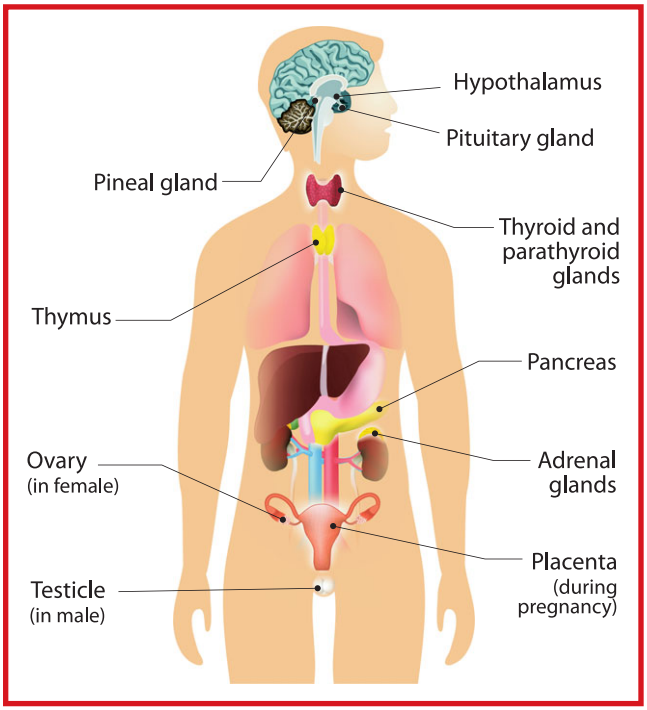
Endocrine System: Thyroid and Adrenal Gland Diseases and Disorders

GLANDS are organs in the body that do everything from regulating and secreting saliva, tears, and breast milk, to creating and releasing hormones and/or antibodies that fight illness, lower stress, help with sleep, and more. If they are not functioning correctly it can lead to many different health conditions.



Objectives:

1. Explain disorders of the thyroid gland.
2. Explain disorders of the adrenal glands.

Key Terms:

Addison's disease
adrenal crisis
adrenal incidentaloma
adrenal medulla
adrenaline
adrenal cortex
adrenalectomy
adrenocortical carcinoma
aldosterone
benign
Conn's syndrome
cortisol
cretinism
Cushing's syndrome
diuretics
epinephrine
exophthalmos
goiter
Graves' disease
Hashimoto's thyroiditis
hyperthyroidism
hypothyroidism
hyperprolactinemia
iodine
isthmus
jaundice
myxedema coma
norepinephrine
pheochromocytoma
prolactinoma
thyroidectomy
thyroiditis
thyroid storm
thyrotoxicosis

Thyroid and Adrenal Gland Diseases and Disorders

The thyroid and adrenal glands are important for helping to regulate and control various body functions by producing and secreting vital hormones. The thyroid gland regulates the body's metabolic rate, heart and digestive functions, muscle control, brain development, and mood and bone maintenance. The adrenal glands produce hormones that help the immune system, blood pressure, metabolism, and the body's response to stress. Because of their essential role in the body, even small hormonal imbalances (too much or too little) can cause complications throughout the body.

DISORDERS OF THE THYROID GLAND

The thyroid gland is in the neck immediately below the larynx and partially in front of the trachea. Its two lateral lobes are found on both sides of the trachea and are joined by the

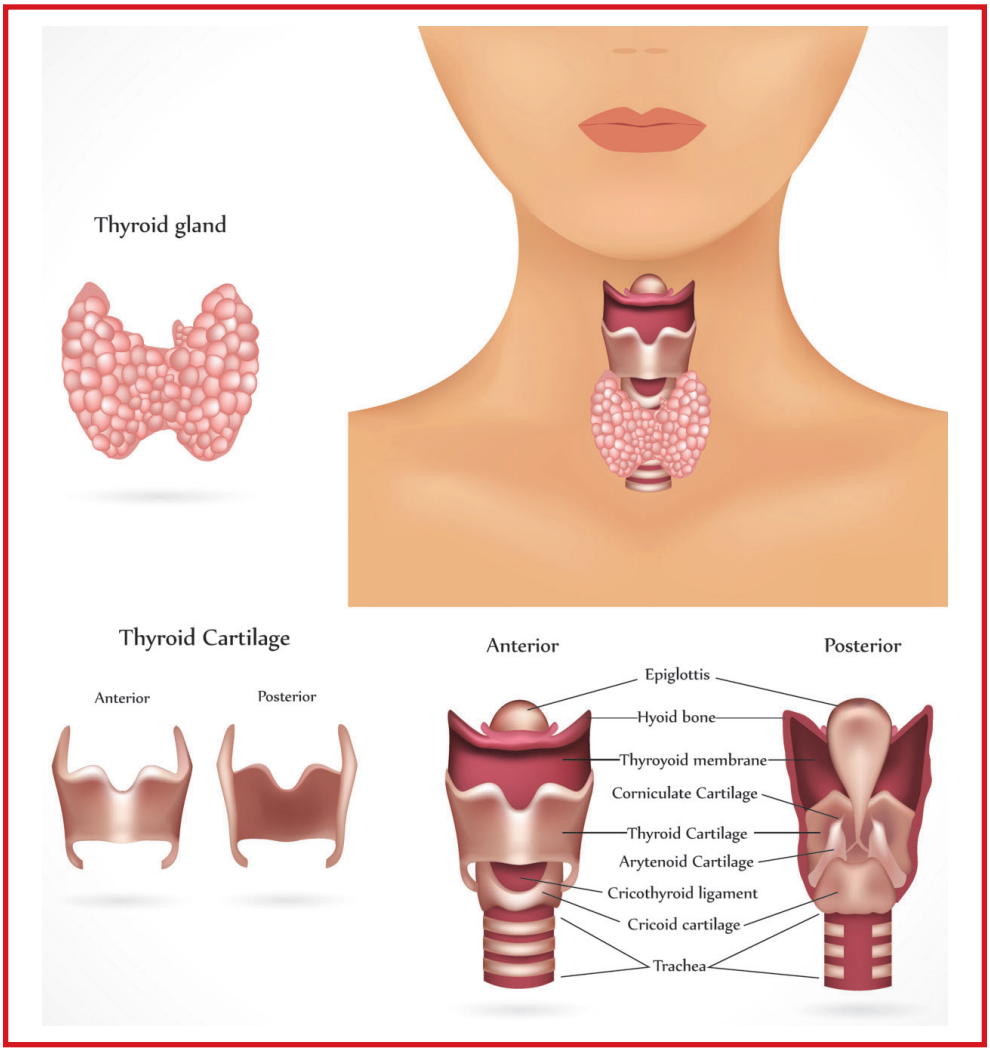


FIGURE 1. The thyroid is a butterfly-shaped gland in situated on both sides of the trachea.

isthmus, a narrow bridge of tissue giving the gland its characteristic butterfly shape. The thyroid hormones regulate the metabolism of the body and help maintain normal blood pressure, heart rate, digestion, muscle tone, and reproductive functions. The thyroid gland also contributes to bone growth and nervous system development in children.

Goiter

A **goiter** is an enlarged thyroid gland. When the thyroid gland is enlarged, it can produce too much, too little, or just enough thyroid hormone. The most common cause of goiter outside of the United States is a lack of iodine in the diet. **Iodine** is a substance in food (iodized salt and seafood) that the thyroid uses to make thyroid hormones. However, a lack of iodine is not common in the United States because iodine is added to salt and many foods.

Symptoms include swelling at the base of the neck. Some people also may have tightness in the throat, coughing, hoarseness, trouble swallowing, and trouble breathing.

Treatment depends on the cause of the goiter, its size, and the symptoms. If the goiter is small and the thyroid is making normal amounts of thyroid hormone, observation of the goiter over time is recommended.

Hypothyroidism

Hypothyroidism is a condition in which the thyroid gland doesn't produce enough of certain crucial hormones. Primary hypothyroidism is due to a disorder of the thyroid gland when the gland fails to develop or function normally. The thyroid is being stimulated properly by the pituitary gland and hypothalamus, but it is not able to produce enough thyroid hormones for the body to function properly. Infantile **cretinism** (congenital or neonatal hypothyroidism) is three times more common in females than in males. Early diagnosis and treatment are essential for the best possible patient outcomes.

Symptoms for infants if the disease is not recognized or not adequately treated include persistent **jaundice** (yellowish discoloration of the white part of the eyes and skin,) hoarse crying, and respiratory problems. Older children experience dystrophy of bones and muscles, stunted growth, and mental deficiencies.

Treated with thyroid hormone replacements. If treatment begins before the age of 3 months the infant usually experiences normal growth and development. However, if treatment is not initiated within that timeframe and children remain untreated beyond the age of two, irreversible intellectual disabilities occur. However, the skeletal abnormalities are reversible with treatment.

Secondary hypothyroidism is the result of a failure to stimulate normal thyroid function by the pituitary gland and the hypothalamus. It also occurs in people who have had their thyroid glands surgically removed or medically destroyed. Hypothyroidism may not cause noticeable symptoms in the early stages. Over time, untreated hypothyroidism can cause several health problems, such as obesity, joint pain, infertility and heart disease.

Possible symptoms include an enlarged thyroid, trouble swallowing, intolerance to cold, weight gain, fatigue, dry skin, and hair loss. Serious complications include mental health issues such as depression, decreased sexual desire, slowed mental functioning, birth defects, and

myxedema coma; a rare life-threatening condition that results in decreased mental status, hypothermia, and symptoms related to slowing function of multiple organs that requires immediate emergency treatment.

Treatment involves thyroid hormone replacement therapy.

FIGURE 2. Ultrasound technology is often used to diagnose thyroid gland disorders.

Hyperthyroidism

Hyperthyroidism is known as overactive thyroid. It occurs when the thyroid gland makes and releases too much thyroid hormone. It affects heart rate and the proper function of other organs. It also affects muscles, bones, and menstrual cycles. Several factors can increase the risk including family history, gender (more prevalent among women,) and age.

Symptoms may include weight loss, nervousness, rapid heart rate, hand tremors, difficulty sleeping, thinning of the skin, brittle hair, and frequent bowel movements. In some cases, a life-threatening **thyroid storm** occurs with untreated or undertreated hyperthyroidism, resulting in heart rate, blood pressure, and body temperature all increasing to dangerously high levels.

There are several treatments for hyperthyroidism depending on age, health, cause, and severity. The goal is to control thyroid levels and return them to normal ranges. Doing this relieves symptoms and prevents future health problems. Treatments can include:

Most adults in the United States who have hyperthyroidism are treated with radioactive iodine, to destroy overactive thyroid cells. This treatment has been used for more than 60 years without any problems. However, this option is not suitable for women who are pregnant or breastfeeding.

Anti-thyroid medicine is used to tell the thyroid to produce fewer hormones. Treatment can last for at least a year. This is a better option for women who are pregnant or breastfeeding.

A **thyroidectomy** (removal of the thyroid) to eliminate most of the thyroid gland followed by thyroid supplements to restore hormone levels to normal.

Graves' Disease

Graves' disease is the most common form of hyperthyroidism in the United States and worldwide. It is an autoimmune disease, in which the immune system stimulates the thyroid to overproduce thyroid hormones. In addition to symptoms of hyperthyroidism, Graves' disease can be associated with thyroid eye disease symptoms, such as swelling, redness, and **exophthalmos** (a bulging of the eye anteriorly out of the orbit.) The goal of treatment is to

DIGGING DEEPER...

UNCOVERING ADDITIONAL FACTS: Thyroid Storm

When thyroid hormone levels become extremely elevated, the symptoms of an overactive thyroid may worsen and can result in a serious condition called thyroid storm or thyrotoxic crisis. It typically occurs in people with untreated thyroid problems. When these levels become very high, the symptoms of hyperthyroidism worsen and can result in this life-threatening condition leading to acute heart failure and a buildup of fluid in the lungs.

Causes of thyroid storm include infections, thyroid surgery, stopping medications given for hyperthyroidism, thyroid hormone replacement taken in too high doses, treatment with radioactive iodine, pregnancy, heart attack, or other cardiac emergencies.

Symptoms of thyroid storm include rapid heartbeat, greatly increased body temperature (may be as high as 105-106 F,) increased sweating, chest pain, shortness of breath, anxiety, irritability, disorientation, weakness, and heart failure. Thyroid storm is a life-threatening medical emergency and a person experiencing these symptoms should be taken to the emergency department immediately.

For more information on thyroid storm, how it occurs, its symptoms, treatments, and preventions, visit Medical News Today's site at https://www.medicalnewstoday.com/articles/312442.php.

control over-production of thyroid hormones and may involve anti-thyroid medications, radioactive iodine, and sometimes a partial or total thyroidectomy.

Thyroid Nodules

Thyroid nodules are solid or fluid-filled lumps that form within the thyroid. Most thyroid nodules don't cause signs or symptoms. Occasionally, some nodules become so large that they can be felt or seen, or press on the windpipe or esophagus, causing shortness of breath or difficulty swallowing. Thyroid cancer accounts for only a small percentage of thyroid nodules but determining which nodules are malignant can't be done by symptoms alone. Most cancerous thyroid nodules are slow growing and may be small when they're discovered. Aggressive thyroid cancers are rare, but these nodules may be large, firm, fixed and rapid growing.

Thyroiditis

Thyroiditis is a general term that refers to inflammation of the thyroid gland. Thyroiditis includes a group of individual disorders causing inflammation but presenting in different ways. Postpartum thyroiditis causes temporary **thyrotoxicosis** (high thyroid hormone levels in the blood) followed by temporary hypothyroidism, after the delivery of a baby. Subacute thyroiditis is the major cause of pain in the thyroid.

Hashimoto's thyroiditis is an autoimmune disease resulting in hypothyroidism. Anyone can develop it, but it occurs more often in women and those with a family history of thyroid

disease. It also occurs more often as people get older. People with other autoimmune disorders are more likely to develop Hashimoto disease. The hypothyroidism caused by Hashimoto disease progresses slowly over months to years.

Thyroiditis can also be seen in patients taking the certain drugs. Depending on the severity, thyroiditis may or may not produce any symptoms or need to be treated. Symptoms include neck pain, enlargement of the thyroid gland, and symptoms of an infection, such as fever and generalized body aches.

Treatment depends on the type of thyroiditis and the clinical presentation, and can include antithyroid medications. The pain associated with subacute thyroiditis usually can be managed with mild anti-inflammatory medications such as aspirin or ibuprofen. Occasionally, the pain can be severe and require steroid therapy with prednisone.

DISORDERS OF THE ADRENAL GLANDS

The adrenal glands are two, triangular-shaped organs that measure about 1.5 inches in height and 3 inches in length. They are located on top of each kidney and each is made up of two distinct parts. The **adrenal cortex** or outer part of the gland produces hormones vital to life, such as **cortisol** which helps regulate metabolism and helps the body respond to stress, and **aldosterone** which helps control blood pressure. The **adrenal medulla** or inner part of the gland produces nonessential hormones, such as **adrenaline**, also called **epinephrine**, which helps the body respond to stress by increasing ther heart rate and rushing blood to the muscles and brain.

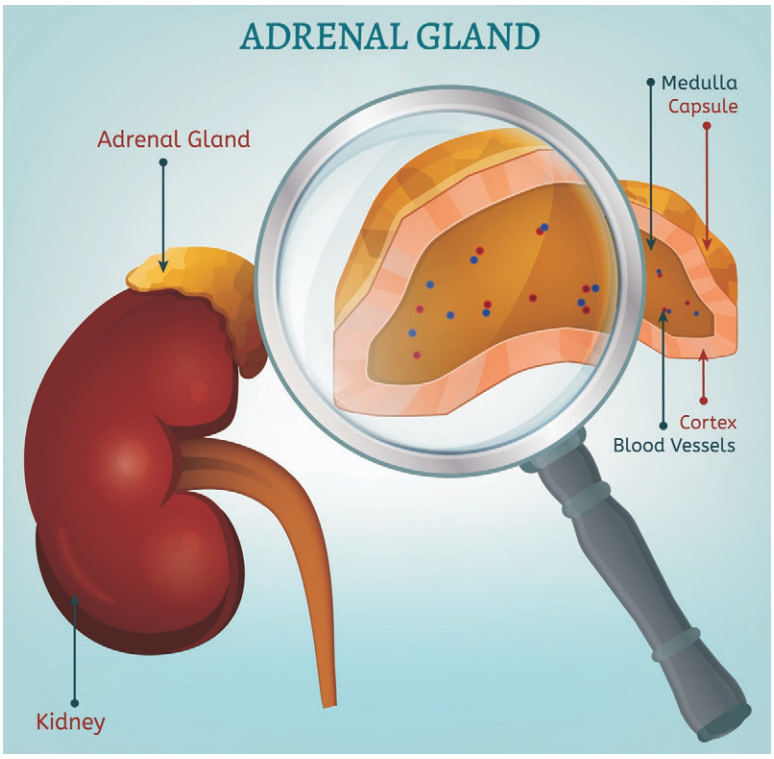


FIGURE 3. The adrenal glands are two, triangular-shaped organs positioned on top of each kidney.

Addison's Disease

Adrenal insufficiency, also known as **Addison's disease** and adrenal hypofunction, is the result of inadequate function of the adrenal glands.

Symptoms include fatigue, muscle weakness, loss of appetite, weight loss, and abdominal pain. The most serious complication is **adrenal crisis**, a life-threatening condition that occurs when there is not enough cortisol. It can develop gradually or abruptly, resulting in sig-

nificant weakness, abrupt severe pain in the lower back, abdomen, or legs, severe nausea and vomiting, hypotension, and loss of consciousness.

Treatment goals are to ensure proper hormone levels with daily replacement of hormones.

Pheochromocytoma

Pheochromocytoma is a rare tumor of adrenal gland tissue that results in the release of too much epinephrine and norepinephrine, hormones that control heart rate, metabolism, and blood pressure. Usually, this type of tumor affects one of the two adrenal glands, but it can affect both. the tumor releases hormones that cause either episodic or persistent high blood pressure. Untreated, a pheochromocytoma can result in severe or life-threatening damage to other body systems, especially the cardiovascular system. Symptoms include high blood pressure, headache, flushing, rapid heartbeat and palpitations. Treatment involves appropriate blood pressure medications followed by removal of the tumor.

Cushing's Syndrome

Cushing's syndrome occurs when adrenal nodules over-produce cortisol and the body is exposed to high levels of cortisol for a long time. Also called hypercortisolism, it may be caused by the long-term use of oral corticosteroid medication. Symptoms include a fatty hump between the shoulders, a rounded face, and pink or purple stretch marks on the skin. Cushing syndrome can also result in high blood pressure, bone loss and occasionally Type 2 diabetes. Treatment normally includes surgery to remove the adrenal gland, and the earlier treatment begins, the better the chances for recovery.

Conn's Syndrome

Conn's syndrome is a rare health problem that occurs when the adrenal glands make too much aldosterone. This problem is also known as primary hyperaldosteronism. Aldosterone is a hormone that controls salt and potassium levels in the blood and too much leads to high blood pressure. It is more common in females than in males. It can happen at any age, but more often in people in their 30s and 40s.

Symptoms include higher than normal blood pressure with the usual treatments for high blood pressure not being effective. This causes high blood pressure that is difficult to control despite multiple medications, as well as low blood levels of potassium. The

FIGURE 4. Conn's syndrome presents with high blood pressure that is difficult to control despite multiple medications.

abnormal electrolyte levels often seen with too much aldosterone lead to signs such as lack of muscle strength, frequent urination, headache, increased thirst, eyesight problems, and muscle twitching and cramps

Treatment varies depending on the type. Most are treated by **adrenalectomy** (surgical removal of the adrenal gland.) **Diuretics** (water pills) help manage fluid buildup in the body, and various other medications are used to treat electrolyte abnormalities.

Adrenal Nodules

Adrenal nodules, including **adrenal incidentaloma** (asymptomatic adrenal nodule that is discovered on imaging) are normally **benign** (non-cancerous,) and do not produce excess amounts of any hormone or health problems. Most adrenal nodules do not cause any symptoms and are only found when performing imaging studies for other causes.

Treatment includes ensuring the nodule has benign imaging characteristics and there is no evidence of hormone abnormalities.

Adrenocortical Carcinoma

Adrenocortical carcinoma is a very rare cancer of the adrenal glands that occurs in about 1 per 1 million people. There are no obvious symptoms or signs unless the adrenal cancer is producing excessive hormones (such as cortisol and aldosterone.) This makes it hard to detect at an early stage, and unfortunately these cancers tend to be aggressive and grow quickly. Some late stage symptoms include a lump in the abdomen, pain the abdomen or back, and a feeling of fullness. Treatment varies but may include surgery, radiation therapy, and chemotherapy.

Adrenal Metastases

Isolated adrenal metastases are cancers that normally arise from other parts of the body that metastasize to the adrenal gland. Nearly any cancer can spread to the adrenal glands, but some tumors are more likely to metastasize to this region including breast cancer, lung cancer, and melanoma.

Symptoms occur rarely but when present, they may include back pain, abdominal pain, bleeding into the abdomen, and adrenal insufficiency.

Treatment for most patients includes systemic treatment with chemotherapy. However, if the only site of spread is to the adrenal gland, surgical removal with laparoscopic adrenalectomy can improve the patient's prognosis.

Summary:

Specific hormones are associated with the thyroid gland. When the thyroid gland malfunctions, problems occur, such as hypothyroidism, hyperthyroidism, and thyroiditis. Hypothyroidism is a condition that results from underactivity of the thyroid gland and decreased secretion of hormones. Hyperthyroidism is a condition

that results from thyroid gland overactivity resulting in hypersecretion of hormones.

Hypofunction or hyperfunction of the adrenal glands results in certain disorders, such as Addison's disease, Cushing's syndrome, and pheochromocytoma. Addison's disease results from underactivity of the adrenal cortex. Cushing's syndrome results from overactivity of the adrenal cortex. Pheochromocytoma is a tumor of the adrenal medulla which is generally benign, which can present without symptoms until triggered by pregnancy or some other body stressor.

Checking Your Knowledge:

1. Which thyroid disorder results from decreased secretion of the thyroid hormones?
2. What is the most common cause for hypothyroidism?
3. List three possible causes of thyroiditis.
4. Which disorder results from overactivity of the adrenal cortex?
5. List three symptoms that accompany Cushing's syndrome.

Expanding Your Knowledge:

The Hormone Health Network offers information on Peer Support Groups providing patients with information and additional resources. The site highlights several support groups that help patients take an active role in their health, and offers further information on various endocrine disorders. Visit their website at https://www.hormone.org/support-and-resources/peer-support-groups

Web Links:

Causes and Risk Factors of Thyroid Disease
https://www.emedicinehealth.com/thyroid_storm/article_em.htm#what_facts_should_i_know_about_thyroid_storm

Endocrine Gland Anatomy
https://www.emedicinehealth.com/anatomy_of_the_endocrine_system/article_em.htm#what_is_the_endocrine_system.

Hormone Health Network
https://www.hormone.org/diseases-and-conditions

Thyroid Quiz
https://www.emedicinehealth.com/thyroid_quiz_iq/quiz.htm