Patient information: Hyperthyroidism (overactive thyroid) (Beyond the Basics)

Author
Douglas S Ross, MD

Section Editor
David S Cooper, MD

Deputy Editor
Jean E Mulder, MD

HYPERTHYROIDISM OVERVIEW

Hyperthyroidism is the medical term for an overactive thyroid (hyper = excessive). In people with hyperthyroidism, the thyroid gland produces too much thyroid hormone. When this occurs, the body's metabolism is increased, which can cause a variety of symptoms.

This topic discusses the symptoms, diagnostic tests, and treatment options for HYPERThyroidism. HYPOThyroidism is discussed in a separate topic. (See "Patient information: Hypothyroidism (underactive thyroid) (Beyond the Basics)."

WHAT IS THE THYROID?

The thyroid is a butterfly-shaped gland in the middle of the neck, located below the larynx (voice box) and above the clavicles (collarbones) (figure 1). The thyroid produces two hormones, triiodothyronine (T3) and thyroxine (T4), that regulate how the body uses and stores energy (also known as the body's metabolism).

The thyroid is controlled by a gland in the brain, known as the pituitary. The pituitary produces thyroid stimulating hormone (TSH), which stimulates the thyroid to produce T3 and T4.

HYPERTHYROIDISM CAUSES

Graves' disease — Graves' disease is the most common cause of hyperthyroidism. It is not clear why Graves' disease develops in most people, although it more common in certain families.

In people with Graves' disease, the immune system produces an antibody that stimulates the thyroid gland to produce too much thyroid hormone. This is most common in women between the ages of 20 and 40, but can occur at any age in men or women. The thyroid gland enlarges (called a goiter) (figure 2) and makes excessive amounts of thyroid hormone, causing symptoms of hyperthyroidism (see 'Hyperthyroidism symptoms' below).

Some people develop eye problems (called Graves' ophthalmopathy or orbitopathy), which causes dry, irritated or red eyes, and in severe cases may cause double vision. Others develop swelling behind or around the eyes that causes the eyes to bulge out, or inflammation of muscle in the eyelids that can cause excessive lid opening (figure 2). The more severe manifestations of Graves' eye disease are
uncommon, except in smokers. In its most severe form, people with Graves' ophthalmopathy can develop inflammation of the optic nerves, which can result in loss of vision.

**Other causes**

- One or more thyroid nodules (small growths or lumps in the thyroid gland) can produce too much thyroid hormone. The nodule is then called a hot nodule, toxic nodule, or when there is more than one, a toxic nodular goiter. (See "Patient information: Thyroid nodules (Beyond the Basics)."

- Painless ("silent or lymphocytic") thyroiditis and postpartum thyroiditis are disorders in which the thyroid becomes temporarily inflamed and releases thyroid hormone into the bloodstream, causing hyperthyroidism.

  Postpartum thyroiditis can occur several months after delivery. The hyperthyroid symptoms may last for several months, often followed by several months of hypothyroid symptoms, such as fatigue, muscle cramps, bloating, and weight gain.

- Subacute (granulomatous) thyroiditis is thought to be caused by a virus. It causes a painful, tender, enlarged thyroid gland. The thyroid becomes inflamed and releases thyroid hormone into the bloodstream; the hyperthyroidism resolves when the viral infection improves, and may also be followed by several months of hypothyroid symptoms.

- Taking too much thyroid hormone medication for hypothyroidism.

### HYPERTHYROIDISM SYMPTOMS

Most people with hyperthyroidism have symptoms, including one or more of the following:

- Anxiety, irritability, trouble sleeping
- Weakness (in particular of the upper arms and thighs, making it difficult to lift heavy items or climb stairs or get up from a chair)
- Tremors (of the hands)
- Perspiring more than normal, difficulty tolerating hot weather
- Rapid, forceful, or irregular heartbeats
- Fatigue
- Weight loss in spite of a normal or increased appetite
- Frequent bowel movements

In addition, some women have irregular menstrual periods or stop having their periods altogether. This can be associated with infertility. Men may develop enlarged or tender breasts, or erectile dysfunction, which resolves when hyperthyroidism is treated.

### HYPERTHYROIDISM DIAGNOSIS

Hyperthyroidism can be diagnosed with blood tests that measure the amount of thyroid hormone and thyroid-stimulating hormone (TSH). Typically, the thyroid hormone level is high and the TSH level is low. A thyroid scan may also be recommended to help determine the cause of hyperthyroidism (Graves' disease, toxic nodular goiter, or thyroiditis).
HYPERTHYROIDISM TREATMENT

Hyperthyroidism can be treated using medicine, radioiodine, or surgery. Many factors, such as your age and the severity and type of hyperthyroidism, as well as your preferences, are important in determining which treatment is best.

Medications — The two main types of medicines used to treat hyperthyroidism are antithyroid drugs and beta-blockers. (See "Patient information: Antithyroid drugs (Beyond the Basics)")

Antithyroid drugs — Antithyroid drugs, such as methimazole (MMI or Tapazole) and propylthiouracil (PTU), work by decreasing how much thyroid hormone the body makes. Both are very effective, but methimazole is preferred because of a greater risk of serious side effects with PTU. Carbimazole is similar to methimazole and is used in many countries, but not in the United States.

Because methimazole can be associated with birth defects, for pregnant women, PTU is the preferred drug during the first trimester. After the first trimester, methimazole is preferred. (See "Patient information: Antithyroid drugs (Beyond the Basics)")

These medications can be used:

- As a short-term (four to eight weeks) treatment in people with Graves' disease or toxic nodular goiter, before treatment with radioiodine or surgery.
- As a long-term (one to two years) treatment for Graves' disease. The disease goes into remission in about 30 percent of people and antithyroid drugs can be used to control hyperthyroidism while waiting to see if remission occurs.

People who have very mild Graves' disease may have as high as a 50 to 70 percent chance of remission. It is possible to have a relapse years later, and most people will need to eventually consider permanent treatment with radioactive iodine or surgery.

Antithyroid drugs have some minor side effects, such as rash, hives, painful joints, fever, and stomach upset. A more serious complication called agranulocytosis (lack of white blood cells) can occur, but this is very rare. Patients taking antithyroid drugs should notify their clinician immediately if they get a sore throat, fever, or any signs of a bacterial infection. PTU has rarely been linked with liver failure.

While taking antithyroid drugs, you will have a blood test for thyroid hormone every four to six weeks until your hyperthyroidism is under control.

Beta-blockers — Beta-blockers, such as atenolol or propranolol, are often started as soon as the diagnosis of hyperthyroidism is made. While beta-blockers do not reduce thyroid hormone production, they can control many of the bothersome symptoms, such as rapid heart rate, tremors, anxiety, and heat intolerance. Once the hyperthyroidism is under control (with antithyroid drugs, surgery, or radioactive iodine), the beta-blocker is stopped.

Radioactive iodine — Destroying the thyroid with radioiodine, called ablation, is a permanent way to treat hyperthyroidism. The amount of radiation used is small and does not cause cancer, infertility, or birth defects. This is the most widely used treatment for hyperthyroidism in the United States.

Radioiodine is given in liquid or capsule form, and it works by destroying much of the thyroid tissue. This takes about 6 to 18 weeks. People with severe symptoms, older adults, and people with heart problems should first be treated with an antithyroid drug to control symptoms. Most people who take radioiodine
develop hypothyroidism and will need to take thyroid hormone supplements for the rest of their lives. (See "Patient information: Hypothyroidism (underactive thyroid) (Beyond the Basics).")

As with most treatments, there are some risks with radioactive iodine:

- Sometimes, after apparently successful treatment, the condition returns and further treatment is needed.
- About 10 to 20 percent of people who use radioiodine treatment require a second dose. These people usually have severe hyperthyroidism or a very large goiter.
- Occasionally, people with Graves' disease find that their eye symptoms worsen after therapy.

People who are treated with radioiodine should avoid close physical contact, especially with young children and pregnant women, for three to seven days after treatment because of the possibility of exposing them to low doses of radiation. This can be difficult for parents of young children.

You will need to see your doctor or nurse on a regular basis after treatment to have your thyroid hormone levels checked and monitor for hypothyroidism or recurrent hyperthyroidism.

**Surgery** — Although surgical removal of the thyroid is a permanent cure for hyperthyroidism, it is used far less often than antithyroid drugs or radioactive iodine because of the risks (and expense) associated with thyroid surgery. The risks include damage to the nerves of the voice box and parathyroid glands, which regulate the body's calcium balance.

However, surgery is recommended when:

- A large goiter blocks the airways, making it difficult to breathe
- You cannot tolerate antithyroid drugs and you do not want to use radioiodine
- There is a nodule in the thyroid gland that could be cancer

The follow-up after surgery includes regular appointments to test your thyroid hormone levels and monitor for signs of hypo- and hyperthyroidism. Most people develop hypothyroidism after surgery and require treatment with thyroid hormone. (See "Patient information: Hypothyroidism (underactive thyroid) (Beyond the Basics).")

**PREGNANCY AND HYPERTHYROIDISM**

Women who take antithyroid drugs and want to become pregnant should discuss this with their doctor or nurse. There are risks to the mother and developing baby if hyperthyroidism is not well controlled; these risks can be avoided or minimized with frequent monitoring and medication adjustment throughout the pregnancy.

Women who are pregnant or breastfeeding should not be treated with radioactive iodine. Having radioactive iodine treatment before becoming pregnant usually eliminates the need for antithyroid drugs and any possible associated risks. A woman should wait at least six months after radioactive iodine treatment before trying to become pregnant.

**WHERE TO GET MORE INFORMATION**

Your healthcare provider is the best source of information for questions and concerns related to your medical problem.
This article will be updated as needed on our web site (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for healthcare professionals, are also available. Some of the most relevant are listed below.

**Patient level information** — UpToDate offers two types of patient education materials.

**The Basics** — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

- Patient information: Hyperthyroidism (overactive thyroid) (The Basics)
- Patient information: Thyroid nodules (The Basics)
- Patient information: Congenital hypothyroidism (The Basics)
- Patient information: Multinodular goiter (The Basics)
- Patient information: Pituitary adenoma (The Basics)
- Patient information: Periodic paralysis syndrome (The Basics)
- Patient information: Thyroiditis after pregnancy (The Basics)
- Patient information: Hyperthyroidism (overactive thyroid) and pregnancy (The Basics)
- Patient information: Thyroiditis (The Basics)

**Beyond the Basics** — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

- Patient information: Hypothyroidism (underactive thyroid) (Beyond the Basics)
- Patient information: Thyroid nodules (Beyond the Basics)
- Patient information: Antithyroid drugs (Beyond the Basics)

**Professional level information** — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

- Amiodarone and thyroid dysfunction
- Beta blockers in the treatment of hyperthyroidism
- Bone disease with hyperthyroidism and thyroid hormone therapy
- Cardiovascular effects of hyperthyroidism
- Hyperthyroidism during pregnancy: Clinical manifestations, diagnosis, and causes
- Clinical manifestations and diagnosis of hyperthyroidism in children and adolescents
- Hyperthyroidism during pregnancy: Treatment
- Diagnosis of hyperthyroidism
- Disorders that cause hyperthyroidism
- Evaluation and management of neonatal Graves' disease
- Exogenous hyperthyroidism
- Iodinated radiopaque agents in the treatment of hyperthyroidism
- Iodine in the treatment of hyperthyroidism
- Neurologic manifestations of hyperthyroidism and Graves' disease
- Overview of the clinical manifestations of hyperthyroidism in adults
- Radiodine in the treatment of hyperthyroidism
- Subclinical hyperthyroidism
- Surgery in the treatment of hyperthyroidism: Indications, preoperative preparation, and postoperative

follow-up

Thionamides in the treatment of Graves' disease
Treatment of Graves' hyperthyroidism

The following organizations also provide reliable health information.

- National Library of Medicine
  (www.nlm.nih.gov/medlineplus/healthtopics.html)
- The American Thyroid Association
  (www.thyroid.org)
- Thyroid Foundation of Canada
  (www.thyroid.ca)
- The Hormone Foundation
  (www.hormone.org/public/thyroid.cfm, available in English and Spanish)

Patient support — There are a number of online forums where patients can find information and support from other people with similar conditions.

- About.com Thyroid Conditions Forum
  (http://thyroid.about.com/forum)

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References

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Overactive thyroid

Hyperthyroidism can cause the thyroid gland to enlarge. This causes a swelling in the neck called a "goiter". Hyperthyroidism caused by Grave's disease can also make the eyes bulge.

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