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## Patient education: Hypothyroidism (underactive thyroid) (Beyond the Basics)

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### HYPOTHYROIDISM OVERVIEW

Hypothyroidism is a condition in which the thyroid gland does not produce enough thyroid hormone. It is the most common thyroid disorder.

This topic discusses **hypothyroidism**. **Hyperthyroidism** is discussed separately. (See "[Patient education: Hyperthyroidism \(overactive thyroid\) \(Beyond the Basics\)](#)".)

### 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 produce two hormones, triiodothyronine (T3) and thyroxine (T4), which regulate how the body uses and stores energy (also known as the body's metabolism).

Thyroid function is controlled by a gland just below the brain, known as the pituitary. The pituitary produces thyroid-stimulating hormone (TSH), which stimulates the thyroid to produce

T3 and T4.

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## HYPOTHYROIDISM CAUSES

In approximately 95 percent of cases, hypothyroidism is due to a problem in the thyroid gland itself and is called primary hypothyroidism. However, certain medications and diseases can also decrease thyroid function. As an example, **hypothyroidism** can also develop after medical treatments for **hyperthyroidism**, such as thyroidectomy (surgical removal of the thyroid) or radioactive iodine treatment (to destroy thyroid tissue). In some cases, hypothyroidism is a result of decreased production of thyroid-stimulating hormone (TSH) by the pituitary gland (called secondary hypothyroidism). (See "[Patient education: Hyperthyroidism \(overactive thyroid\) \(Beyond the Basics\)](#)".)

Thyroid problems are more common in women, increase with age, and (in the United States) are more common in white people and Mexican Americans than in African Americans.

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## HYPOTHYROIDISM SYMPTOMS

The symptoms of hypothyroidism vary widely; some people have no symptoms, while others have dramatic symptoms or, rarely, life-threatening symptoms. The symptoms of hypothyroidism are notorious for being nonspecific and for mimicking many of the normal changes of aging. Usually, symptoms are milder when hypothyroidism develops gradually. Symptoms, when caused by hypothyroidism, generally are related to the degree of hypothyroidism. Many patients with mild hypothyroidism are identified on screening tests for potential hypothyroid symptoms but have few or no symptoms that ultimately are attributed to hypothyroidism or respond to treatment of hypothyroidism. In contrast, patients with moderate to severe hypothyroidism are usually symptomatic and improve significantly with thyroid hormone replacement.

The following list of symptoms are those that may be present prior to treatment; hypothyroid patients on appropriate treatment should no longer be symptomatic. If symptoms persist, they likely have causes other than hypothyroidism.

**General symptoms** — Thyroid hormone normally stimulates the metabolism, and most of the symptoms of hypothyroidism reflect slowing of metabolic processes. General symptoms may include fatigue, sluggishness, slight weight gain, and intolerance of cold temperatures.

**Skin** — Hypothyroidism can decrease sweating. The skin may become dry and thick. The hair may become coarse or thin, eyebrows may disappear, and nails may become brittle.

**Eyes** — Hypothyroidism can lead to mild swelling around the eyes. People who develop hypothyroidism after treatment for Graves' disease may retain some of the eye symptoms of Graves' disease, including protrusion of the eyes, the appearance of staring, and impaired movement of the eyes. (See ["Patient education: Hyperthyroidism \(overactive thyroid\) \(Beyond the Basics\)"](#).)

**Cardiovascular system** — Hypothyroidism slows the heart rate and weakens the heart's contractions, decreasing its overall function. Related symptoms may include fatigue and shortness of breath with exercise. These symptoms may be more severe in people who also have heart disease. In addition, hypothyroidism can cause mild high blood pressure and raise blood levels of cholesterol.

**Respiratory system** — Hypothyroidism weakens the respiratory muscles and decreases lung function. Symptoms can include fatigue, shortness of breath with exercise, and decreased ability to exercise. Hypothyroidism can also lead to swelling of the tongue, hoarse voice, and sleep apnea. Sleep apnea is a condition in which there is intermittent blockage of the airway while sleeping, causing fitful sleep and daytime sleepiness. (See ["Patient education: Sleep apnea in adults \(Beyond the Basics\)"](#).)

**Gastrointestinal system** — Hypothyroidism slows the actions of the digestive tract, causing constipation. Rarely, the digestive tract may stop moving entirely. (See ["Patient education: Constipation in adults \(Beyond the Basics\)"](#).)

**Reproductive system** — Women with hypothyroidism often have menstrual cycle irregularities, ranging from absent or infrequent periods to very frequent and heavy periods. The menstrual irregularities can make it difficult to become pregnant, and pregnant women with hypothyroidism have an increased risk for miscarriage during early pregnancy. Treatment of hypothyroidism can decrease these risks. (See ["Patient education: Absent or irregular periods \(Beyond the Basics\)"](#) and ["Patient education: Heavy or prolonged menstrual bleeding \(menorrhagia\) \(Beyond the Basics\)"](#).)

**Myxedema coma** — In people with severe hypothyroidism, trauma, infection, exposure to the cold, and certain medications can rarely trigger a life-threatening condition called myxedema coma, which causes a loss of consciousness and hypothermia (low body temperature).

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## HYPOTHYROIDISM DIAGNOSIS

In the past, hypothyroidism was not diagnosed until symptoms had been present for a long time. However, simple blood tests can now detect hypothyroidism at an early stage. A person may be tested for hypothyroidism if there are signs and symptoms, such as those discussed above, or as a screening test.

**Blood tests** — Blood tests can confirm the diagnosis and pinpoint the underlying cause of the thyroid hormone deficiency. The most common blood test for hypothyroidism is thyroid-stimulating hormone (TSH). TSH is the most sensitive test because it can be elevated even with small decreases in thyroid function. Thyroxine (T4), the main product of the thyroid gland, may also be measured to confirm and assess the degree of hypothyroidism. "Overt" hypothyroidism is diagnosed when the TSH is elevated and the T4 is low. "Subclinical" hypothyroidism is diagnosed when the TSH is elevated but the T4 is normal.

**Routine screening** — All newborn babies in the United States are routinely screened for thyroid hormone deficiency. It is not clear if all adults should be tested for thyroid disease [1].

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## HYPOTHYROIDISM TREATMENT

The goal of treatment for hypothyroidism is to return blood levels of thyroid-stimulating hormone (TSH) and thyroxine (T4) to the normal range and to alleviate symptoms.

**Medication** — The treatment for hypothyroidism is thyroid hormone replacement therapy. This is usually given as an oral form of T4 ([levothyroxine](#)). T4 should be taken once per day on an empty stomach (ideally one hour before eating or two hours after; most patients take their hormone as soon as they wake in the morning, and delay eating breakfast as long as practical before leaving for work or school). Generic (levothyroxine) and brand-name (Synthroid, Levoxyl, Levothroid, Unithyroid) are available as tablets, and gel-caps and liquid preparations are also available (Tirosint). These formulations are equally effective. However, it is preferable to stay on the same manufacturer of T4 rather than switching between brand name and/or generic formulations.

If a switch is necessary and the patient feels that their levels may be off, a blood test can be done six weeks later to determine if the dose needs to be adjusted. Color-coded tablets can help with dose adjustments.

Some clinicians prescribe another form of thyroid hormone, T3 ([lithyronine](#)), in combination with T4. However, since T4 is converted into triiodothyronine (T3) in other organs, the majority of studies have not shown an advantage of combination T3 and T4 therapy over T4 alone.

In most cases, symptoms of hypothyroidism begin to improve within two weeks of starting thyroid replacement therapy. However, people with more severe symptoms may require several months of treatment before they fully recover.

**Duration and dose** — A health care provider will prescribe an initial dose of T4 and then retest the blood level of TSH after six weeks. The T4 dose can be adjusted at that time, depending upon these results. This process may be repeated several times before hormone levels become normal. After the optimal dose is identified, a provider may recommend monitoring blood tests once yearly, or more often as needed. Most people with hypothyroidism require lifelong treatment, although the dose of T4 may need to be adjusted over time.

Never increase or decrease the T4 dose without first consulting a health care provider. Over-replacement of T4 can cause mild hyperthyroidism, with the associated dangers of atrial fibrillation (irregular heart beat) and, possibly, accelerated bone loss (osteoporosis).

**Dose changes** — Changes in the T4 dose are based upon the person's TSH and T4 level. The dose may need to be increased if thyroid disease worsens, during pregnancy, if gastrointestinal conditions impair T4 absorption, or if the person gains weight. A high-fiber diet, calcium- or aluminum-containing antacids, and iron tablets can interfere with the absorption of T4 and should be taken at a different time of day.

The dose may need to be decreased as the person gets older, after childbirth, or if the person loses weight.

**Monitoring** — Individual T4 doses can vary widely and depend upon a variety of factors, including the underlying cause of hypothyroidism. People with certain conditions require more frequent monitoring.

**Advanced age and heart disease** — Thyroid hormone makes the heart work a bit harder. Therefore, a clinician may opt for more conservative T4 treatment in older adults and in people with coronary artery disease.

**Pregnancy** — Women often need higher doses of T4 during pregnancy. Testing is usually recommended every four weeks, beginning after conception, until levels are stable, then once each trimester. After delivery, the woman's dose of T4 will need to be adjusted again, usually returning to the pre-pregnancy dose.

**Surgery** — Hypothyroidism can increase the risk of certain surgery-related complications; bowel function may be slow to recover, and infection may be overlooked if there is no fever. If

preoperative blood tests reveal low thyroid hormone levels, nonemergency surgery is usually postponed until treatment has returned T4 levels to normal.

**Subclinical hypothyroidism** — Subclinical hypothyroidism is when the TSH is elevated but the T4 is normal. The decision to treat subclinical hypothyroidism with T4 is controversial. Patients with a TSH >10 mU/L are usually treated. The decision to treat patients with a TSH that is above the upper limit of normal (this cutoff can vary but is usually around 5 mU/L) but below 10 mU/L is often based upon age and the presence of goiter (enlargement of the thyroid) or new or worsening symptoms of hypothyroidism. Symptoms can include fatigue, constipation, cold intolerance, or depression. Younger patients (under age 65 to 70 years) are treated more often than older patients.

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## WHERE TO GET MORE INFORMATION

Your health care 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 website ([www.uptodate.com/patients](http://www.uptodate.com/patients)). Related topics for patients, as well as selected articles written for health care 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 education: Hypothyroidism \(underactive thyroid\) \(The Basics\)](#)

[Patient education: Hemochromatosis \(The Basics\)](#)

[Patient education: Thyroid nodules \(The Basics\)](#)

[Patient education: Congenital hypothyroidism \(The Basics\)](#)

[Patient education: Hypoparathyroidism \(The Basics\)](#)

[Patient education: Panhypopituitarism \(The Basics\)](#)

[Patient education: Thyroiditis after pregnancy \(The Basics\)](#)

[Patient education: 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 education: Hyperthyroidism \(overactive thyroid\) \(Beyond the Basics\)](#)

[Patient education: Sleep apnea in adults \(Beyond the Basics\)](#)

[Patient education: Constipation in adults \(Beyond the Basics\)](#)

[Patient education: Absent or irregular periods \(Beyond the Basics\)](#)

[Patient education: Heavy or prolonged menstrual bleeding \(menorrhagia\) \(Beyond the Basics\)](#)

**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.

[Acquired hypothyroidism in childhood and adolescence](#)

[Cardiovascular effects of hypothyroidism](#)

[Central hypothyroidism](#)

[Clinical features and detection of congenital hypothyroidism](#)

[Clinical manifestations of hypothyroidism](#)

[Diagnosis of and screening for hypothyroidism in nonpregnant adults](#)

[Disorders that cause hypothyroidism](#)

[Laboratory assessment of thyroid function](#)

[Myxedema coma](#)

[Neurologic manifestations of hypothyroidism](#)

[Overview of thyroid disease and pregnancy](#)

[Subclinical hypothyroidism in nonpregnant adults](#)

[Treatment and prognosis of congenital hypothyroidism](#)

[Treatment of primary hypothyroidism in adults](#)

[Endocrinopathies in cancer survivors and others exposed to cytotoxic therapies during childhood](#)

The following organizations also provide reliable health information.

- National Library of Medicine

[www.nlm.nih.gov/medlineplus/healthtopics.html](http://www.nlm.nih.gov/medlineplus/healthtopics.html)

- The American Thyroid Association

[www.thyroid.org](http://www.thyroid.org)

- Hormone Health Network

([www.hormone.org/diseases-and-conditions/thyroid/hypothyroidism](http://www.hormone.org/diseases-and-conditions/thyroid/hypothyroidism))

[1,2]

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## REFERENCES

1. [U.S. Preventive Services Task Force. Screening for thyroid disease: recommendation statement. Ann Intern Med 2004; 140:125.](#)
2. [Surks MI, Ortiz E, Daniels GH, et al. Subclinical thyroid disease: scientific review and guidelines for diagnosis and management. JAMA 2004; 291:228.](#)

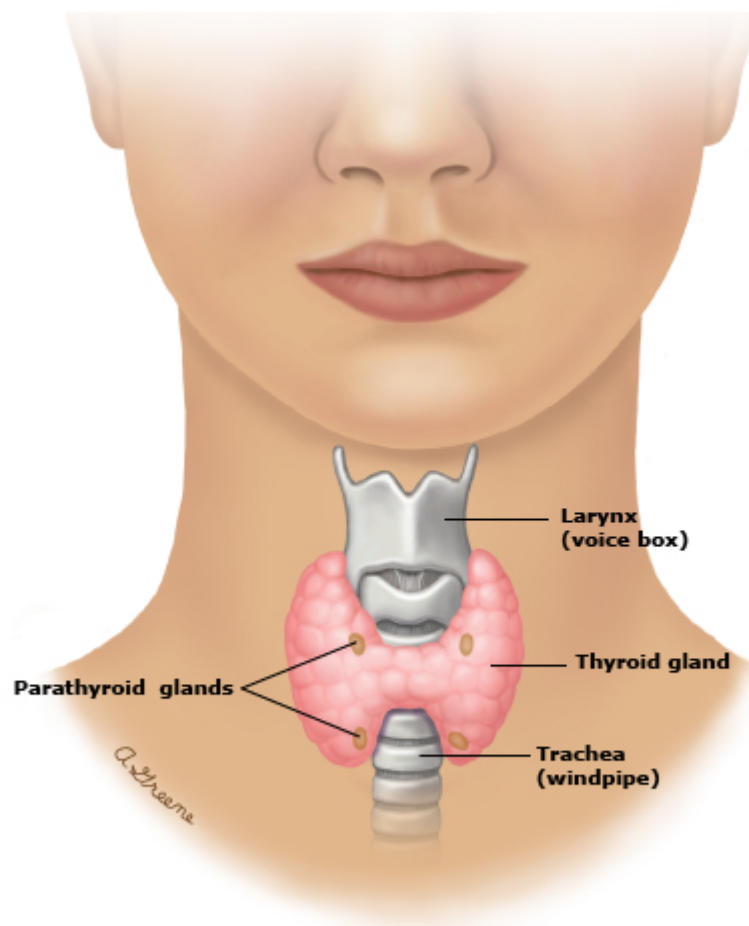
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## GRAPHICS

### Thyroid and parathyroid glands

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The thyroid is a butterfly-shaped gland in the middle of the neck. It sits just below the larynx (voice box). The thyroid makes two hormones, called T3 and T4, which control how the body uses and stores energy. The parathyroid glands are four small glands behind the thyroid. They make a hormone called parathyroid hormone, which helps control the amount of calcium in the blood.

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T3: triiodothyronine; T4: thyroxine.

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## Contributor Disclosures

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