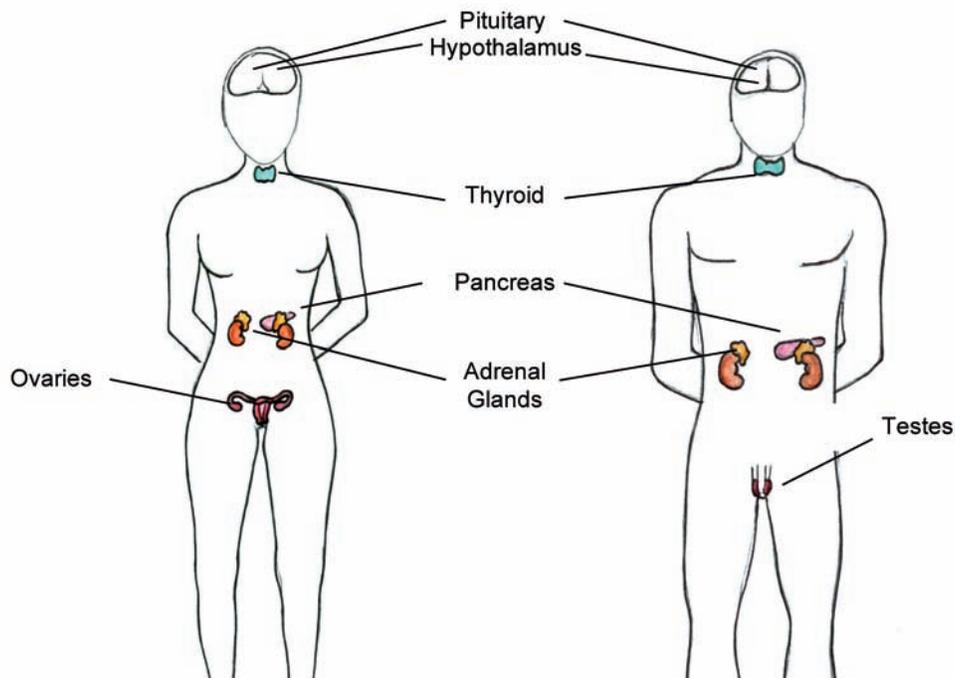


Endocrine Problems after Childhood Cancer: Hypopituitarism

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, adrenals, pancreas, ovaries (in females), and testes (in males). 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 hypopituitarism?

Hypopituitarism is the decrease or lack of one or more of the pituitary hormones. The lack of three or more of the pituitary hormones is referred to as panhypopituitarism. Pituitary hormones include:

- **Growth hormone (GH)** – stimulates the growth of bone and other body tissues, and also affects how the body uses fat, makes muscle, strengthens bones, and generally influences overall health throughout life
- **Adrenocorticotrophic hormone (ACTH)** – stimulates the adrenal gland to produce cortisol
- **Thyroid stimulating hormone (TSH)** – stimulates the thyroid gland to produce thyroid hormones
- **Reproductive hormones (gonadotropins)**, including **luteinizing hormone (LH) and follicle stimulating hormone (FSH)** – stimulate the testes and ovaries to make sex hormones
- **Antidiuretic hormone (ADH)** – helps to control the balance of water in the body by controlling urine output
- **Prolactin** – controls milk production in women who are breastfeeding

What causes hypopituitarism?

Risk factors related to childhood cancer treatment include:

- Radiation to the brain, especially in doses of 40 Gy (4000 cGy/rads) or higher
- Surgical removal of the pituitary gland

Other risk factors for pituitary problems include infections, severe head trauma, or the lack of development of the pituitary from birth.

What are the symptoms of hypopituitarism?

The symptoms depend on the specific hormones that are lacking. One or more of the following hormones may be affected:

Adrenocorticotrophic hormone (ACTH) deficiency:

The adrenal glands (located on top of the kidneys) are stimulated by ACTH to produce cortisol. If the pituitary gland doesn't make enough ACTH, then cortisol will not be made. Cortisol helps keep the body's blood sugar at a normal level and helps the body deal with physical stress, such as fever or injury. For more information about ACTH deficiency, *see the related Health Link: Central Adrenal Insufficiency.*

Growth hormone (GH) deficiency:

Growth hormone affects the growth of body tissues and bone as well as fat, muscle, and sugar metabolism. For more information about growth hormone problems, see the related *Health Link: Growth Hormone Deficiency*.

Gonadotropin (FSH, LH) deficiency:

LH and FSH control the production of male and female hormones. In males LH and FSH stimulate the testicles to make testosterone, and in females LH and FSH stimulate the ovaries to make estrogen and progesterone, resulting in development of sexual characteristics during puberty. If the body doesn't have enough LH and FSH during puberty, there can be problems with pubertal development. For more information about male and female hormonal issues, see the related *Health Links: Male Health Issues after Childhood Cancer Treatment and Female Health Issues after Childhood Cancer Treatment*.

Thyroid Stimulating Hormone (TSH) deficiency:

TSH stimulates the thyroid gland to release thyroxin, which is important for brain development, growth, and metabolism. People with too little thyroxin may develop the following symptoms: tiredness, sleeping too much, weight gain, slow growth, poor appetite, cold intolerance, dry skin, constipation, or coarse, dry thin hair. For more information about thyroid problems, see the related *Health Link: Thyroid Problems after Childhood Cancer*.

What screening is recommended?

All cancer survivors should have a yearly physical examination including measurement of height and weight, assessment of their progression through puberty, and assessment of overall well-being. If a hormone problem, such as hypopituitarism is suspected, further tests may be done and a referral may be made to an endocrinologist (doctor who specializes in hormone problems).

Written by Debra Eshelman, RN, MSN, CPNP, After the Cancer Experience (ACE) Pediatric and Young Adult Survivor Programs, Children's Medical Center of Dallas and the University of Texas Southwestern Medical Center, Dallas, TX.

Reviewed by Lillian R. Meacham MD, Charles Sklar MD, Julie Blatt MD, Melissa M. Hudson MD, Winnie Kittiko, RN, MS, and Susan Shaw, RN, MS, PNP.

Illustrated by Devika Bhatia.

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.

Disclaimer and Notice of Proprietary Rights

Introduction to Late Effects Guidelines and Health Links: The "*Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers*" and accompanying "*Health Links*" were developed by the Children's Oncology Group as a collaborative effort of the Late Effects Committee and Nursing Discipline and are maintained and updated by the Children's Oncology Group's Long-Term Follow-Up Guidelines Core Committee and its associated Task Forces.

For Informational Purposes Only: The information and contents of each document or series of documents made available from by the Children's Oncology Group relating to late effects of cancer treatment and care or containing the title "*Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers*" or the title "*Health Link*", whether available in print or electronic format (including any digital format, e-mail transmission, or download from the website), shall be known hereinafter as "Informational Content". All Informational Content is for informational purposes only. The Informational Content is not intended to substitute for medical advice, medical care, diagnosis or treatment obtained from a physician or health care provider.

To cancer patients (if children, their parents or legal guardians): Please seek the advice of a physician or other qualified health provider with any questions you may have regarding a medical condition and do not rely on the Informational Content. The Children's Oncology Group is a research organization and does not provide individualized medical care or treatment.

To physicians and other healthcare providers: The Informational Content is not intended to replace your independent clinical judgment, medical advice, or to exclude other legitimate criteria for screening, health counseling, or intervention for specific complications of childhood cancer treatment. Neither is the Informational Content intended to exclude other reasonable alternative follow-up procedures. The Informational Content is provided as a courtesy, but not intended as a sole source of guidance in the evaluation of childhood cancer survivors. The Children's Oncology Group recognizes that specific patient care decisions are the prerogative of the patient, family, and healthcare provider.

No endorsement of any specific tests, products, or procedures is made by Informational Content, the Children's Oncology Group, or affiliated party or member of the Children's Oncology Group.

No Claim to Accuracy or Completeness: While the Children's Oncology Group has made every attempt to assure that the Informational Content is accurate and complete as of the date of publication, no warranty or representation, express or implied, is made as to the accuracy, reliability, completeness, relevance, or timeliness of such Informational Content.

No Liability on Part of Children's Oncology Group and Related Parties/ Agreement to Indemnify and Hold Harmless the Children's Oncology Group and Related Parties: No liability is assumed by the Children's Oncology Group or any affiliated party or member thereof for damage resulting from the use, review, or access of the Informational Content.

You agree to the following terms of indemnification: (i) "Indemnified Parties" include authors and contributors to the Informational Content, all officers, directors, representatives, employees, agents, and members of the Children's Oncology Group and affiliated organizations; (ii) by using, reviewing, or accessing the Informational Content, you agree, at your own expense, to indemnify, defend and hold harmless Indemnified Parties from any and all losses, liabilities, or damages (including attorneys' fees and costs) resulting from any and all claims, causes of action, suits, proceedings, or demands related to or arising out of use, review or access of the Informational Content.

Proprietary Rights: The Informational Content is subject to protection under the copyright law and other intellectual property law in the United States and worldwide. The Children's Oncology Group retains exclusive copyright and other right, title, and interest to the Informational Content and claims all intellectual property rights available under law. You hereby agree to help the Children's Oncology Group secure all copyright and intellectual property rights for the benefit of the Children's Oncology Group by taking additional action at a later time, action which could include signing consents and legal documents and limiting dissemination or reproduction of Informational Content.