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For patients

Thyroid Disease

Thyroid disease occurs when the thyroid (a small, butterfly-shaped gland in the front of your neck) does not produce the right amount of thyroid hormone. Or it occurs when an abnormal growth develops, giving rise to a lump or nodule. Thyroid hormones control how your body uses energy. If you are feeling fatigued, notice skin or hair changes, have hoarseness or pain, your doctor may conduct a physical exam and order blood tests to assess thyroid function. If these tests indicate a problem, your doctor may order a thyroid scan. Your doctor may find a lump or nodule at your thyroid. If so, they may use ultrasound imaging, a thyroid scan or thyroid biopsy to help assess your condition. Treatment will depend on the specific nature of your thyroid condition and its underlying cause.

What is thyroid disease?

The thyroid is a small, butterfly-shaped gland in the front of your neck that wraps around your windpipe (trachea). The two halves of the thyroid gland are connected in the middle by a thin layer of tissue known as the isthmus. The thyroid gland uses iodine (mostly absorbed from food) to produce hormones that control how your body uses energy. Your thyroid gland function affects nearly every organ in your body.

The pituitary gland and hypothalamus, an area at the base of the brain, control the rate at which the thyroid produces and releases these hormones. The main function of the thyroid gland is to release a hormone called thyroxine or T4, which is converted into a hormone called T3. Both hormones circulate in the bloodstream and help regulate your metabolism. The amount of T4 produced by the thyroid gland is determined by a hormone produced by the pituitary gland called TSH or thyroid-stimulating hormone. Depending on T4 levels in the body, the pituitary gland produces either more or less TSH in order to prompt the thyroid to produce the appropriate amount of T4.

Thyroid disease occurs when the thyroid fails to function properly, either by releasing too much T4 hormone or by not releasing enough. Your thyroid may also develop a lump or nodule. There are three main thyroid disorders:

- Hypothyroidism (underactive thyroid)
- Hyperthyroidism (overactive thyroid)
- Thyroid cancer.

Hypothyroidism (underactive thyroid)

Hypothyroidism occurs when the thyroid gland does not produce enough T4 hormone. Underactive thyroid may occur because the pituitary gland, the hypothalamus, or the thyroid itself is not working properly. Nearly five percent of the population has an underactive thyroid. More women than men suffer from the condition. Symptoms of an underactive thyroid include:

- high cholesterol
- depression
- fatigue

- hair loss
- memory loss
- extremely dry skin
- feeling cold
- constipation.

Hyperthyroidism (overactive thyroid)

Hyperthyroidism occurs when the thyroid gland produces more thyroid hormone than the body needs. Overactive thyroid may occur because the hypothalamus, the pituitary gland, or the thyroid itself is not working properly. Overactive thyroid is not very common. It only affects a little over one percent of the U.S. population. Just like underactive thyroid, more women than men suffer from the condition.

Symptoms of an overactive thyroid include:

- restlessness
- agitation
- tremors
- weight loss
- rapid heart rate
- sweating
- intolerance to heat
- irregular menstrual flow
- thinning skin
- sleep changes
- frequent bowel movements
- goiter, an enlargement of the thyroid gland that resembles a large mass protruding from the neck and is caused by the excess hormone production in the gland.

Older patients may experience arrhythmias (irregular heart rhythms), heart failure, and mental confusion (delirium). Left untreated, patients can suffer from a "thyroid storm" in which high blood pressure, heart failure, and fever can lead to a critical situation requiring urgent medical care.

Thyroid Cancer

Thyroid cancer occurs when cells in the thyroid change and multiply, and cancerous cells form nodules or growths. Left untreated, these cancerous nodules can spread into the lymph nodes, surrounding tissues, and bloodstream. Thyroid cancer is uncommon. However, rates have been on the rise over the last 30 years. Experts believe this increase is mostly due to better detection through the use of ultrasound technology. Most thyroid cancers can be cured. There are five different kinds of thyroid cancer.

- **Papillary thyroid cancer:** Over 70 percent of thyroid cancer patients have papillary thyroid cancer. It starts in the follicular cells where thyroid hormone is stored. It is slow growing, but 20-50 percent of patients may have cancer spread to the lymph nodes of the neck at the time of diagnosis.
- **Follicular thyroid cancer:** Like papillary thyroid cancer, follicular thyroid cancer also starts in the follicular cells. However, it is much more aggressive than papillary cancer and often spreads into the bloodstream and to the lungs or bones. Most follicular thyroid cancer patients are over the age of 40.
- **Hurthle cell cancer** is a rare type of thyroid cancer. This used to be considered a variant of follicular thyroid cancer but is now classified as a distinct type of thyroid cancer. Hurthle cell cancers are more likely to have spread at the time of

diagnosis.

- **Medullary thyroid cancer:** Medullary thyroid cancer is rare. Only four percent of thyroid cancer patients have this type of cancer. It develops in the C cells of the thyroid that make a hormone called calcitonin. Calcitonin helps the body maintain the appropriate level of calcium. Medullary thyroid cancer may be associated with other types of cancer and may also be genetic. This cancer has a lower cure rate than papillary or follicular thyroid cancers. However, the overall 10-year survival rates are as high as 90 percent when the disease is confined to the thyroid gland.
- **Anaplastic thyroid cancer:** Anaplastic thyroid cancer is the rarest form of thyroid cancer. It affects only one percent of thyroid cancer patients. It is the most aggressive and most difficult thyroid cancer to treat. Anaplastic cancer is often called "undifferentiated" because the cells do not look or act like typical thyroid cells. It can occur within follicular or papillary thyroid cancer or within a goiter (enlargement of the thyroid gland). Most anaplastic thyroid cancer patients are over the age of 60. The majority will have metastases (additional sites of disease) present at the time of diagnosis.

There are many causes of thyroid disorders. Conditions that affect how the thyroid functions include:

- **Thyroiditis (inflamed thyroid):** The thyroid gland can become inflamed for unknown reasons. This inflammation causes extra thyroid hormone to leak into the bloodstream, causing too much thyroid hormone to circulate throughout the body or hyperthyroidism (overactive thyroid). This period of hyperthyroidism typically lasts no more than three months. Eventually, the thyroid becomes underactive, releasing too little T4 hormone either temporarily or permanently. A viral or bacterial infection may cause thyroiditis. The condition may also occur following childbirth. Most of the time, the inflammation is painless. However, for subacute granulomatous thyroiditis patients, pain or soreness around the thyroid can last for several weeks.
- **Hashimoto's disease or chronic lymphocytic thyroiditis (inflamed thyroid):** This condition occurs when a patient's own immune system identifies the thyroid as foreign and produces antibodies to attack it. The thyroid becomes chronically inflamed from these attacks and stops producing enough thyroid hormone for the body to function properly. People who suffer from other autoimmune disorders such as arthritis, lupus, and Type 1 diabetes are at higher risk of developing the disease. People who have been exposed to higher levels of environmental radiation also are at higher risk.
- **Pituitary or hypothalamic disease:** Because the pituitary gland and the hypothalamus regulate the thyroid, injury to or dysfunction in these areas may cause the thyroid to become underactive. This condition is known as secondary or tertiary hypothyroidism.
- **Radiation treatment**: Patients who have received radioactive iodine for an overactive thyroid typically experience hypothyroidism (underactive thyroid) after treatment. Patients who receive (http://radiologyinfodev2.rsna.org/en/info.cfm?pg=ebt) *external beam radiation therapy (EBT) (https://www.radiologyinfo.org/en/info/ebt)* to the thyroid, neck, or chest for cancer treatment may also experience thyroid dysfunction.
- **Graves' Disease:** The most common cause of overactive thyroid is Graves' Disease. It occurs when the immune system creates antibodies that cause the thyroid to grow and make more T4 thyroid hormone than the body needs. In healthy people, the amount of T4 is regulated by TSH (thyroid-stimulating hormone). Patients with Graves' disease release antibodies that mimic TSH and fool the thyroid into producing more T4 than is necessary, leading to overactive thyroid. The antibodies that attack the thyroid often also attack the tissue behind the eyes, a condition known as Graves' ophthalmopathy or thyroid eye disease. This condition may cause mild symptoms such as red and irritated eyes or sensitivity to light. It may also cause one or both eyes to protrude from the eye sockets as a result of inflammation and swelling in the muscles and tissues in the eye socket. Patients with Graves' Disease can uncommonly also develop skin thickening and redness on the front of their lower legs, a condition called Graves' dermopathy.
- **Hyperfunctioning thyroid nodules** (also called toxic adenoma, toxic multinodular goiter or Plummer's disease): Non-cancerous nodules called adenomas (http://www.radiologyinfo.org) occur when part of the thyroid gland begins to swell and separate from the rest of the gland. These adenomas may begin producing thyroid hormones independently of the rest of the thyroid gland, a condition called a functioning nodule. When these nodules do not respond to the normal feedback mechanisms meant to keep the thyroid hormone levels in check, this is known as a toxic adenoma or Plummer's disease.

How is thyroid disease diagnosed and evaluated?

Symptoms often prompt patients to visit the doctor, including fatigue, the inability to get pregnant, changes in the skin or hair, a lump in the neck, hoarseness, or pain in the thyroid area. Based on these symptoms, a doctor will likely perform a physical exam to determine whether the thyroid is enlarged and order blood tests to measure thyroid hormone levels. If blood tests reveal signs of abnormal thyroid activity, or a thyroid nodule is found and thyroid cancer needs to be excluded, further testing will be required, such as:

- **Thyroid Scan and Uptake:** During this test, the patient swallows a small amount of radioactive iodine (radioiodine). Over a period of time, the iodine collects in the thyroid. After a few hours, you will sit in front of a special camera called a gamma camera to measure the amount of iodine absorbed by your thyroid. This device does not emit radiation, but there is a small amount of radiation exposure from the swallowed or injected radioiodine. *See the (https://www.radiologyinfo.org/en/info/thyroiduptake) Thyroid scan and uptake (https://www.radiologyinfo.org/en/info/thyroiduptake) page for more information.*
- ***Ultrasound:*** *Ultrasound (https://www.radiologyinfo.org/en/info/us-thyroid) allows detailed examination of the internal structure of the thyroid. Doctors use it to assess thyroid nodules for the likelihood of cancer. They will further evaluate any nodule that is suspicious for cancer can using ultrasound-guided fine-needle aspiration biopsy (https://www.radiologyinfo.org/en/info/thyroidbiopsy) .*
- ***Ultrasound-guided fine-needle aspiration biopsy:*** *During thyroid biopsy, the doctor uses ultrasound (https://www.radiologyinfo.org/en/info/us-thyroid) imaging to insert a thin, hollow needle through the skin and into the thyroid gland or the suspicious nodule. Biopsy removes a small tissue sample lab analysis to determine if cancer is present. See the Thyroid Biopsy (https://www.radiologyinfo.org/en/info/thyroidbiopsy) page for more information.*
- ***Imaging tests*** *(CT scan, PET/CT scan, whole body iodine scan): If you have thyroid cancer, your doctor will order imaging exams to determine the size and location of the thyroid cancer and if it has spread. See the Body CT Scan (https://www.radiologyinfo.org/en/info/bodyct) , the PET/CT Scan (https://www.radiologyinfo.org/en/info/pet) and the Thyroid scan and uptake (https://www.radiologyinfo.org/en/info/thyroiduptake) pages for more information.*

How is thyroid disease treated?

Hypothyroidism (underactive thyroid): Patients suffering from underactive thyroid generally receive a synthetic (man-made) thyroid hormone known as levothyroxine (Synthroid®). Levothyroxine will restore your body's hormone levels and provide symptom relief. Your blood will be tested periodically to make sure the medication is controlling your hypothyroidism. It may take several months to determine the right dosage needed to control your symptoms. Patients with underactive thyroid generally need to take replacement thyroid hormone for the rest of their lives.

Hyperthyroidism (overactive thyroid): The treatment for patients with overactive thyroid depends on how severe the symptoms are and what the underlying cause is. You and your doctor will discuss which of the following options is best for you.

- **Anti-thyroid medications:** Medication such as methimazole (Tapazole®) prevents the thyroid from producing too much thyroid hormone. It is often used for patients suffering from Graves' disease or before thyroid surgery. Symptom relief typically occurs within six to 12 weeks of starting the medication but therapy usually continues for at least a year. Twenty to 30 percent of patients have permanent relief while others may see symptoms return. Anti-thyroid medications may affect your liver and increase your risk of infection. A small number of people are allergic to these medications.
- **Radioactive iodine:** Radioactive iodine (I-131), an isotope of iodine that emits radiation, is a common treatment for hyperthyroidism. When you swallow a small dose of I-131, it is absorbed into the bloodstream and absorbed by the thyroid gland, where it begins destroying the gland's cells. Over a period of three to six months, patients generally see their symptoms subside. Radioactive iodine typically causes the thyroid to become underactive, and many patients will require daily synthetic thyroid hormone to restore adequate hormone levels in the body. Radioactive iodine has been used for decades and has been shown to be safe. *See the Radioactive Iodine page (https://www.radiologyinfo.org/en/info/radioiodine) for more information.*
- **Beta blockers:** This is a class of drug used to treat high blood pressure. Beta blockers do not treat the thyroid directly but can help reduce a rapid heart rate and prevent heart palpitations. Patients often receive beta blockers along with anti-thyroid medication and radioactive iodine to feel better until the thyroid is functioning more normally. Most patients tolerate beta

blockers well, but some may experience upset stomach, diarrhea, dizziness, or headache.

- **Surgery (thyroidectomy):** For patients who are not able to either take anti-thyroid medication or radioactive iodine, surgical removal of the thyroid, called a thyroidectomy, is an option. For this procedure, the surgeon makes an incision at the base of the neck and removes most of the thyroid gland. In a minimally invasive video-assisted thyroidectomy, a smaller incision is made and the surgeon is aided by a video camera. Most surgeries last between 2 and 2 ½ hours. Patients either return home the same day or the next day after a period of observation. While thyroid surgery complications are rare, there is always risk involved with surgery. An experienced surgeon can help avoid complications such as damage to the parathyroid glands (causing low calcium levels) or to the vocal cords (causing hoarseness in the voice). Once the thyroid gland is removed, patients need lifelong replacement of thyroid hormones with synthetic hormones (Synthroid®). If the doctor also removes the parathyroid glands, patients will need calcium supplements as well.

Thyroid Cancer: Most thyroid cancers are treated with surgery to remove the thyroid gland. Radioactive iodine therapy is often used after surgery to destroy any remaining thyroid tissue. This includes both healthy remaining tissue and any remaining cancer cells. Depending on the stage of the cancer, the doctor may remove lymph nodes in the neck for testing. In some cases where the cancer is very small, they may only remove a portion of the gland. This is called a thyroid lobectomy. After surgery, most patients will need to take daily synthetic thyroid hormone for the rest of their lives. You and your doctor will discuss the best surgical option for you depending on the kind of cancer you have and whether or not it has spread. *See the Radioactive Iodine page (https://www.radiologyinfo.org/en/info/radioiodine) for more information.*

Which test, procedure or treatment is best for me?

- *Thyroid Disease (https://www.radiologyinfo.org/en/info/acs-thyroid-disease)*

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