



PATIENT RESOURCES

# Childhood Cancer Survivors and Endocrine Gland Disruption

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The care of individuals who survived cancer—including children, adolescents, and young adults—is complex, and patients should be cared for by endocrinolog and other physicians who are familiar with important aspects of this care. The

various therapies used to treat cancer can throw off the endocrine/hormonal system. Thus, it is critical to know the early and late endocrine symptoms that may develop and possible effects following cancer treatment in cancer survivors.

## **Endocrine Connection**

The causes of endocrine effects in survivors of cancer include surgery, chemotherapy, radiation, and effects of the cancer or tumor itself. Endocrine glands may be affected in the areas of a tumor, where surgical and radiation interventions are targeted. Chemotherapy may have effects on endocrine glands distant from the site of the tumor, often affecting the reproductive organs.

The most frequently affected endocrine organs in cancer survivors are the hypothalamus and pituitary glands. The hypothalamus produces **hormones** which link the nervous and endocrine systems through the pituitary gland. Hormones produced in this region include growth hormone (GH), the fertility hormones luteinizing hormone (LH) and follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), and the cortisol-producing adrenocorticotrophic hormone (ACTH).

### **► Symptoms and Signs**

Often, following cancer therapy, the endocrine system becomes deranged, manifesting with symptoms and signs that may mimic the recurrence of cancer itself. Evaluation should be based on specific clinical evidence, confirmatory blood tests, and radiological studies. Most symptoms or signs are dependent on the affected endocrine gland:

Low growth hormone levels from pituitary growth hormone deficiency:

- › Height growth failure or lack of a growth spurt with puberty in growing children
- › Fatigue, body composition with more fat and less lean mass, elevated cholesterol in teens or adults

Growth may also be affected by non-endocrine factors such as radiation-induced damage to growth plates of the spine.

Low estrogen or testosterone levels (**hypogonadism**) due to pituitary FSH and LH deficiency or gonadal failure (damage to ovary/testes):

- › Delayed, absent, or arrested puberty—lack of breast development in girls or testes/penis enlargement in boys
- › Secondary amenorrhea (loss of periods) or loss of libido in sexually mature individuals
- › Hypogonadism can lead to low bone mineral density if not adequately treated

Too much/too early estrogen or testosterone levels (precocious puberty):

- › Breast development in girls before age 8 years or testes/penis enlargement in boys before age 9 years

Low thyroid hormone levels (hypothyroidism) from pituitary TSH deficiency or thyroid gland damage:

- › Fatigue, constipation, feeling cold, dry skin/hair, shortness of breath during exercise, irregular periods, muscle weakness, slow growth in

children

Rarely, survivors can develop high thyroid hormone levels (hyperthyroidism) or thyroid cancer due to direct thyroid damage.

Low cortisol levels (**adrenal insufficiency**) from pituitary ACTH deficiency or adrenal gland damage:

- › Fatigue, weakness, nausea/vomiting, headache, abdominal pain, weight loss, loss of appetite, low blood sugar or low sodium levels, particularly in times of acute illness or injury
- › May result in crises with low blood pressure, lethargy, dizziness

Low anti-diuretic hormone [ADH] levels leading to diabetes insipidus:

- › Excessive urination leading to excessive thirst

### › **Additional Risks**

Adult childhood cancer survivors are also at risk for obesity, especially if they were a young child at the time of cancer diagnosis, were exposed to cranial, abdominal, or total body radiation, were treated with dexamethasone, had a brain tumor, or needed stem cell transplant. Obesity in these survivors may lead to metabolic syndrome (high blood pressure, high cholesterol, and abdominal fat gain), type 2 diabetes mellitus, or atherosclerosis, in addition to cancer recurrence. Lifestyle changes such as

smoking cessation, physical activity, and healthy eating can improve these risks.

### ► **Screening and Treatment**

Cancer survivors are encouraged to ask their health care providers about early and late endocrine effects of their cancer and/or treatment. Nearly one-half of childhood cancer survivors experience at least one endocrine disorder in their lifetime. Endocrine disorders may present several years to decades after cancer diagnosis and completion of treatment. Therefore, lifelong screening is required.

- › Childhood cancer survivors should provide their primary care provider and endocrinologist with a summary of their cancer treatment history and a list of conditions they are at risk for based on their treatment history.
- › A skilled medical provider should closely monitor the growth and puberty of child survivors, since each of those can impact adult height.
- › Stimulation testing – a medical test to determine how the endocrine system responds—may be needed to assess production of certain hormones (e.g., growth hormone and cortisol).
- › Based on the diagnosis, treatments for cancer-related endocrine disorders include replacing missing hormones or suppression/induction of puberty.

### ► **Questions for Your Healthcare Provider**

- › When should I/my child start having endocrine screening testing and how often should it be done?

- › Should any endocrine testing be done differently than for someone who is not a cancer survivor?
- › What are the risk and the benefits of each treatment option?

AN ENDOCRINE SOCIETY PATIENT RESOURCE

## SURVIVING CHILDHOOD CANCER

A cancer diagnosis is something of an age, but especially when the patient is a child. The care of children, adolescents, and young adults who survive cancer is complex. A 5-year survival rate is greater than 80% for various types of cancer, but cancer can have effects on the endocrine and hormonal systems. It is important to know the signs and symptoms of endocrine problems that may develop and possible effects following cancer treatment is survival.



**CHILDHOOD CANCER SURVIVORS**  
One of the most frequently affected endocrine organs in cancer survivors are the hypothalamus and pituitary gland.

- The hypothalamus produces and releases hormones and links the nervous and endocrine systems through the pituitary gland.
- The pituitary gland is often referred to as the "master gland" and influences other organs in the body. It also produces the growth hormone.
- The growth hormone controls the body's growth. If survivors have the ability of the growth hormone, it can lead to health problems, including weight gain and growth issues in young survivors.
- Other hormones that may be affected include thyroid hormones, sex hormones, and adrenal hormones.

**THE ENDOCRINE CONDITIONS FACING CANCER SURVIVORS INCLUDE:**

- Growth failure
- Sex hormone deficiency
- Diabetes mellitus
- Adrenal insufficiency
- ACTH deficiency, which is the hormone responsible for cortisol production

**ENDOCRINE COMPLICATIONS OF CANCER SURVIVAL MAY BE CAUSED BY:**

- Surgery
- Chemotherapy
- Radiation
- Effects from the cancer or tumor

These conditions are diagnosed based on specific clinical history, blood tests, and radiological evidence. Most signs and symptoms are dependent on the affected endocrine gland.



Visit [endocrine.org](http://endocrine.org) for more information.  
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## Developed for patients based on **Hypothalamic-Pituitary and Growth Disorders in Survivors of Childhood Cancer, An Endocrine Society Clinical Practice Guideline.**

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