

Acute Lymphoblastic Leukemia



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What is the bone marrow?

The bone marrow is the factory that produces different cells that form blood. It is the soft inner part of some bones, such as the skull, shoulder blades, ribs, pelvis, and bones in the spine. Immature cells are produced in the bone marrow. These are called the blood stem cells. With time and under the effect of maturation factors, these cells become mature blood cells. Broadly there are of two types –myeloid stem cell or a lymphoid stem cell.

A myeloid stem cell goes on to form one of three types of mature blood cells:

- Red blood cells that carry oxygen and other substances around the body.
- Platelets that help stop bleeding.
- White blood cells (granulocyte) that fight infection and disease.

A lymphoid stem cell becomes a lymphoblast cell (immature cell) and then one of three types of lymphocytes (white blood cells):

- B lymphocytes that make antibodies to help fight infection.
- T lymphocytes that help B lymphocytes make the antibodies that help fight infection.
- Natural killer cells that attack cancer cells and viruses.

What is acute lymphoblastic leukemia?

Acute lymphoblastic leukemia (ALL) is the commonest blood cancer in children. It is caused because of an unchecked

overproduction of lymphoblasts in the bone marrow. The marrow gets overcrowded with these immature cells and production of normal cells is hampered. These immature or cancer cells then spill over in the blood and spread to other organs in the body. The disease progresses very fast and can be lethal in a short time if left untreated.

What is the cause of acute lymphoblastic leukemia?

We really do not know what causes ALL. However some factors have been identified which might increase the risk of getting ALL.

What are the risk factors for acute lymphoblastic leukemia?

Factors that may increase the risk of getting ALL are as follows.

- Exposure to x-rays before birth
- Radiation exposure
- Chemotherapy
- Exposure to certain chemicals such as benzene
- Viral infections
 - Human T-cell lymphoma/leukemia virus-1 (HTLV-1)
 - Epstein-Barr virus (EBV)
- Genetic conditions
 - Down syndrome
 - Neurofibromatosis type 1
 - Bloom syndrome
 - Fanconi anemia
 - Ataxia-telangiectasia
 - Li-Fraumeni syndrome

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- Constitutional mismatch repair deficiency (mutations in certain genes that stop DNA from repairing itself, which leads to the development of cancers at an early age)
 - Having a brother or sister with ALL
- Some unproven risk factors include:
- Exposure to electromagnetic fields (such as living near power lines or using cell phones)
 - Workplace exposure to diesel, gasoline, pesticides, and certain other chemicals
 - Smoking
 - Exposure to hair dyes

What are the symptoms of acute lymphoblastic leukemia?

Most symptoms in ALL are caused by bone marrow failure. Symptoms include:

- Pallor
- Fatigue
- Shortness of breath
- Bruising
- Bleeding
- Fever
- Frequent infections
- Bone and joint pain
- Swollen lymph nodes
- Abdominal pain caused by enlarged liver and/or spleen
- Unexplained weight loss
- Loss of appetite

ALL can present with symptoms of spread to brain, spinal cord, testis, chest cavity, skin, eyes, kidneys, etc.

How is acute lymphoblastic leukemia diagnosed?

The following tests and procedures may be used to diagnose childhood ALL and its spread to various parts of body:

- Complete blood count (CBC) and blood cell exam (peripheral blood smear)
- Blood chemistry and coagulation tests to detect liver and kidneys problems caused by spread of disease
- Bone marrow aspiration and biopsy. The bone marrow is studied by different tests. Each gives crucial information regarding the type of disease and probable outcome. These tests also help the doctor to decide the kind of treatment.
 - Morphology
 - Immunophenotyping by flowcytometry
 - Cytogenetics both karyotyping and FISH
 - Bone marrow biopsy interpretation
- Lumbar puncture for spread to brain and spinal cord
- Imaging tests for infection and spread to parts of body
 - Chest x-ray
 - CT scan
 - MRI
 - Ultrasound

What is the treatment for acute lymphoblastic leukemia?

ALL requires aggressive therapy in three phases:

- Induction therapy – entails killing the cancer cells aggressively. Preventive

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intrathecal therapy also forms a part of this phase.

- Consolidation therapy – Includes prevention of disease spread to the brain with the help of systemic chemotherapy as well as intrathecal chemotherapy
- Maintenance therapy – lasts for 18 month to 2 years. Most of the treatment is oral chemotherapy

The treatment modalities are :

- Chemotherapy
- Supportive care
- Radiation therapy