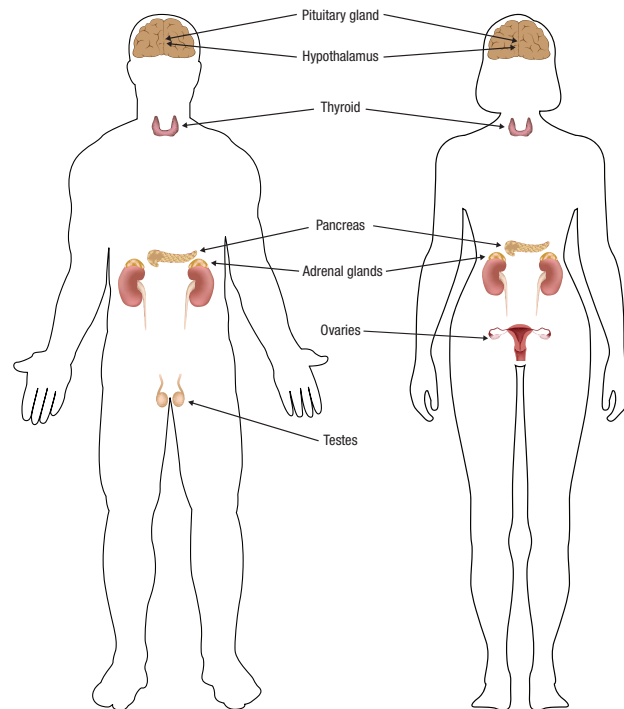


## Thyroid Disease after Cancer Treatment

Some people who were treated for cancer during childhood may develop endocrine (hormone) problems as a result of changes in the function of a complex system of glands known as the endocrine system.

### What is the endocrine system?

The endocrine system is a group of glands that regulate many body functions including growth, puberty, energy level, urine production, and stress response. Glands of the endocrine system include the pituitary, hypothalamus, thyroid, pancreas, adrenals, ovaries, and testes. The hypothalamus and pituitary are sometimes called the “master glands” because they control many of the other glands in the endocrine system. Unfortunately, some treatments given for childhood cancer can damage the endocrine system, resulting in a variety of problems.

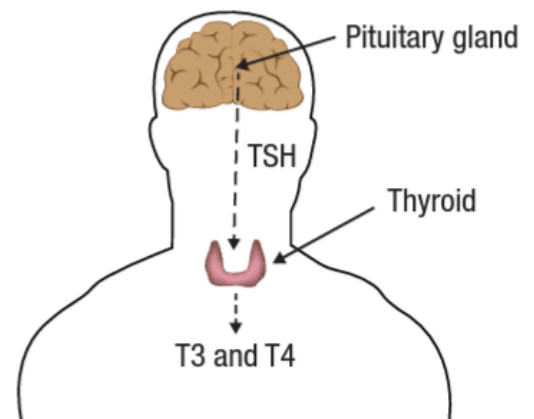


### What are hormones?

Hormones are chemical messengers that carry information from the endocrine glands through the bloodstream to the body's cells. The endocrine system makes many hormones (such as growth hormone, sex hormones, adrenal and thyroid hormones) that work together to maintain specific bodily functions.

### What is the thyroid gland?

The thyroid gland is located in the lower part of the neck in front of the throat. The gland makes two hormones, thyroxine (T4) and triiodothyronine (T3), that play an important role in growth and brain development and help to regulate the body's metabolism. The thyroid gland is controlled by the pituitary, a gland in the brain that makes thyroid stimulating hormone (TSH). TSH is released from the pituitary in response to the levels of T4 and T3 in the blood. If the levels are low, the pituitary makes more TSH to signal the thyroid to increase the production of thyroid hormones. If T4 and T3 are high, the pituitary makes less TSH to signal the thyroid gland to slow down production.



## What are the possible late effects?

Damage to the thyroid gland after childhood cancer can be caused by surgical removal of all or part of the thyroid gland, treatment with tyrosine kinase inhibitors, high doses of MIBG (sometimes used in the treatment of neuroblastoma), and/or treatment with radiation to the head, brain or neck. This damage is usually very easy to treat, although it may not show up for years after treatment. Regular check-ups may help find thyroid problems early so that the proper treatment can be started. Several different types of thyroid problems may develop including an underactive thyroid (hypothyroidism), overactive thyroid (hyperthyroidism), and growths on the thyroid that may be benign (nodules) or malignant (cancer).

## What is hypothyroidism?

**Hypothyroidism** occurs when the thyroid gland is not active enough. This is the most common thyroid problem seen in childhood cancer survivors. This can occur if the brain doesn't make TSH to properly signal the thyroid gland to work or if the thyroid gland is damaged or has been removed and cannot make enough thyroid hormone. When the thyroid gland is underactive, thyroid hormone levels are low and the body's metabolism slows down.

**Signs and symptoms of hypothyroidism** may include:

- Slowing of normal growth
- Weight gain
- Dry skin
- Brittle hair/hair loss
- Constipation
- Weakness
- High cholesterol level
- Feeling tired and listless
- Hoarse voice
- Mood changes
- Feeling cold all of the time
- Difficulty concentrating
- Delayed puberty
- Irregular menstrual cycles
- Muscle and joint aches
- Poor exercise tolerance
- Puffiness around the eyes
- Low heart rate or blood pressure

## What is hyperthyroidism?

**Hyperthyroidism** occurs when the thyroid gland is too active. In this condition thyroid hormone levels are high and the body's metabolism speeds up.

**Signs and symptoms of hyperthyroidism** may include:

- Jitteriness
- Anxiety
- Problems concentrating
- Feeling tired
- Muscle weakness
- Tremors
- Fast or irregular heartbeat
- Increased sweating
- Feeling hot all of the time
- Diarrhea
- Weight loss
- Irregular menstrual periods
- Bulging or protruding eyes
- Neck tenderness and swelling
- Poor exercise tolerance

## What are thyroid nodules and thyroid cancer?

**Thyroid nodules and thyroid cancer** are growths that usually begin as slow-growing, painless lumps in the neck. Most thyroid growths do not cause any symptoms. They may occur many years after cancer treatment.

## Who is at risk for thyroid problems?

People who received radiation that may have affected the thyroid gland directly are at risk for primary hypothyroidism, compensated hypothyroidism, thyroid nodules, and/or thyroid cancer. People who received radiation to the thyroid gland in high doses, especially more than 30 Gy or 3000 cGy/rads, are also at risk for hyperthyroidism. The following radiation fields have the potential to affect the thyroid gland directly:

- Head/brain
- Neck
- Spine (cervical/neck portion)
- Total body irradiation (TBI)

In addition, people who received radioiodine therapy (I-131), high doses of MIBG, or tyrosine kinase inhibitors or had their thyroid gland partially or completely removed surgically (thyroidectomy) are also at risk for hypothyroidism.

People who received high doses of radiation (30 Gy or 3000 cGy/rads or higher) to the head/brain are at risk for hypothyroidism.

Other factors that have been shown to increase the risk of thyroid problems after childhood cancer include being:

- Treated with higher radiation doses
- Treated at a young age
- Born with ovaries

Thyroid problems may occur soon after radiation, but generally do not occur until several years later. If treated promptly, thyroid problems are easily managed.

## What screening is recommended?

All childhood cancer survivors should have a yearly comprehensive health check-up including measurement of height and weight, examination of the thyroid gland, and blood tests to measure the levels of TSH and T4. During periods of rapid growth, healthcare providers may recommend more frequent monitoring of thyroid levels.

Survivors at risk for thyroid problems who are planning to become pregnant should have their thyroid levels checked before attempting pregnancy. It is important to do this before becoming pregnant, as there is a higher chance of having babies with developmental problems if untreated thyroid disease is present. It is also important to monitor thyroid levels periodically during pregnancy.

## How are thyroid problems treated?

If problems with thyroid levels are identified, you may be referred to an endocrinologist (hormone specialist) for evaluation and to discuss treatment, such as medication, if needed. If a lump is detected on the thyroid, you may also be referred to a surgeon or other specialist for further evaluation and management.

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Additional health information for childhood cancer survivors is available at  
[www.survivorshipguidelines.org](http://www.survivorshipguidelines.org)

**Note:** Throughout this *Health Links* series, the term "childhood cancer" is used to designate pediatric cancers that may occur during childhood, adolescence, or young adulthood. Health Links are designed to provide health information for survivors of pediatric cancer, regardless of whether the cancer occurred during childhood, adolescence, or young adulthood.

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