrenals to respond to stress with increased production of cortisol. Stress such as surgery or trauma modifi es cortisol production. Thus a certain cortisol concentration may be appropriate in a relaxed patient but much too low for a severely distressed patient. Only a dynamic function test, commonly the short synacthen test described above, can give a conclusive answer, supported by the clinical judgement of an experienced endocrinologist.

Following the confirmation of adrenal insufficiency by the short synacthen test (and sometimes by the insulin tolerance test), the endocrinologist will determine the exact cause of the failure of the adrenal glands.The first step is to establish if the adrenal failure arises from a problem with the adrenal glands themselves ("primary adrenal insufficiency") or with a problem within their regulatory centres, the hypothalamus and the pituitary ("secondary adrenal insufficiency").

In patients with primary adrenal insufficiency, autoimmune disease destroying the adrenal glands by turning the patient's own immune system against them is the most common cause. In most of those cases, this can be confirmed by measuring adrenal antibodies in the blood. If these results come back negative, further investigations might be warranted. In particular in male patients with a negative adrenal antibody result the possibility of adrenoleukodystrophy has to be considered, which can be diagnosed by checking the blood levels of the Very Long Chain Fatty Acids (VLCFA).

Adrenal Crisis

When a patient is suspected of suffering from adrenal insufficiency and concurrently shows signs of possible adrenal crisis (typically, persistent vomiting with profound muscle weakness, low blood pressure or even shock, extreme sleepiness or even coma) the patient should be admitted to hospital as an emergency and if possible stabilised by a saline infusion prior to transfer. In such cases, doctors often take only baseline blood samples and defer the short synacthen test to later. Baseline blood cortisol levels of less than 100 nmol/L in a severely distressed patient who requires emergency hospital treatment is indicative of adrenal insufficiency. Emergency treatment should be initiated without delay as the diagnosis can still be formally confirmed later by the short synacthen test once the patient is stable again.

Only patients who have been conclusively diagnosed with adrenal insufficiency, as described above, should receive adrenal hormone replacement therapy as advised by an endocrinologist. A normal adrenal gland does not need supplements to function properly and there is no recognised medical condition called “adrenal fatigue”, the adrenal glands cannot be “fatigued”. Either the adrenal is fine and needs no treatment or there is adrenal insufficiency due to adrenal or pituitary failure, as measured by an endocrinologist. Taking adrenal hormones or so-called “adrenal supplements” that may contain active adrenal hormone extract when they are not needed means that the adrenal glands of that individual may become incapable of producing sufficient hormones when they are needed, as described above for the deep sleep of the adrenals caused by synthetic steroids.

Importantly, individuals who self-medicate in this way may delay detection of the real cause of their symptoms. Many illnesses present with symptoms of fatigue, poor concentration and sleepiness. Some examples are cancer, rheumatic diseases, depression, obstructive sleep apnoea, hepatitis C along with many others. Precious time might be wasted while the real underlying disease progresses.

A normal adrenal gland does not need supplements to function properly and there is no recognised medical condition called “adrenal fatigue”

Further information

Patient support groups:

Addison's Disease Self-Help Group
Web: www.addisons.org.uk

ALD life
Tel: 0207 701 4388
Email: info@aldlife.org
Web: www.aldlife.org

Association for Multiple Endocrine Neoplasia Disorders (AMEND)
Tel: 01892 516076
Email: info@amend.org.uk
Web: www.amend.org.uk

CLIMB CAH Support Group
Web: www.livingwithcah.com

Pituitary Foundation
Tel: 0117 370 1320 (Mon-Fri 10:00-16:00)
Email: helpline@pituitary.org.uk
Web: www.pituitary.org.uk

Further reading and useful web addresses:

You & Your Hormones
Web: www.yourhormones.info

Myth vs Fact - Adrenal Fatigue factsheet (January 2015)
Produced by the Hormone Health Network and The Endocrine Society
http://www.hormone.org/hormones-and-health/myth-vs-fact/adrenal-fatigue

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Husebye ES et al. Consensus statement on the diagnosis, treatment and follow-up of patients with primary adrenal insufficiency, J Intern Med. 2014 Feb;275(2):104-15. doi: 10.1111/joim.12162. http://onlinelibrary.wiley.com/doi/10.1111/joim.12162/full

Wass J et al. Diagnosing Addison's: a guide for GPs, Addison's Clinical Advisory Panel 2009, http://www.addisons.org.uk/forum/index.php?/files/file/3-diagnosing-addisons-a-guide-for-gps/

This leaflet has been endorsed by...

Addison's Disease Self Help Group
www.addisons.org.uk

ALD Life
www.aldlife.org

Association for Multiple Endocrine Neoplasia Disorders (AMEND)
www.amend.org.uk

CLIMB CAH Support Group
www.livingwithcah.com

European Society of Endocrinology
www.ese-hormones.org

Pituitary Foundation
www.pituitary.org.uk

Royal College of Physicians
www.rcplondon.ac.uk

Society for Endocrinology
www.endocrinology.org

About this leaflet

This patient information leaflet is authored by Professor Wiebke Arlt (Centre for Endocrinology, Diabetes & Metabolism, University of Birmingham, UK), on behalf of the Clinical Committee of the Society for Endocrinology (www.endocrinology.org) with assistance from Katherine White of the Addison's Disease Self Help Group UK (www.addisons.org.uk).

Note to patients

Patients should consult their GP/specialist physician regarding all diagnosis and treatment decisions and any changes to medication should be with the doctor's knowledge and agreement.

Society for Endocrinology

22 Apex Court, Bradley Stoke,
Bristol BS32 4JT UK