Health Link
Healthy living after treatment of childhood, adolescent, and young adult cancer

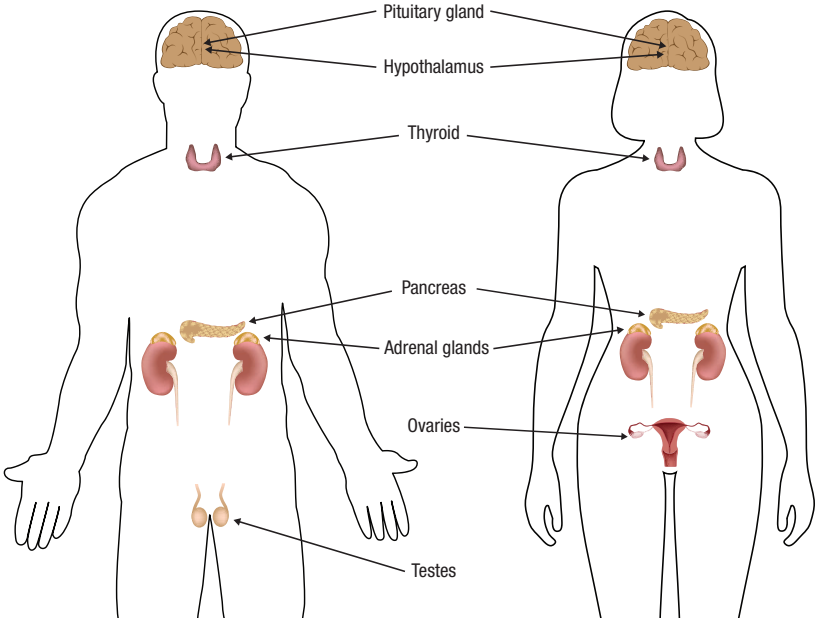
CHILDREN'S ONCOLOGY GROUP
The world's childhood cancer experts

Thyroid Problems 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 (in females), and testes (in males). The hypothalamus and pituitary are sometimes called the "master glands" because they control many of the other the endocrine system. Unfortunately, some treatments given for childhood cancer can damage the endocrine system, resulting in a variety of problems.

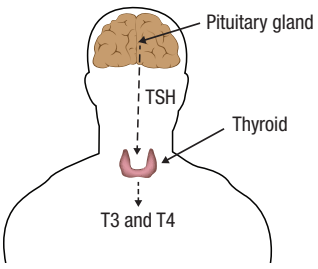


What are hormones?

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 windpipe. The gland makes two hormones, thyroxine (T4) and triiodothyronine (T3), that play an important role in growth and mental 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.



The possible late effects

Damage to the thyroid gland after childhood cancer is usually the result of radiation to the head, brain or neck, or high doses of MIBG (sometimes used in the treatment of neuroblastoma). 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). Surgical removal of the thyroid gland (thyroidectomy) and radioiodine treatments (I-131 thyroid ablation) may also result in low or absent levels of thyroid hormone, depending on the amount of thyroid tissue removed or destroyed.

Hypothyroidism occurs when the thyroid gland is not active enough. This is the most common thyroid problem seen in childhood cancer survivors. When the thyroid gland is underactive, thyroid hormone levels are low and the body's metabolism slows down.

There are three different types of hypothyroidism seen in childhood cancer survivors:

- **Primary hypothyroidism** is caused by direct damage to (or surgical removal of) the thyroid gland. Blood tests in people with primary hypothyroidism show a high TSH because the pituitary gland is responding to the lower than normal levels of T3 and T4 produced by the damaged thyroid gland.
- **Central hypothyroidism** is caused by damage to the hypothalamus or pituitary gland in the brain. Blood tests in people with central hypothyroidism show low TSH, T3 and T4 levels because the pituitary gland does not produce enough TSH to stimulate secretion of T3 and T4.
- **Compensated hypothyroidism** occurs when the pituitary gland has to overwork the thyroid gland to keep the level of thyroid hormones normal in the blood. This may be a temporary problem after radiation, or it may be a sign that the thyroid gland is beginning to fail. Blood tests in people with compensated hypothyroidism show higher than normal TSH levels and normal T3 and T4 levels. Some survivors with compensated hypothyroidism may be treated with thyroid hormone in order to decrease the workload on the thyroid gland.

Signs and symptoms of hypothyroidism may include:

- Feeling tired and listless
- Hoarse voice
- Problems concentrating
- Feeling sad/depressed
- Mood changes
- Constipation
- Weakness
- Feeling cold all of the time
- Puffiness around the eyes
- Slowing of normal growth
- Delayed onset of puberty
- Puffiness of the face and hands
- Weight gain
- Dry skin
- Brittle hair
- Muscle and joint aches
- Slowing of the heart rate
- Low blood pressure
- High cholesterol level
- Poor exercise tolerance

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

Thyroid nodules and thyroid cancer are growths that may occur many years after radiation to the thyroid gland or treatment with high doses of MIBG. Both usually begin as slow-growing, painless lumps in the neck. Most thyroid growths do not usually cause any symptoms.

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 had their thyroid gland surgically removed (thyroidectomy) are also at risk for primary hypothyroidism.

People who received radiation that may have affected the pituitary gland in the brain are at risk for central hypothyroidism. Radiation in high doses, especially more than 30 Gy or 3000 cGy/rads, to the head/brain has the potential to affect the pituitary gland.

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

- Female
- Treated with higher radiation doses
- Treated at a young age

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 follow up is needed for those at risk?

Since thyroid problems may occur many years after cancer treatment, a yearly checkup is recommended for survivors who are at risk of developing thyroid problems. This check-up should include evaluation of growth in children and teens, examination of the thyroid gland, and a blood test to measure the levels of TSH and T4. During periods of rapid growth, healthcare providers may recommend more frequent monitoring of thyroid levels.

Female 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, because mothers with thyroid disease have a higher chance of having babies with developmental problems. 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 continuing treatment. If a lump is detected on the thyroid, you may be referred to a surgeon or other specialist for evaluation and management.

All types of **hypothyroidism** are treated with daily thyroid pills. Treatment is usually for life. In some cases of compensated hypothyroidism, treatment may be stopped if the thyroid gland begins to work normally.

Hyperthyroidism may be treated in several ways. Sometimes medication is given on a temporary basis to prevent thyroid hormone production. Thyroid ablation (destroying the hormone-producing cells in the gland by drinking a radioactive liquid iodine called I-131) may be done. Surgery to remove the thyroid gland is another treatment. Your healthcare provider will determine which treatment option is the best choice for you.

Treatment for hyperthyroidism may result in hypothyroidism, which is then treated with a daily thyroid pill.

Thyroid nodules. Thyroid growths need additional testing. This is generally done with an ultrasound (picture made using sound waves) and biopsy (sampling the thyroid tissue to check for cancer cells). Surgery may be done to remove enlarging nodules because of the concern about thyroid cancer.

Thyroid cancer. Treatment for thyroid cancer involves surgery to remove the cancer and as much additional normal thyroid tissue as the surgeon feels is necessary. After surgery, additional treatment with radioactive iodine (I-131) may be needed to destroy any remaining thyroid tissue. After treatment for thyroid cancer, most people will need to take daily thyroid pills.

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Additional health information for childhood cancer survivors is available at *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.