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Childhood Leukemia

Leukemia is a cancer affecting the blood and bone marrow (the soft inner part of bones). It's the most common type of cancer in children and teenagers. Around 30% of childhood cancers is leukemia. Most children with leukemia respond well to treatment.

What is childhood leukemia?

Cancer occurs when cells in any body region grow rapidly without control. Childhood leukemia is cancer affecting the bone marrow cells of children and teens. The bone marrow cells, which are either lymphocytes or myeloid cells, become cancerous at different stages of their development.

Lymphocytes are white blood cells that fight off infections in the body. Myeloid cells can develop into red blood cells, platelets (cells that help blood to clot), or white blood cells other than lymphocytes.

Leukemia most commonly affects white blood cells, upsetting the cells' immune function.

Difference between chronic and acute childhood leukemia

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Most childhood leukemia is acute. Acute means that the leukemia develops quickly and needs immediate treatment. Acute leukemia affect immature blood cells. This means these blood cells become cancerous before they fully develop.

Chronic means that the leukemia slowly develops. Symptoms take a longer time to appear. Chronic leukemia affect mature blood cells that have fully developed. Childhood leukemia is rarely chronic.

Childhood leukemia facts and stats

- **Acute lymphoblastic leukemia (https://leukemiarf.org/leukemia/acute-lymphoblastic-leukemia/)** (ALL) is the most common type of childhood leukemia. ALL accounts for around 75% of all childhood leukemia.
  - ALL occurs during early childhood, most commonly in children ages two to five years.
  - ALL occurs more in boys than girls. It also affects children with Hispanic or white ethnicities more than Asian or African ethnicities.
  - Two types of ALL that can occur during childhood include **B-cell acute lymphoblastic leukemia (B-ALL)** (https://leukemiarf.org/leukemia/acute-lymphoblastic-leukemia/b-cell-lymphoblastic-leukemia/) and **T-cell acute lymphoblastic leukemia (T-ALL) (https://leukemiarf.org/leukemia/acute-lymphoblastic-leukemia/t-cell-lymphoblastic-leukemia/).**
- **Acute myeloid leukemia (https://leukemiarf.org/leukemia/acute-myeloid-leukemia/)** (AML) accounts for most of the remaining childhood leukemia (~20%).
  - AML occurs slightly more during adolescence and the first two years of life.
  - AML occurs equally in boys and girls.
  - Acute promyelocytic leukemia (APL), oaccounts for around 1% of all childhood leukemia.
- Chronic leukemia rarely occurs during childhood.
  - **Chronic myeloid leukemia** (https://leukemiarf.org/leukemia/chronic-myeloid-leukemia/) (CML) accounts for around 2-3% of all childhood leukemia and is the main cause of chronic childhood leukemia. This type of leukemia develops more in teenagers than in younger children.
  - Juvenile myelomonocytic leukemia (JMML) accounts for 1% of all pediatric leukemia and shares features with **chronic myelomonocytic leukemia (https://leukemiarf.org/leukemia/chronic-myelomonocytic-leukemia/)** (CMML). The main difference between the two types is the age of onset. JMML most often occurs in children younger than 6, while CMML most often occurs in adults over 60.

Causes and risk factors of childhood leukemia

Risk factors for developing childhood leukemia include:

- **Environmental factors**: Environmental exposures include chemicals, pesticides, radiation, or viral or bacterial infections. The risk is higher if infections occur before birth or after the first few years of life.
- **Family history**: You may have a higher risk for leukemia if your sibling has leukemia. Risk increases among identical twins.

- **Genetic factors:** Most leukemia isn't linked to any known genetic causes, but some are. Genetic syndromes, such as Down syndrome, Li-Fraumeni syndrome, neurofibromatosis, and Fanconi anemia, increase risk.
- **Inherited immune system conditions:** Ataxia-telangiectasia, Bloom syndrome, Shwachman-Diamond syndrome, and Wiskott-Aldrich syndrome increase risk.
- **Lifestyle factors:** Lifestyle factors usually don't contribute to childhood leukemia development as they do in adult leukemia. Some studies suggest that drinking alcohol during pregnancy increases the risk of childhood leukemia. Not all studies agree.
- **Medications**: Medications such as chemotherapy or immunosuppressants weaken the immune system and increase the risk of leukemia. Doctors most often give immunosuppressants to children after organ transplantation.
- **Uncertain risk factors:** Not enough evidence confirms that the following factors increase leukemia risk. These factors include contaminated water, electromagnetic fields, hormones, nuclear power plants, parental smoking, and parental workplace exposures to chemicals and radiation.

Symptoms of childhood leukemia

Symptoms of leukemia include:

- Abdominal (belly) swelling
- Coughing or trouble breathing
- Headaches, seizures, balance problems, visual changes, or vomiting (if the leukemia spreads to the brain and spinal cord)
- Loss of appetite or weight
- Pain in the bones and joints
- Rashes (more commonly found in AML than ALL)
- Swelling of the lymph nodes under the armpits, around the neck, and in the groin

Some symptoms of leukemia depend on the types of blood cells affected.

- If there is a lower number of red blood cells (anemia), symptoms might include
  - Feeling:
    - Cold
    - Dizzy or lightheaded
    - Tired (fatigued)
    - Weak
    - Short of breath, especially during activity
  - Looking pale
- If there is a lower number of white blood cells, symptoms might include:
  - Frequent fevers, sometimes in the absence of any active infection
  - Recurrent infections
- If there is a lower number of platelets in the blood, symptoms might include:
  - Bleeding that is hard to stop
    - Bleeding gums (may happen after teeth cleaning or at the dentist's office)
    - Frequent or severe nosebleeds
  - Easy bruising

Diagnosing childhood leukemia

Your pediatrician asks questions about your child's symptoms, how long they've been present, and your family's history. Next, the doctor examines your child for swollen lymph nodes; enlarged organs; and signs of infection, bruising, or bleeding.

Further testing might include:

- **Complete blood cell (CBC) count**: This test counts the number of platelets, red blood cells, and white blood cells in a sample of your child's blood. This tells the doctor if the blood cell counts are too low or too high.
- **Blood smear**: This test allows a laboratory specialist to look at your child's blood cells under a microscope to confirm any changes in appearance.

Your doctor might refer you and your child to a pediatric cancer specialist (oncologist) if they suspect childhood leukemia.

The oncologist may recommend additional tests, such as:

- **Bone marrow aspiration and biopsy:** The doctor may collect samples of liquid bone marrow and solid bone for laboratory testing. This test may confirm the leukemia diagnosis. Future repeated tests may determine how well the leukemia responds to treatment.
- **Genetic testing:** These tests determine if changes (mutations) in genes or chromosomes are causing the leukemia. Specific mutations may suggest the need for specific treatments.
- **Imaging:** Imaging studies identify swollen lymph nodes or enlarged organs, such as the liver, spleen, or thymus (an organ behind the breastbone). Usually, solid tumors don't form in leukemia. Imaging studies may include:
  - Chest X-rays
  - Computed tomography (CT) scans
  - Magnetic resonance imaging (MRI) scans
  - Ultrasounds
- **Lymph node biopsy:** Providers rarely use this procedure for children with leukemia. If needed, your doctor may remove one or more swollen lymph nodes to examine the tissues. The doctor administers general anesthesia, causing the child to sleep during the procedure.
- **Lumbar puncture (spinal tap):** The doctor uses a thin, hollow needle to collect a cerebrospinal fluid sample. The fluid surrounds the brain and spinal cord. The doctor usually administers general anesthesia, causing the child to sleep during the procedure. This test detects if the leukemia has spread to the brain or spinal cord.

Treatment for childhood leukemia

Doctors may recommend different types of **treatment (https://leukemiarf.org/childhood-leukemia/treatment/)** based on the child's age, leukemia type, and current symptoms. The development of better treatments in the past few decades has improved outcomes for childhood leukemia.

Children often can tolerate higher chemotherapy doses (which kill more cancer cells) than adults. Most childhood leukemia has high remission rates (significant reduction of cancer cells).

Please take a moment to review the **long term and late effects** (https://leukemiarf.org/leukemia/childhood-leukemias/treatment/long-term-and-late-effects/) of childhood leukemia treatment.

Learn more about Childhood ALL treatments from Dr. Jen McNeer from University of Chicago Medicine, in **a special recorded webinar. (https://leukemiarf.org/patients/webinars/childhood-all-treatments/)**

Helpful resources

Support can make a significant difference when you face a cancer diagnosis. You can connect with others who understand these challenges through our **peer support (https://leukemiarf.org/patients/support/)** programs. We offer an online support community and a mentoring program. We also have a **directory of resources**, (https://leukemiarf.org/patients/resources/) including information for **children (https://leukemiarf.org/patients/resources/children/)**and **adolescents/young adults (https://leukemiarf.org/patients/resources/young-adults/)** (AYA), to help patients, families, and caregivers.

Clinical Trials Hub: A resource for leukemia patients and caregivers

Do you have questions about clinical trials? On our new Clinical Trials Hub learn how clinical trials are developed or if they are right for you. You can also use the new Search Tool to see if there is a current leukemia-focused trial you would qualify for.

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