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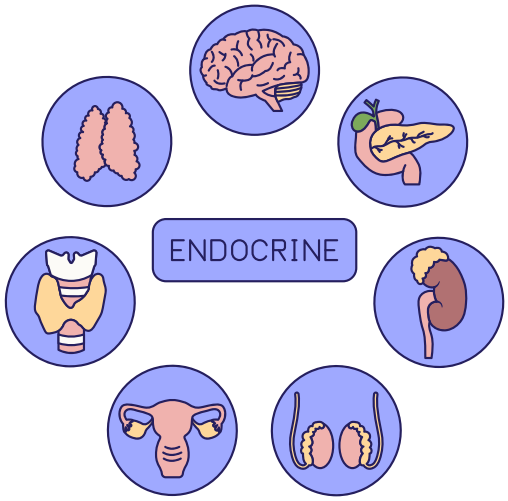
THE ENDOCRINE SYSTEM

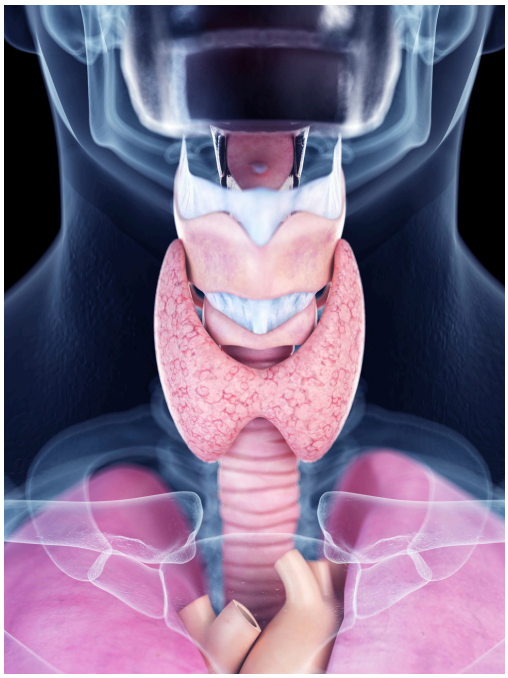
The endocrine system is a collection of different organs called “glands.” These glands produce hormones—chemical messages carried in the bloodstream—which help to regulate many functions in the body. The thyroid and parathyroid glands are both part of the endocrine system.



THYROID DISEASE

THE ROLE OF THE THYROID GLAND

The thyroid gland is a small, butterfly-shaped organ that is located in the neck below the voice box. The thyroid gland produces two hormones, thyroxine (T4) and triiodothyronine (T3), which play a role in controlled the speed of the body’s metabolism. This is the process of turning food into energy and it must be regulated carefully to keep you healthy. Thyroid hormone affects all cells in the body, and proper thyroid hormone levels are important to support healthy growth and to maintain a normal temperature, heart rate, and energy level.



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THYROID HORMONE

A complex cycle regulates the thyroid to keep hormone levels within an ideal range.

The cycle begins with the hypothalamus and pituitary gland in the brain, which constantly monitor the body's thyroid hormone levels. In response to fluctuations in hormone levels, the pituitary gland produces thyroid stimulating hormone (TSH).

TSH travels through the bloodstream to the thyroid gland, where it regulates how much thyroid hormone is released.

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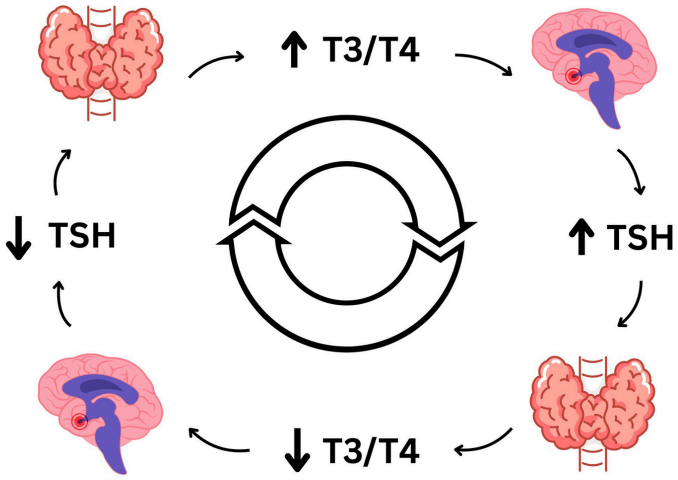
The thyroid gland uses iodine, obtained through eating, to make thyroid hormone, which is then stored in an inactive form inside thyroid cells. In response to TSH, the thyroid gland releases the specified amount of thyroid hormone.

The thyroid hormone level is then monitored by the hypothalamus and pituitary, which adjust the amount of TSH produced accordingly - completing the cycle. This is called a feedback loop.

Thyroid Hormone Feedback Loop

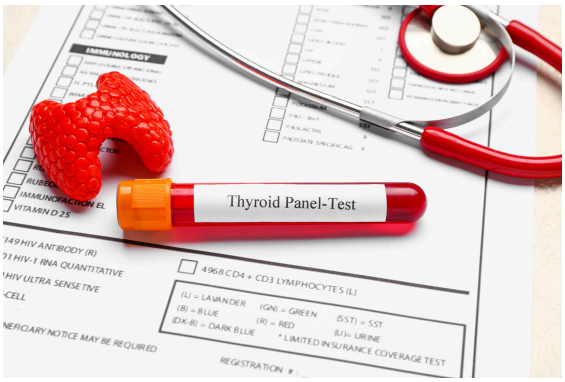


TYPES OF THYROID DISEASE

Thyroid disease can by classified into two main groups: functional and structural thyroid problems. Functional thyroid diseases cause an imbalance of the thyroid hormone cycle leading to levels that are either too low *(hypothyroidism)* or too high (*hyperthyroidism)*. Structural thyroid disease involves changes in the size or shape of the thyroid gland resulting in thyroid nodules or overall enlargement of the thyroid gland *(goiter)*. Sometimes, both functional and structural thyroid disease can occur at the same time.

Hypothyroidism

- This occurs when the thyroid gland is underactive and does not produce enough thyroid hormone. It results in low levels of T3 and T4 in the bloodstream and a high TSH level.
- Symptoms of hypothyroidism include fatigue/loss of energy, feeling cold, weight gain, puffiness in the face or hands/feet, hair loss, dry skin, depression, and constipation.
- Hypothyroidism may be caused by an autoimmune condition (e.g. Hashimoto's disease), radiation therapy, thyroid surgery, or rarely by damage to the pituitary gland.
- Hypothyroidism cannot be cured and is usually treated by taking a thyroid hormone replacement medication.



Hyperthyroidism

- This occurs when the thyroid gland is overactive and produces too much thyroid hormone. It causes high levels of T3 and T4 and a low TSH level.
- Symptoms of hyperthyroidism include racing heart or irregular heartbeat, anxiety/irritability, hand tremor, unexplained weight loss, hot flashes/excessive sweating, difficultly sleeping, irregular or absent menstrual periods, and sometimes vision changes or eye bulging (exophthalmos).
- The most common cause of hyperthyroidism is Graves' disease, an autoimmune condition, but may also be caused by one or more overactive nodules or thyroid inflammation, which can be triggered by viral infections, pregnancy, medication, or trauma.
- The treatment for hyperthyroidism depends on the cause. Treatment usually involves medication to treat hyperthyroid symptoms and/or reduce thyroid hormone production, radioactive iodine ablation (RAI) which works by destroying thyroid cells, or surgery to remove part or all of the thyroid.
- RAI and surgery may permanently reduce the amount of thyroid hormone and result in the need for thyroid hormone medication.

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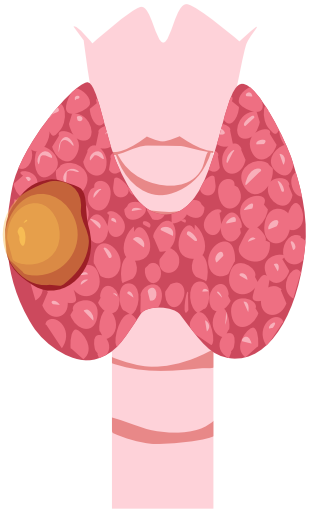
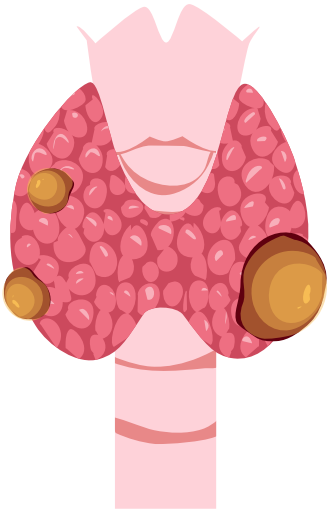
Thyroid Nodules

- A nodule is a lump in the thyroid gland. They can be solid or cystic (filled with fluid), or a mix of both.
- You can have only one nodule or multiple nodules throughout the thyroid.

Single Nodule



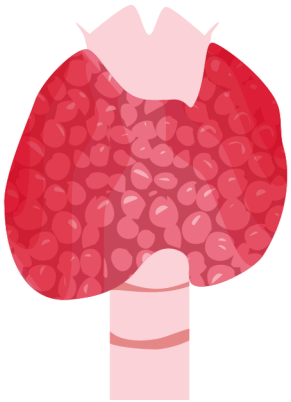
Multiple Nodules



- Large nodules may cause pain in the throat, difficulty swallowing, or trouble breathing. Some nodules also produce too much thyroid hormone causing symptoms of hyperthyroidism.
- There is not a clear cause for benign thyroid nodules. An increased risk for thyroid cancer may be related to family history, certain genetic mutations, or prior exposure to radiation.
- Benign nodules and cysts that do not cause symptoms do not automatically require treatment and may be observed with exams or ultrasounds. If the nodules grow or begin to cause symptoms over time, then the decision may be made to intervene.
- Cystic nodules may be treated with aspiration – removal of the fluid from the nodule using a needle and ultrasound. They may also sometimes be treated with ethanol ablation, where alcohol (ethanol) is injected into the cavity causing scarring and shrinkage of the nodule.
- Both cystic and solid nodules that are causing symptoms can be treated with surgery to remove a portion or the entire thyroid. Surgery is also used to treat thyroid cancer or nodules that may be suspicious for thyroid cancer.

Goiter

- A goiter is an enlarged thyroid gland. It may involve only part of the thyroid or the entire thyroid gland.
- Sometimes goiters are made up of multiple thyroid nodules (multinodular goiter).
- Goiters can be associated with low, normal, or high thyroid hormone levels.
- Goiters may cause enlargement of the neck that can be seen or felt. Other symptoms include pain or pressure in the neck, difficulty swallowing, or trouble breathing.



- Most goiters are benign (not cancer). Goiters may rarely be caused by iodine deficiency; however, this is very uncommon in the United States and other developed countries.
- Goiters may be observed if they are not causing symptoms. Large goiters or those causing symptoms are usually treated with surgery to remove the affected portion of the thyroid.

EVALUATION OF THYROID DISEASE

History and Exam

Your doctor will ask about your symptoms and medical history, including your family history, other medical problems, prior procedures, and medications.

Blood Tests

Your doctor may also perform blood tests. This usually includes tests to check your thyroid hormone levels, such as TSH, T3, or T4. These tests determine if your thyroid levels are normal or if you are hypothyroid (low thyroid hormone level) or hyperthyroid (high thyroid hormone level).

You may also have other blood tests, such as thyroid antibodies or parathyroid tests (small organs near your thyroid gland that can be affected during thyroid surgery).

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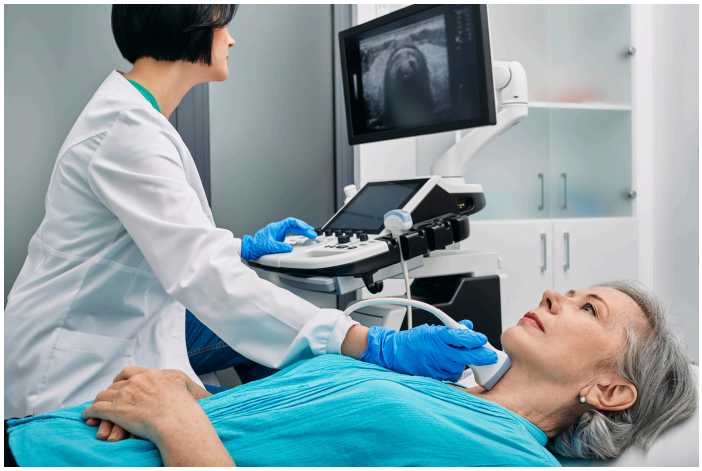
Imaging

You will have imaging of your thyroid gland as part of your evaluation.

In the office, you will have an ultrasound, which uses sound waves delivered with a small probe, to produce images of your thyroid gland and the surrounding structures. The ultrasound is used to evaluate the size and shape of the thyroid gland and to assess for thyroid nodules or other abnormalities.

You may also need other imaging studies such as a radioactive iodine uptake test, which evaluates if any portion of the thyroid gland is overactive, or a CT scan ("cat" scan), which produces a more detailed picture of the neck.

Thyroid Ultrasound



Fine-Needle Aspiration

If a thyroid nodule is identified on ultrasound, you may need to have a biopsy, called a fine-needle aspiration (FNA). This is performed in the office using the ultrasound to locate the nodule. A small needle is then inserted through the skin to take a small sample of cells. The cells are examined under a microscope by a pathologist to determine whether the nodule is benign or cancerous.

Sometimes, if the answer is not clear, a repeat biopsy or additional testing of the cells may be necessary.

An FNA may also be used to sample cells from abnormal appearing lymph nodes in the neck to check for cancer that has spread.

Thyroid Fine-Needle Aspiration

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RISK FACTORS FOR THYROID DISEASE

- Older age
- Female gender
- A family history of thyroid problems
- Prior radiation to the head, neck, or chest
- A history of an autoimmune disease

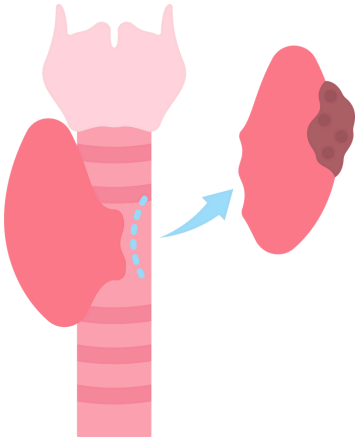
THYROID SURGERY

Surgery may be the best treatment for some thyroid conditions. You and your doctor will decide together if surgery is the best option for you.

Thyroid surgery may involve removing part of the thyroid gland (*lobectomy or hemithyroidectomy*) or the entire thyroid (*total or complete thyroidectomy*).

Lobectomy

During a thyroid lobectomy, the right or left side of the thyroid gland is removed.



A lobectomy may be used to remove large benign or overactive thyroid nodules or goiters affecting only one side of the gland. It may also be used to treat small thyroid cancers or to diagnose a nodule when the results of the biopsy were uncertain.

In a partial thyroidectomy, the other half of the thyroid gland is left undisturbed and continues to produce thyroid hormone. In approximately 70% of patients, the remaining thyroid tissue will produce enough thyroid hormone to keep levels in the normal range. In the other 30% of patients, the thyroid does not produce enough hormone, and thyroid hormone medication is required.

Total Thyroidectomy

In a total or complete thyroidectomy, the entire thyroid gland is removed.

A total thyroidectomy may be used to treat patients with nodules on both sides of the thyroid, large goiters affecting the entire gland, or more advanced thyroid cancers. This is also the best type of surgery for patients with Graves' disease.

Because all of the thyroid tissue is removed with this procedure, it causes permanent hypothyroidism (low thyroid levels) and requires lifelong thyroid hormone replacement medication after surgery.

PREPARING FOR SURGERY

Before Surgery

You and your doctor will discuss all the details of surgery at your pre-op clinic appointment. You will be given a detailed list of instructions to prepare for surgery. These will include instructions such as when to stop eating and drinking before surgery and directions about what medications are safe to take or must be stopped. Be sure to follow all instructions carefully since failing to do so may result in delay or need to reschedule your surgery.

During Surgery

Thyroid surgery typically takes 2-3 hours depending on the type of problem and how much thyroid tissue needs to be removed. Thyroid surgery is performed under general anesthesia, meaning that you are totally asleep during surgery and a tube is placed in your throat to help you breath. The thyroid gland is then removed through a small incision in the neck.

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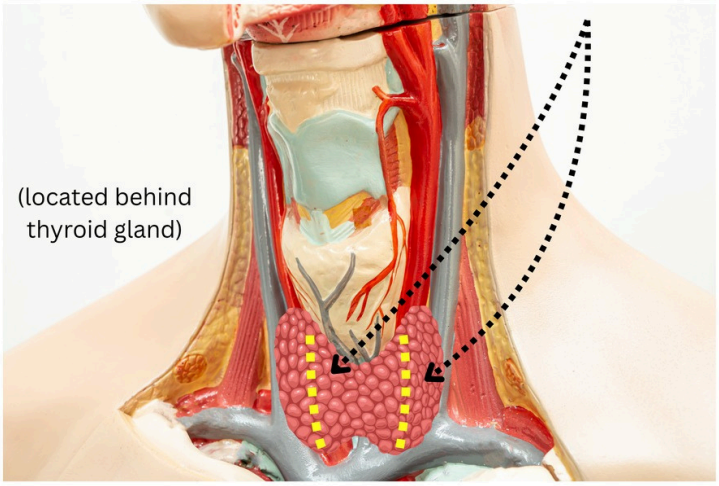
RISKS OF THYROID SURGERY

For people who are healthy, thyroid surgery is generally very safe. Like all surgery, however, there are some risks. The most common risks and complications include:

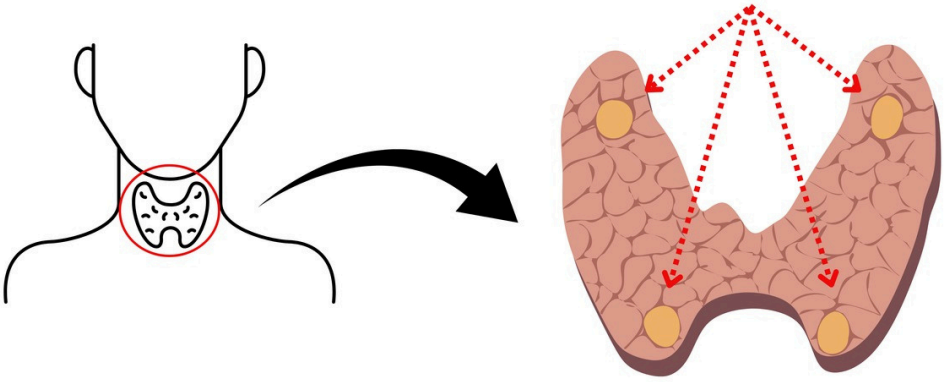
- Reactions to medication or anesthesia given during the surgery
- Bleeding
- Infection
- Injury to nearby structures, including the recurrent laryngeal nerves. These nerves run behind the thyroid gland on both sides and control movement of the vocal cords. Injury to one of these nerves may lead to temporary or permanent hoarseness in the voice.

Recurrent Laryngeal Nerves



- Damage to parathyroid glands, which are 4 small glands located behind the thyroid gland. These glands produce parathyroid hormone which helps to control blood calcium levels. Temporary stunning of these glands is common after thyroid surgery and can lead low calcium levels that may require short-term calcium supplementation, but usually return to normal after 1-2 weeks. If the parathyroid glands are permanently damaged, then lifelong calcium and vitamin D supplements may be needed.

Parathyroid Glands



(back side of thyroid)

- Other complications related to underlying heart or lung problems or other medical conditions, such as heart attacks, blood clots, or pneumonia.

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RECOVERING FROM THYROID SURGERY

You will be kept in the recovery unit for at least 4 hours after surgery for observation. Rarely, patients will need to spend the night in the hospital.

You may have your parathyroid hormone levels checked to determine if you need to take a calcium or vitamin D supplement when you go home.

Most patients have a sore throat and mild hoarseness after surgery from the breathing tube, as well as soreness or tightness in the neck. These symptoms are very common and usually go away after 1-2 weeks.

Most patients do not require strong pain medications, such as opiates, after thyroid surgery.

You will likely have skin glue and small white strips (steri-strips) covering your incision to keep it protected. These usually fall off on their own in 2-3 weeks.

Most patients can take a shower 24 hours after surgery, but you should check with your doctor. It is generally recommended to avoid swimming or submerging your incision until it is completely healed.

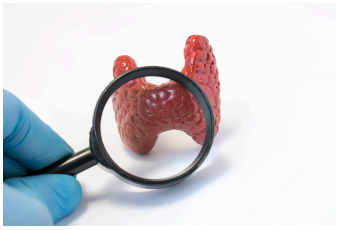
You will be asked to avoid strenuous activity and heavy lifting for 1-2 weeks after surgery, but you should be able to complete most daily activities, including walking, taking stairs, eating, and other self-care tasks.

Most patients take 1-2 weeks off of work to recover from thyroid surgery. You will be given detailed instructions for your post-operative care at home, including signs to monitor for and when to call your surgeon.

Sometimes patients can develop low calcium symptoms several days after surgery, which requires starting a calcium and vitamin D supplement. Please follow all postoperative instructions carefully.

You will have a follow up appointment with your surgeon within 1-2 weeks of surgery. Your wound will be checked. Most patients do not have sutures that need to be removed.

Pathology results from your surgery will also be discussed at this appointment and any follow up tests or appointments will be arranged.



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THYROID HORMONE MEDICATION

If you had your entire thyroid removed, you will be started on a thyroid hormone medication called levothyroxine (Synthroid). You will receive your first prescription from your surgeon when you are discharged after surgery.

The initial dose is based on your weight. You will then have your TSH checked 4-6 weeks after surgery to determine if your dose needs to be adjusted.

If you have thyroid surgery for cancer, you may be started on a different thyroid hormone medication temporarily to aid in cancer treatment.

If you have a partial thyroidectomy (lobectomy), you will not be started on a thyroid hormone medication right after surgery. You will have your TSH checked 4-6 weeks after surgery to determine if your remaining thyroid tissue is making enough hormone for your body. If your thyroid levels are too low, then you will be started on thyroid hormone medication.

Once you start taking thyroid hormone medication after surgery, it will usually need to be taken for the rest of your life.

It is important to take your medication every day to prevent symptoms of hypothyroidism (low thyroid hormone levels). It is best to take it first thing in the morning on an empty stomach because certain medications and foods can interfere with the absorption of your thyroid medication.

Your surgeon will provide your first prescription for thyroid hormone medication, if you need one . Long term, most patients will follow up with their endocrinologist or primary care doctor for management of their medication.

If you had surgery for thyroid cancer, you may need additional follow-up tests or appointments with your surgeon and endocrinologist.