Acute Lymphoblastic Leukemia

This Acute Lymphoblastic Leukemia (ALL) guide provides an overview of the disease: how it starts, its risk factors, symptoms, diagnosis, and treatment options. Knowing more about the disease can help you cope better, take informed decisions, and make the course of treatment as manageable as possible.

What is leukemia?

- Leukemia is cancer of the blood cells.
- Most blood cells develop in the bone marrow (soft spongy tissue inside the bones) from a parent cell known as a "stem cell". Different types of blood cells are:
  - Red blood cells which carry oxygen all over the body
  - White blood cells which fight infections
  - Platelets which help blood to clot
- Leukemia develops when the bone marrow starts producing abnormal white blood cells in an uncontrolled way. It starts in immature (early formed) white blood cells and then reaches the bloodstream.
- When abnormal leukemia cells accumulate in the bone marrow, they crowd out and prevent other red and white blood cells and platelets from working normally.
- There are different types of leukemia depending on what type of blood cell is affected.
- When the disease grows fast and gets worse quickly it is called acute leukemia, when it is slow-growing and gets worse gradually over time it is called chronic leukemia. Treatment and recovery from leukemia depend on whether the leukemia is acute or chronic and what type of blood cell is affected.

What is acute lymphoblastic leukemia?

- Acute lymphoblastic leukemia (ALL), is a cancer of the blood and bone marrow where immature white blood cells - lymphoblasts- that fight infection become cancerous. It is the most common type of leukemia and is also called acute lymphocytic leukemia.
- The bone marrow produces immature blood cells called stem cells hat become either:
  A myeloid stem cell which grows into one type of mature blood cell:
  - Red blood cell.
  - Platelet.
  - Granulocyte (white blood cell): fights infection and disease.

  A lymphoid stem cell which grows into a lymphoblast cell and then one type of white blood cell or lymphocyte:

  - B lymphocyte: produce antibodies to help fight infection.
  - T lymphocyte: help B lymphocytes produce the antibodies.
  - Natural killer cell: attack cancer cells and viruses.

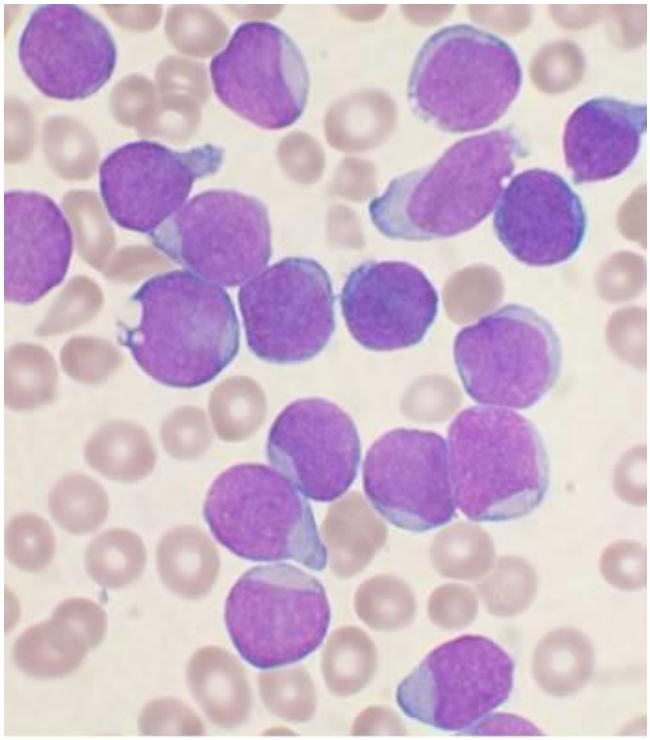
- The type of leukemia depends on what type of white blood cells is affected (lymphoid or myeloid cells).
- ALL causes too many lymphoblasts to develop abnormally. The leukemic cells do not fight infection very well and as they increase and build up uncontrollably in the blood and bone marrow, they crowd out healthy blood cells making you susceptible to infection, easy bleeding and anemia.
- When cancerous cells move into the bloodstream, they can also reach and spread to other organs like the central nervous system (spinal cord and brain) and accumulate in the lymph nodes, liver, spleen and testicles and prevent them from functioning normally.

What is the difference between lymphoma and ALL?

- Lymphoma a cancer of the lymphatic system also starts in lymphocytes just like ALL.
- But leukemias such as ALL mainly affect the blood and bone marrow and may spread to other organs, while lymphomas involve the lymph nodes mainly or other organs but can also affect the bone marrow.
- When cancer is found at times in both lymph nodes and the bone marrow, it can make it unclear whether the disease is leukemia or lymphoma.
- The disease is usually considered leukemia If the bone marrow contains a bigger amount of cancerous blood cells. The size of the lymph nodes also helps determine the disease, the disease is more likely to be lymphoma the bigger they are.

What causes acute lymphoblastic leukemia? Are there known risk factors for the disease?

- The exact cause of most leukemias is still unknown
- An uncontrollable growth of abnormal lymphocyte cells happens due to damage or changes in the genes of healthy lymphocyte cells (DNA).
- Doctors don’t know yet what causes the DNA mutations that makes acute lymphocytic leukemia develop. But what is for sure is that most cases of ALL aren't inherited.
- Damage in the cells causes the bone marrow starts to produce abnormal lymphoblast blood cells.
- A risk factor can increase your chances of getting cancer.



Bone marrow with ALL https://en.wikipedia.org/wiki/File:Acute_leukemia-ALL.jpg

These risk factors are linked with a higher risk of ALL:

- Being older: Most cases occur in people above 70 years old.
- Being male: The risk of leukemia is higher in men than in women overall.
- Having an inherited syndrome: Some inherited diseases that increase the risk of ALL such as
  - Down syndrome.
  - Ataxia-telangiectasia.
  - Neurofibromatosis.
  - Klinefelter syndrome.
  - Fanconi anemia.
  - Bloom syndrome.
- Having a sibling who has had ALL: Those who have a sibling who has been diagnosed with ALL specially a twin run a higher risk of developing ALL.
- Having a weakened immune system: Increases the risk of developing ALL because of the body's decreased ability to fight off threatening cells: Having the Human Immunodeficiency Virus or AIDS or being exposed to immune system suppressing medications such as those received after an organ transplant.
- Exposure to high levels of environmental radiation: From radioactive material used in heavy war weapons or from nuclear radiation, or, high levels used in treatment of cancer, and excessive use of X-rays and CT scans
- Previous radiation for cancer treatment: Having received radiation therapy also increases the risk of ALL.

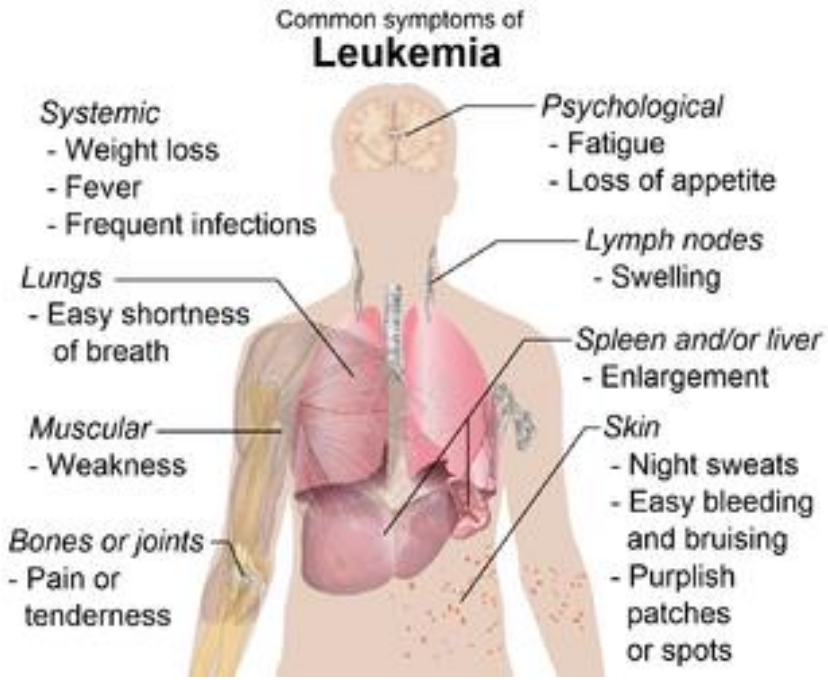
- Previous chemotherapy: Some chemotherapy medications used to treat cancer may raise the risk of developing ALL. Risk is higher if chemotherapy and radiation were both used.
- Exposure to certain chemicals: Chemicals like benzene and gasolene used in refineries, gasoline, the rubber industry, and also present in cigarettes may increase the risk of ALL.

If you think you have risk factors for ALL, consult your doctor

What are the symptoms of ALL?

- ALL often does not cause symptoms in the early stages. Sometimes leukemia is discovered during a routine blood test before symptoms develop.
- Symptoms of ALL may appear because of a shortage of healthy blood cells or result from where leukemia cells accumulate in the body. Many symptoms are common to many other illnesses as well. Most often they have causes other than ALL.
- Early signs and symptoms of ALL may resemble other common diseases or the flu.
- .Consult with your doctor if you are experiencing any of the following symptoms:

    - Enlarged lymph nodes (especially in the underarm areas, the neck, stomach, or groin)
    - Recurrent frequent or resistant infections
    - Episodes of fever or chills
    - Bleeding and bruising easily (such as bleeding gums, frequent or severe nosebleeds, purple skin patches, heavy periods in women)
    - Feeling generally unwell and run-down, sometimes with a sore throat or mouth.
    - Pale skin appearance
    - Appearance of pinhead-sized red or violet spots on the skin called petechiae (from bleeding)
    - Extreme fatigue and weakness
    - Feeling dizzy or light-headed.
    - Pain in the joints, arms, legs, bones, below the ribs or stomach for no known reason.
    - Unusual night sweats.
    - Pain and fullness in the belly area below the ribs.
    - Prolonged bleeding from small cuts
    - Shortness of breath
    - Abdominal pain, swelling, or distention
    - Loss of appetite & unintentional weight loss
    - Blood in the urine



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How is ALL diagnosed?

If you have symptoms that may signal ALL, your doctor will examine you and ask you questions about your health and your medical history.
To find out if you have cancer and whether it is spread one or more of the following tests may be used:

Physical exam and history: Your doctor will review your medical history to check for possible risk factors, previous illnesses and treatments, as well as your family history. The doctor will fully examine your body and check for any enlarged lymph nodes, spleen, or liver, and request some tests.

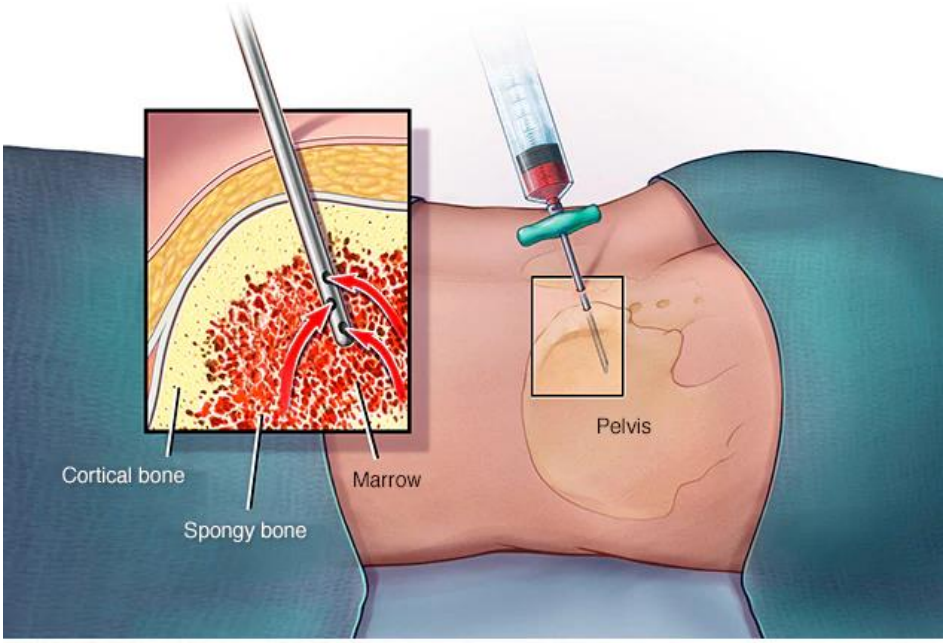
Blood tests: The doctor will request a blood smear and a complete blood count. Blood cells are also studied under the microscope to check for any abnormality. A complete blood count will be done by drawing a blood sample and checking:
- Number of white blood cells, red blood cells and platelets.
- Level of hemoglobin (the protein that carries oxygen) in red blood cells.
- Proportion of red blood cells.

Blood chemistry function tests: Your blood is checked for any abnormal amounts of certain substances released by organs and tissues that can be a sign of disease.

Peripheral blood smear: A sample of blood is examined for abnormal blast cells, amount and type of platelets, white blood cells and blood cells shape changes.

Bone marrow aspiration and biopsy: A procedure done to examine the bone marrow for cancer cells.

Bone marrow aspiration: After numbing a small area of the skin (usually over the hip), the doctor will insert a thin needle into the hip bone or breastbone. This is done to remove (aspirate) a small amount of liquid from the bone marrow.
- Bone marrow biopsy: It is usually done right after the bone marrow aspiration. The doctor will remove a small piece of the bone marrow's bone with a larger needle and will then send it for biopsy.
The samples are examined by a pathologist to look for signs of cancer under a microscope.



https://www.mayoclinic.org/diseases-conditions/leukemia/diagnosis-treatment/drc-20374378#dialogId62578768

These chromosomal tests are done on a sample of bone marrow cells or a blood sample:

Cytogenetic analysis: A laboratory test that looks for certain changes in chromosomes of leukemia cells like abnormalities or translocations (a genetic change where part of one chromosome breaks off and attaches to another chromosome) by studying them under a microscope.

Immunophenotyping: A process where cells from blood, bone marrow or a lymph node, are studied under a microscope to diagnose the type of ALL. This test compares normal immune system cells to cancer cells, based on the types of antigens (any substance that can cause the immune system to react) on the cancer cell.

Flow cytometry: A laboratory test to measure the number of cells, portion of live cells in a sample, cell size, shape, and the presence of tumor markers. The test uses a light-sensitive dye and fluid to stain the cells and then exposes them to a laser or another type of light. Evaluations are then done according to how the dye reacts to the light.

Immunohistochemistry: This type of test may is used to identify the type of ALL. Antibodies attach to a dye or radioactive substance that lights it up under a microscope help find certain antigens on cancer cells in a sample of tissue.

FISH (fluorescence in situ hybridization): A laboratory test that examines genes and chromosomes in tissues and cells. Fluorescent dyed pieces of DNA are added to cells or tissues, to attach to certain genes and light up them up when viewed under a microscope. This test is used to look for certain genetic markers –changes in DNA that may predispose for a higher ALL disease risk-.

More testing procedures might be done to:

- Learn how far the leukemia might have spread, if disease has reached the central nervous system (spinal cord and brain) or other parts of the body, this allows the doctor to diagnose the stage of ALL in order to plan treatment.
- Examine an abnormal area that might contain leukemia more closely
- Determine if treatment has been effective.

Chest X-ray: An imaging test that produces images of the structures inside the chest to look for enlarged lymph nodes and disease.

Lumbar puncture (spinal tap): It is a procedure done to take a sample of cerebrospinal fluid (CSF) (fluid around the brain and spinal cord). After numbing the lower spine, the doctor inserts a needle between two bones and removes a sample of CSF fluid around the spinal cord. The sample is examined under a microscope to check for the presence of leukemia cells in the spinal cord and brain.

CT or CAT (computed axial tomography): An imaging test that produces detailed three-dimensional images of areas inside the body taken from different angles. It is more detailed than the X-ray and helps find out the extent of disease, if lymph nodes or other body organs are enlarged and if leukemia has reached other organs. Please refer to the “Computed Tomography Scan” handout for more information.

Bone scan: An imaging test that examines any bone damage to check if the bladder cancer might have spread to the bones. It is done when a person is having bone pain to check if disease is present in the bones.

Ultrasound: A test that uses sound waves to produce images of the internal organs in your body. It can be used to look at lymph nodes near the surface of the body or to examine any enlarged organs inside your abdomen like the kidneys, liver, and spleen.

MRI (magnetic resonance imaging) scans: An imaging test that uses radio waves and a magnetic field to take detailed images of soft tissue areas inside the body and check the extent of disease in your body. It helps find out if disease has reached areas such as the brain or spinal cord.

Sometimes a dye might be injected for better detail. Please refer to the "Magnetic Resonance Imaging" handout for more information.

Echocardiogram: a test that uses sound waves (ultrasound) to view the structure of the heart and evaluate its overall function and valves. It may be done if treatment includes chemotherapy drugs that may affect the heart.

How is ALL staged?

- To plan treatment, your doctor will have to check the leukemia has reached beyond the blood and bone marrow.
- ALL has no standard staging, it is classified as untreated, in remission, or recurrent.

Untreated ALL: Disease is diagnosed and has not yet been treated except to relieve symptoms such as pain, fever or bleeding.

- Complete blood count is abnormal.
- More than 5% of the cells in the bone marrow are leukemia cells.
- Signs and symptoms of leukemia are present.

ALL in remission: Disease been treated.

- Complete blood count is normal.
- 5% or fewer of the cells in the bone marrow are leukemia cells.
- There are no signs or symptoms of leukemia other than in the bone marrow.

- Cytogenetic tests, flow cytometry, and other lab tests help identify the subtype of ALL, which is based on:
- The type of lymphocyte (B cell or T cell) leukemia cells come from.
- How mature these leukemia cells are.

B-cell ALL can either be:

- Early pre-B ALL (also called pro-B ALL).
- Common ALL
- Pre-B ALL
- Mature B-cell ALL (Burkitt leukemia)

T-cell ALL can either be:

- Pre-T ALL
- Mature T-cell ALL

What factors affect treatment options?

Certain factors help define what treatment can be most appropriate for every case of ALL:

- Age.
- Initial white blood cell count at diagnosis.

- ALL subtype: Whether T or B cell ALL.
- Chromosome abnormalities: Whether there is an abnormal number of chromosomes or a translocation in leukemia cells: between chromosomes 4 and 11; chromosome 12 and 21; presence of Philadelphia chromosome (a modified chromosome 22 resulting from pieces of chromosome 9 and 22 switching places by breaking off their original position).
- Response to chemotherapy.
- The stage of the cancer: whether it reached the brain or the spinal cord.
- Whether ALL has just been diagnosed or has returned.

What happens after treatment?

After a first round of treatment, tests are done to determine the state of disease and decide if further treatment might be needed:

- **In remission**: No leukemia is found after treatment: the bone marrow has less than 5% blast cells, blood cell counts are normal and there are no symptoms of the disease. However, remission does not always mean leukemia has been cured.
- **Minimal residual disease**: Leukemia cells are not found in the bone marrow using regular lab tests but they can still be identified with more sensitive tests.
- **Active disease**: Leukemia cells are still present or the disease has returned.

How is ALL treated?

The treatment of adult ALL is usually done in phases and typically lasts for about 2 years.

- **Remission induction therapy**: The aim of the first phase of treatment is to destroy leukemia cells in the blood and bone marrow and drive the disease into remission. It usually involves intense chemotherapy.
- **Post-remission or consolidation therapy**: The aim of the second phase of treatment that starts once ALL is in remission is to eliminate any remaining leukemia cells that may not be active but could regrow and re-activate the disease. It usually lasts longer than induction therapy and drugs are usually given in higher doses.
- **Maintenance therapy**: The third phase of treatment is given to maintain the good results of prior treatment and prevent the disease from recurring or leukemia cells from reappearing. Usually drugs are given in lower doses.

Chemotherapy is given in cycles followed by periods of rest to allow your body to recover from treatment.

ALL by stage	Standard treatment options may include:
Untreated ALL	Induction phase: - Combination chemotherapy

	- Tyrosine kinase inhibitor therapy (such as imatinib) or monoclonal antibodies (such as rituximab) in certain cases, combination chemotherapy - Supportive care: antibiotics, blood transfusions - CNS prophylaxis therapy: intrathecal or systemic chemotherapy with or without radiation to the brain
ALL in remission	- Chemotherapy - Tyrosine kinase inhibitor therapy (such as imatinib) or monoclonal antibodies (such as rituximab) in certain cases - Chemotherapy with stem cell transplant - CNS prophylaxis therapy: intrathecal or systemic chemotherapy with or without radiation to the brain
Recurrent ALL	- Combination chemotherapy followed by stem cell transplant - Low dose radiotherapy for symptom relief - Tyrosine kinase inhibitor therapy (such as dasatinib) for certain cases - Clinical trials

Below is an explanation of the different types of treatment for ALL:

Chemotherapy: Chemotherapy consists of medications that stop the growth of cancer cells either by destroying them or by stopping their division. Chemotherapy attacks all cells that grow fast: cancer cells as well as normal cells.

The way the chemotherapy is given depends on the type and stage of the cancer being treated.

Combination chemotherapy is using more than one drug for treatment.

Drugs are administered in cycles followed by periods of rest to allow the body to recover from treatment, depending on the medication.

Chemotherapy is called systemic when medications are taken by mouth (as pills) or injected into a vein or muscle, drugs enter the bloodstream and can reach cancer cells throughout the body.

Intrathecal chemotherapy consists of delivering medications directly into the cerebrospinal fluid, an organ, or a body cavity such as the abdomen; it is regional chemotherapy as it mainly affects disease in those areas.

Intrathecal chemotherapy might be given to treat ALL that has spread to the spinal cord and brain. When it is given to prevent ALL from reaching the brain and spinal cord, it is called central nervous system prophylaxis.

Chemotherapy is often combined with targeted therapy.

Central venous access device surgery: Before chemotherapy can begin, surgery is often needed to place a small plastic tube called a central venous catheter or central venous access device –CVAD- that grants access to a large central vein. The tube stays implanted for the duration of treatment, its end stays under the skin or sticks out in the chest area or upper arm. It allows administering frequent IV drugs and drawing blood tests, without having to do repeated needle stick injections. This provides a safe and direct access to blood vessels. The catheter is most commonly used for long treatments, such as cancer therapy.

You will be instructed on how to care for the device to prevent it from getting infected.

When intrathecal chemotherapy is needed, medications can be given through a lumbar puncture or through a device called an Ommaya reservoir which also has to be surgically placed. It allows for giving you intrathecal chemotherapy and drawing CSF samples without the need of repeated lumbar punctures. Chemotherapy is given by sliding a needle through the skin of the scalp and into the device. The device is a dome-like container implanted under the scalp; it holds the medications as they go through a catheter that links the device to the CSF.

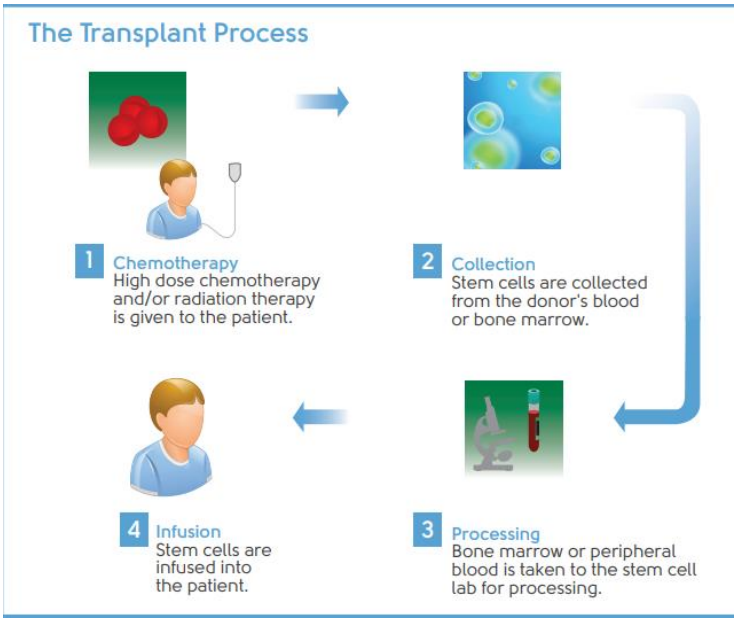
Radiation therapy: This treatment aims to destroy leukemia cells and keep them from growing by using high energy radiation or X-rays.

There are two types of radiation therapy: Radiation can be given from outside of the body or internally by delivering radiation into your body through catheters placed directly at the tumor.

- External radiation might be given to treat ALL that has reached the brain and spinal cord or testicles, it is called central nervous system prophylaxis. Also if disease has spread to the testicles.
- Total-body irradiation is external radiation given to the whole body. It may be given before a stem cell transplant.
- Radiation therapy can also be used to alleviate symptoms like pain caused by leukemia when disease is present in the bone area.

Stem cell transplant: also known as bone marrow transplant. The transplant replaces the diseased bone marrow with a healthy one. This procedure is done after giving high doses of chemotherapy and/or total body radiation to destroy cancer cells in the body. You may receive stem cells from your own blood/bone marrow or from a donor. When removed and collected, stem cells are frozen and stored. After the chemotherapy and/or radiation therapy, the stored stem cells are returned through an infusion; they grow into healthy blood cells and replace the ones lost. Stem cell transplant is sometimes used to treat ALL patients who are in remission or who have a relapse during or after treatment.

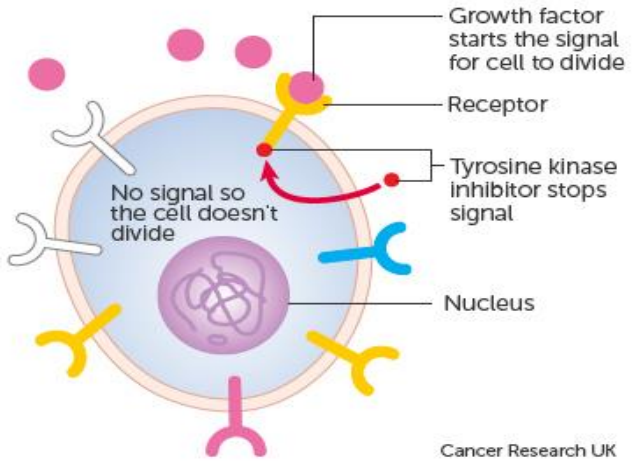
When stem cells are collected from your own blood or bone marrow it is called an autologous transplant, when they are from a donor's, it is an allogeneic transplant.



Targeted therapy: Targeted therapy is a new cancer treatment that specifically attacks cancer cells and blocks their growth. It targets specific cancer cell genes, proteins, or tissues that help cancer cells grow and survive. This treatment affects normal cells less than chemotherapy.

For people with Philadelphia chromosome targeted drugs may be used to attack cells that contain that abnormality. This altered gene makes an abnormal protein, tyrosine kinase, that helps ALL cells grow. Tyrosine kinase inhibitor therapy can block this protein that causes stem cells to grow into abnormal white blood cells. This therapy is taken in combination with chemotherapy, during or after chemotherapy.

Targeted therapy medications you might receive include: Medications that block cancer cell growth such as Imatinib (Gleevec®), Dasatinib (Sprycel®) and Nilotinib (Tasigna®).



http://www.cancerresearchuk.org/about-cancer/cancers-in-general/treatment/biological/types/cancer-growth-blockers

- Targeted therapy can be given in pills that you swallow or intravenously.

- It can be given alone or in combination with chemotherapy.
- Targeted therapy side effects depend on the medication and dose you receive. They might include diarrhea, loss of appetite, skin problems, mouth sores, nausea, fatigue, and vision problems.

Immunotherapy (also called biologic therapy): Immunotherapy is a treatment that helps improve the immune system's ability to fight cancer. It uses substances made either by the body or in the laboratory to enhance or restore the body's natural defenses against cancer.

Antibodies - immune system proteins that fight infection- made by the body or in the lab – called monoclonal antibodies- are used to destroy or slow the growth of cancer cells by helping to identify and attack specific substances in the cancer cells that help them grow and spread. This treatment also affects normal cells less than chemotherapy.

Medications you might receive include:
- Rituximab (Rituxan®), often used in combination with chemotherapy.
- Blinatumomab (Blincyto ®) is a special kind of antibody that can bind both to cancer cells and immune system cells and help the body find and attack cancer cells.

Immunotherapy side effects depend on the medication and dose you receive.

What are the side effects of leukemia treatment?

Chemotherapy may cause several side effects during treatment since it fights all rapidly dividing cells in the body; both cancerous and normal. These side effects depend on several factors such as the type and dose of medications you will receive and treatment duration. They include:

• **Low blood counts**: Chemotherapy can lower the number of healthy blood cells.
- Anemia: Low level of red blood cells : you may feel tired and dizzy. - - -
Neutropenia: Low level of white blood cells called neutrophils (that fight infection) : you may be at higher risk for infections. - --
Thrombocytopenia: Low levels of platelets. You may have easy bruising and bleeding. The doctor will check your blood count levels with regular blood tests. If blood counts are low, the doctor may stop chemotherapy, lower the dose, or recommend a blood transfusion.

• **Hair loss:** Some chemotherapy medications may affect hair cells all over the body (scalp hair, eyebrows, eyelashes, etc.) causing hair loss. Hair will grow back gradually after treatment.

• **Digestive tract problems**: You may have poor appetite, nausea, vomiting, diarrhea, constipation, or mouth/throat sores. Please refer to the "Chemotherapy » handout for more information.

Steroid medications used in chemotherapy can cause:

• **Hypertension** (elevated blood pressure): Blood pressure levels will be monitored regularly during treatment.
• **Hyperglycemia** (high blood sugar): This may be temporary. Blood and urine tests will be regularly done to monitor blood sugar levels during treatment.

Chemotherapy may also cause several late effects after treatment. They depend on your age at the time of treatment, the type and dose of medications you will receive, and the treatment duration. They include:

• **Reproductive issues**: Some types of chemotherapy medications may cause infertility by affecting the testes and ovaries.

- In males: Testes may be damaged and this may lead to lower ability to make sperm or semen (fluid carrying sperm) and may cause damage to sperm.

- In females: Ovaries may be damaged and this may lead to interrupted or irregular menstruation (shorter period duration in younger girls), delayed puberty, and early menopause.

• **Cardiovascular problems**: You may experience irregular heartbeats, rapid heartbeats (tachycardia), chest pain, and shortness of breath. Therapy doses are as limited as possible to reduce possible side effects while treating the disease. Tests are done after treatment to detect any cardiovascular problems.

Radiotherapy may cause several side effects that depend on the dose and area of the body treated; for example radiotherapy to the abdomen can cause nausea, vomiting, or diarrhea. It may also cause late effects that depend on your age at the time of treatment, the dose of radiation, and area of the body treated. Radiotherapy may increase the risk of heart disease and secondary cancers later. It's only given when necessary.

• **Radiotherapy to the pelvic area** can also affect fertility in males and females.

- In males: Testes may be damaged affecting semen and sperm production and quality.
- In females: Ovaries may be damaged which may lead to irregular periods, delayed puberty, or early menopause.

Sperm banking and egg preservation may be done before you start treatment. Ovarian transposition surgery moves the ovaries outside of the treatment area.

To save your fertility chances, talk to the doctor about the options to preserve fertility before starting treatment.

- Late effects of ALL treatment can appear during or after therapy and last for months or years.

- Being treated for ALL may increase the risk of developing a second cancer (such as acute myeloid leukemia and lymphoma) therefore it is essential that patients follow up with physical exams and check-ups after treatment.

What should you ask your doctor about ALL? (Blue box)

Having an open discussion with you doctor and cancer team can help clarify all the issues on your mind about the disease.

Knowing that you have ALL can be overwhelming. It is helpful to prepare for your doctor's appointments.

· Write down the symptoms you are having, their start date, frequency, and severity.

· Write down key personal information that might be relevant such as recent life changes, medical history of a disease, previous diagnosis of lung disease, and any relevant family history.

· List all the medications you are taking.

· Gather all your medical records. If you have any imaging or laboratory tests done at a different medical center, bring all the results with you to your appointment.

You might want to ask your doctor about the following:

- *What kind of leukemia do I have?*
- *When will the results be ready?*
- *Will I need any additional testing?*
- *Are there other doctors I need to see?*
- *What is causing my symptoms? How can they be relieved?*
- *At what stage is my leukemia, and what does that mean in my case?*
- *What's my International Prognostic Index (IPI) score, and does it affect my options?*
- *Have you treated many cases like this type of leukemia?*
- *What are my treatment options?*
- *When do I need to start treatment? How long will it last?*
- *Can you tell me about the risks and side-effects of treatment?*
- *How long will treatment last? What will it involve?*
- *Where will I receive treatment? Will I be able to go back home or do I have to stay at the Medical Center?*
- *Will treatment affect my daily life? When would I be able to practice normal activities?*
- *What are the chances that the disease comes back?*
- *When is my next follow-up visit?*
- *Will I benefit if I quit smoking now?*
- *How often will I need checkups after treatment?*
- *What can I do to stop my cancer from recurring?*

Note down any other concerns you may want more information about.

Have a relative or close friend accompany you during appointments to help you remember the questions you want to ask and the discussion.

Tips during treatment

The health care team as well as the palliative and supportive care team are here to help you during and after treatment. These tips can help you manage the course of the disease, treatment, and follow up.

· **Don't smoke and avoid second-hand smoking**

· **Learn about the disease:** It is very important to know enough information about ALL, its treatment options, and the possible side effects to set your expectations and manage the course of disease. It will also help in taking essential decisions more easily.

· **Talk to your doctor and nurses:** Voice any of your concerns and talk about what you are experiencing. Do not wait until you feel you are overwhelmed.

· **Share your concerns with others:** Try to keep a good support network around you to share your concerns. Sharing concerns or questions related to the disease and treatment with your significant others might be of great help in coping with ALL. Patients who are going through the same experience can be of great support as well.

· **Keep a schedule of your appointments and tests:** Ask your doctor about the expected schedule of appointments and tests you need to go through. Keep a good record of your treatment course and plan, along with test results and your list of medications.

· **Eat healthy:** Take care of yourself by keeping a balanced diet that includes cereals, whole grains, vegetables, and fruits. Limit your intake of red and processed meat. Eating an appropriate amount of food and getting enough calories during and after treatment will help you maintain energy and feel better. It can also help you in maintaining a healthy weight during and after treatment. Maintaining good nutrition is important since treatment side effects can cause loss of appetite, fatigue and nausea. Please refer to the "Nutrition Tips for Cancer Patients" handout for more information.

· **Drink in moderation:** If you drink alcohol, limit your daily intake to one drink (for females) and two drinks (for males).

· **Exercise:** Exercise can help you feel better, have more energy, rebuild strength, and improve your appetite. It can help relieve cancer-related fatigue. Any type of exercise, no matter how long it is can be good. If you have been inactive, you can start slowly and build up your activity level. It is recommended to walk for 15 to 30 minutes every day even if you are using oxygen.

This will improve your heart and lung function. Talk to your doctor before starting any type of exercise.

· **Stay active:** Having ALL does not mean you cannot continue doing the things you normally like to do. If you feel well enough, stay active as much as you can. Try to get enough rest and sleep. Balance between rest and activities. Practicing your regular activities will help you stay connected to your normal life, maintain a sense of normalcy, and have a break from treatment.