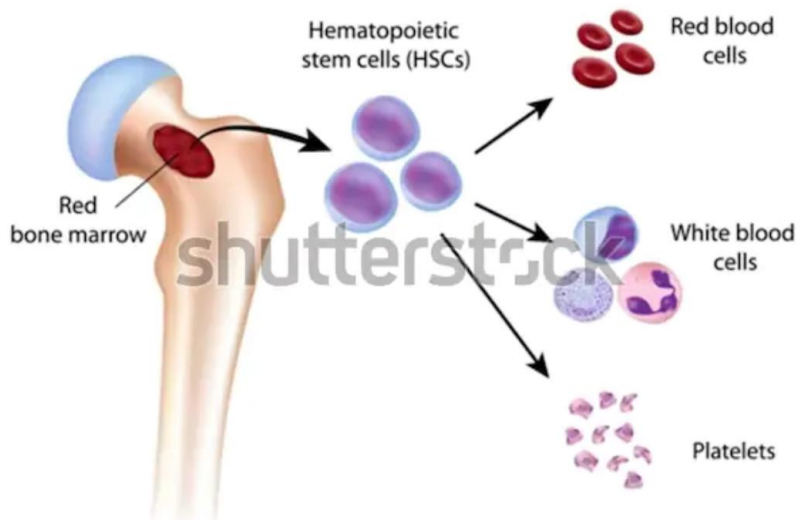


Acute Lymphocytic Leukemia

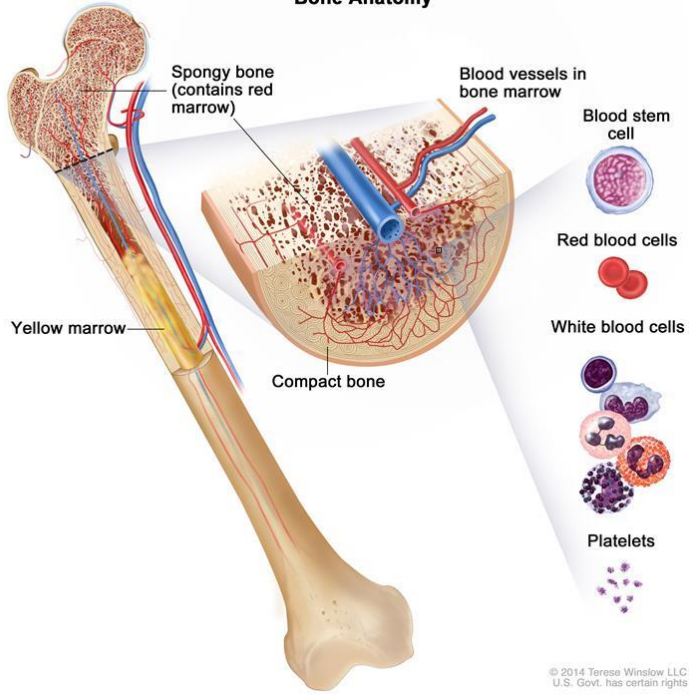
This Acute Lymphocytic Leukemia guide provides an overview of the disease, how it starts, its risk factors, symptoms, diagnosis, and treatment options. Knowing more about the disease can help you cope better, take informed decisions, and make the course of treatment as manageable as possible.

What are blood cells?

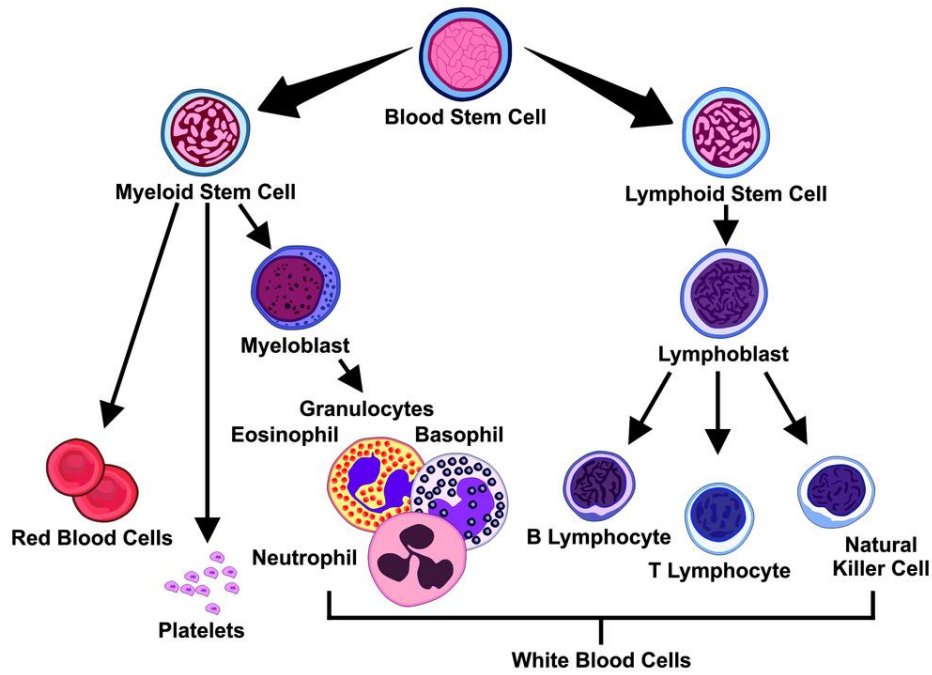
- Different types of blood cells include:
 - Red blood cells that carry oxygen to all body parts
 - White blood cells that fight infections
 - Platelets that help the blood to clot
- All your blood cells develop in the bone marrow (soft spongy tissue inside the bones) from a parent cell known as a “stem cell”.
- The stem cell either matures into a myeloid or lymphoid stem cell.
 - The myeloid stem cell grows into one type of blood cells: either red blood cell, or platelet, or granulocyte (a type of white blood cell).
 - The lymphoid stem cell grows into a lymphoblast cell and then into a type of lymphocyte (the main type of white blood cells):
 - B lymphocyte: produces antibodies to help fight infection
 - T lymphocyte: helps B lymphocytes produce the antibodies
 - Natural killer cell: attacks cancer cells and viruses



Bone Anatomy

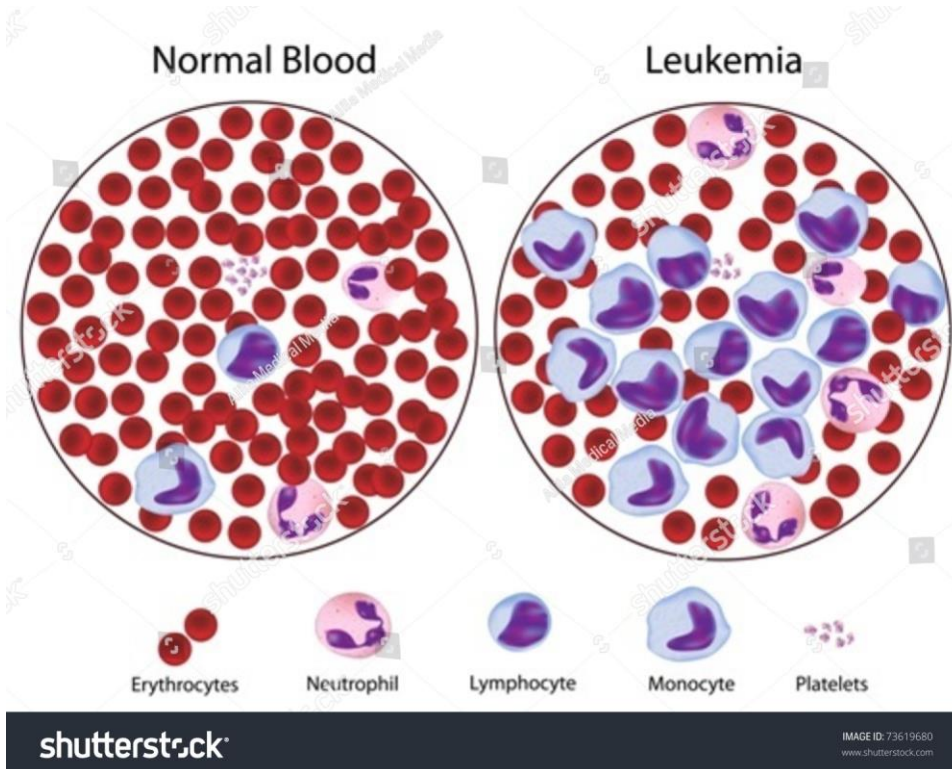


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What is leukemia?

- Leukemia is cancer of the blood cells.
- It 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. When leukemia cells move through the blood, they can spread to other body parts or organs such as the lymph nodes, liver, brain and spinal cord, testicles, and lungs.
- There are different types of leukemia depending on the type of blood cell affected (whether lymphoid or myeloid).
- It is called acute when the disease grows fast and gets worse quickly, or chronic when the disease is slow-growing and gets worse gradually.
- Treatment and recovery from leukemia depend on the type of blood cell affected and whether it is acute or chronic.



What is acute lymphocytic leukemia?

- **Acute lymphocytic leukemia (ALL)**, also called **acute lymphoblastic leukemia**, starts in the **early immature form of lymphocytes**, either in B cells or T cells.
- It is the most common type of leukemia.

What causes ALL?

- The exact cause of most leukemias is still unknown.
- The uncontrollable growth of abnormal lymphocytes happens due to damage or changes in the genes (DNA) of healthy lymphocyte cells. It is unknown yet what causes the DNA mutations but we know for sure that most cases aren't inherited.

Several risk factors are linked with a higher risk of ALL. They include:

- **Age:** Most cases occur in people above 70 years old.
- **Gender:** The risk is little higher in men than in women overall.
- **Having an inherited syndrome:** Some inherited diseases increase the risk of ALL, such as: Down syndrome, ataxia-telangiectasia, neurofibromatosis, Klinefelter syndrome, Fanconi anemia, Bloom syndrome, etc.
- **Family history:** Having a sibling, especially a twin, diagnosed with ALL increases the risk of developing ALL.
- **Having a weakened immune system:** A weakened immune system, due to AIDS or immune suppressing medications for example, decreases your ability to fight threatening cells and increases your risk for ALL.
- **Exposure to high levels of radiation:** Prolonged exposure to high levels of radiation such as heavy war weapons, nuclear radiation, or excessive use of X-rays and CT scans increases your risk.
- **Previous cancer treatment:** Some chemotherapy medications used to treat cancer may increase the risk of developing ALL. Exposure to radiation treatment increases your risk as well. The risk is higher if chemotherapy and radiation were both used.
- **Exposure to certain chemicals:** High exposure to chemicals like benzene (such that in oil refineries, rubber industry, gas stations) may increase the risk of ALL.

What are the symptoms of ALL?

ALL often does not cause any symptoms in the early stages. Early signs and symptoms may resemble other common diseases.

Symptoms might result from a shortage of healthy blood cells or where leukemia cells accumulate in the body. They include:

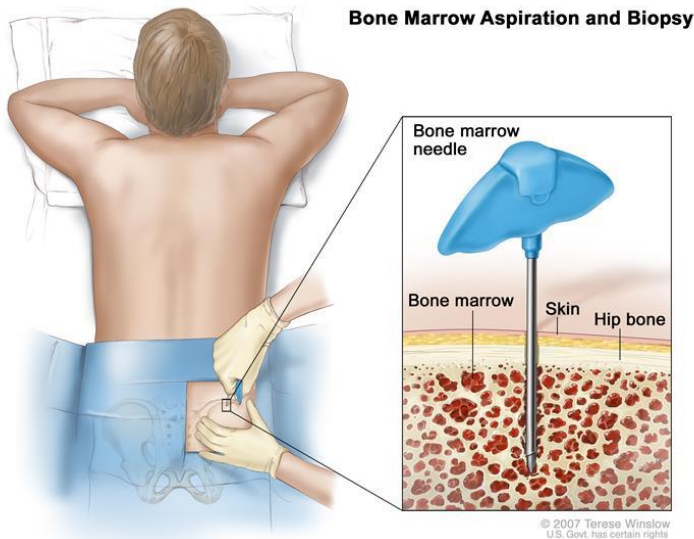
- Enlarged lymph nodes (especially in the underarm areas, neck, stomach, or groin)
- Recurrent, frequent, or resistant infections
- Episodes of fever or chills

- Bleeding and bruising easily (such as bleeding gums, frequent or severe nosebleeds, purple skin patches, red or purple spots on the skin, or heavy periods in women)
- Bleeding that is hard to stop even from small cuts
- Pale skin
- 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
- Shortness of breath
- Abdominal pain, swelling, or distention
- Loss of appetite and unintentional weight loss
- Blood in the urine

How is ALL diagnosed?

- **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 complete blood count to check the number of your blood cells and peripheral blood smear to check how the blood cells under the microscope
- **Bone marrow aspiration and biopsy:** It is a procedure that examines the bone marrow for cancer cells.
 - **Bone marrow aspiration:** After numbing a small area of your skin, the doctor inserts a thin needle into your hip bone or breastbone. He/she then removes (aspirates) 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 your bone marrow with a larger needle and send it for biopsy.

The samples are examined by a pathologist under a microscope to check their size, shape, and percentage.



- **Chromosomal tests:** The doctor might request different tests or a sample of blood or bone marrow cells to check for certain changes in the chromosomes increasing ALL risk and to diagnose the type of ALL.
- **Chest X-ray:** An imaging test that produces images of the structures inside your chest to look for enlarged lymph nodes and disease.
- **Lumbar puncture (spinal tap):** It is a procedure done to take a sample of your cerebrospinal fluid (CSF, the 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. The sample is examined under a microscope to check for the presence of leukemia cells in the spinal cord and brain.
- **Computed tomography (CT) or computed axial tomography:** An imaging test that produces detailed three-dimensional images of areas inside your body taken from different angles. It is more detailed than the X-ray. It helps find out the extent of disease, such as whether your 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.**
- **Ultrasound:** A test that uses sound waves to produce images of the internal organs in your body. It examines lymph nodes near the surface of your body or organs inside your abdomen such as the kidneys, liver, and spleen. **Please refer to the “[Ultrasound](#)” handout for more information.**
- **Magnetic resonance imaging (MRI):** An imaging test that uses radio waves and a magnetic field to take detailed images of the soft tissue areas inside your 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. **Please refer to the “[Magnetic Resonance Imaging](#)” handout for more information.**

How is ALL staged?

ALL has no standard staging, it is classified as untreated, in remission, or recurrent.

- **Untreated ALL:** Disease is recently diagnosed and has not yet been treated.
- **ALL in remission:** Disease has been treated.

- Complete remission: less than 5% of the cells in the bone marrow are leukemia cells
- Partial remission: less than 25% of the cells in the bone marrow are leukemia cells
- **Recurrent ALL or relapsed:** Disease has returned after being treated.

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Knowing that you have ALL can be overwhelming. You might need to know a lot of information. 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, and any relevant family history.
- List all the medications you are taking.
- Gather your medical record. If you have any imaging or laboratory tests done at a different medical center, bring all the results with you to your appointment.
- Write down questions you would want to ask your doctor about:
 - 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?
 - Have you treated many cases like this type of leukemia?
 - What are my treatment options?
 - When do I need to start treatment? What will it involve? How long will it last?
 - Can you tell me about the risks and side-effects of treatment?
 - 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?
- Have a relative or close friend accompany you during appointments to help you remember the questions you want to ask and the discussion.

What factors affect treatment options?

- Your age
- The initial white blood cell count at diagnosis
- The ALL subtype (whether T cell or B cell)
- Presence of chromosome abnormalities
- The stage of cancer (whether it has reached beyond the blood and bone marrow)
- Whether ALL has just been diagnosed or has returned

What is the treatment of ALL?

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

- **Induction therapy:** The aim of the first phase of treatment is to kill leukemia cells in the blood and bone marrow and drive the disease into remission. It usually involves intense chemotherapy. After the first phase, tests are done to determine the state of disease and if further treatment is needed.
- **Consolidation therapy:** The aim of the second phase of treatment is to eliminate any remaining leukemia cells that may not be active but could regrow. It usually lasts longer than induction therapy and chemotherapy medications 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 chemotherapy medications are given in lower doses

The different types of treatment for ALL include:

A. Chemotherapy:

- Chemotherapy medications are used to kill cancer cells. They attack all cells that multiply quickly in the body, both normal and cancerous.
- The way chemotherapy is given depends on the type and stage of cancer.
- One or more medications are usually given by an injection into the veins (IV).
- Chemotherapy is given in cycles. Each cycle is followed by a rest period to allow the body to recover. The length of cycles and the rest period depends on the medications used.
- Intrathecal chemotherapy (giving the medications directly into the cerebrospinal fluid) might be used to treat ALL that has spread to the spinal cord and brain or to prevent it from reaching.

Please refer to the "[Chemotherapy](#)" handout for more information.

Before you receive chemotherapy, you might need to undergo a surgery to place a small plastic tube called a **central venous catheter or central venous access device (CVAD)**. This tube grants access to a large central vein. It is used to administer frequent IV medications and draw blood tests, without having to do repeated needle stick injections. It stays implanted for the duration of treatment. **You will be instructed on how to care for the device to prevent it from getting infected.**

B. Radiation therapy:

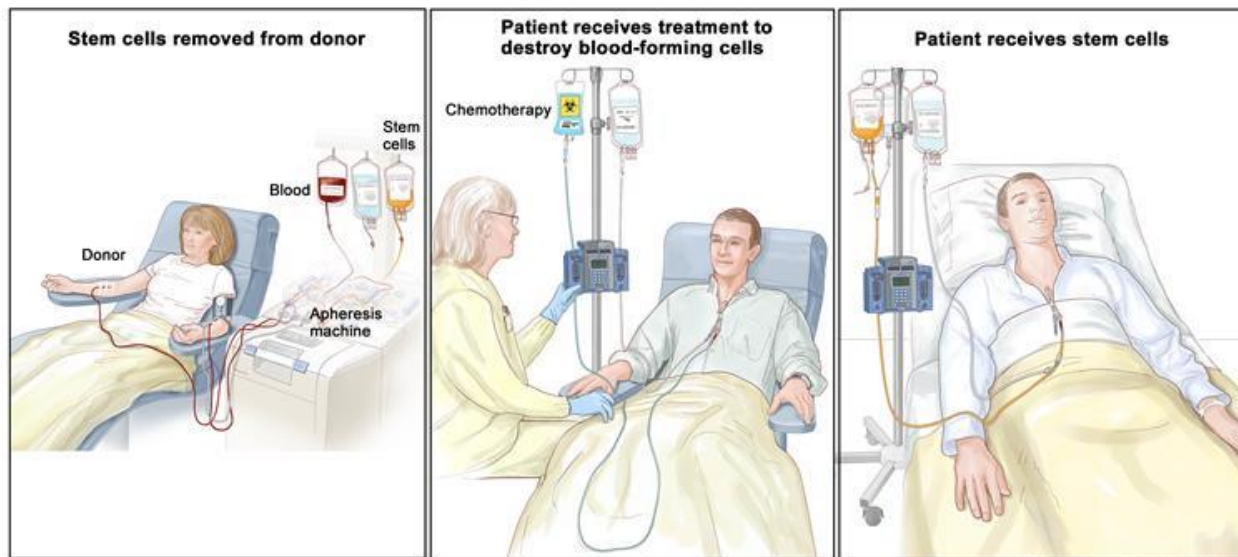
- Radiation therapy uses high energy rays to destroy cancer cells and stop their growth.
- External radiation might be used to treat ALL that has reached the brain, spinal cord, or testicles. A machine moves around your body and directs radiation beams into the tumor area.
- Total body irradiation can be used to the whole body before a stem cell transplant.
- Radiation therapy can also be used to alleviate symptoms caused by leukemia such as pain.

Please refer to the "[Radiation Therapy](#)" handout for more information.

C. Bone marrow transplant:

- Bone marrow transplant, also known as cell stem transplant, replaces the diseased bone marrow with a healthy one.
- The procedure is done after giving high doses of chemotherapy and/or total body irradiation to destroy cancer cells in the body.
- You may receive stem cells from your own blood/bone marrow (autologous transplant) or from a donor (allogeneic transplant).
- Bone marrow transplant is sometimes used to treat ALL patients who are in remission or who have a relapse during or after treatment.

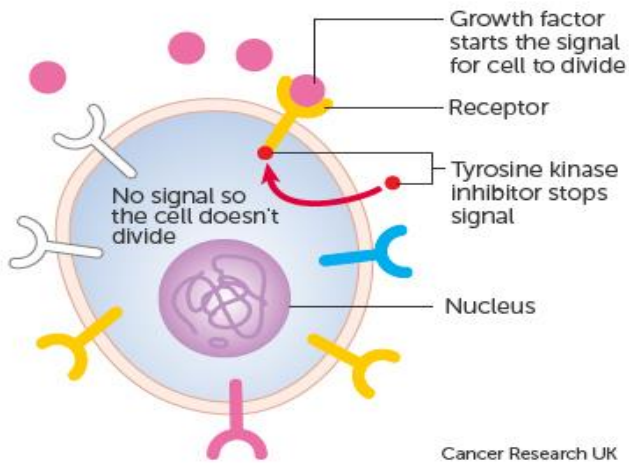
Please refer to the "[Bone Marrow Transplant](#)" handout for more information.



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D. 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.



<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.
- Its 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.

E. Immunotherapy (also called biologic therapy):

- It is a treatment that helps improve the immune system's ability to fight cancer.
- It uses antibodies (made either by the body or in the laboratory) to help the immune system identify and attack specific substances in the cancer cells that help them grow.
- This treatment also affects normal cells less than chemotherapy.
- The side effects depend on the medication and dose you receive. They might include: low levels of white blood counts, fatigue, fever, headache, swelling of the feet and hands, nausea, tremor, rash, constipation

In a box:

Some treatments might affect your fertility. You can discuss fertility preservation techniques with your doctor before you start treatment. Some treatments may also cause cardiac side effects such as rapid heartbeats, chest pain and shortness of breath.

The dedicated "[Onco-Fertility Program](#)" and "[Cardio-Oncology Program](#)" healthcare teams at the [Naef K. Basile Cancer Institute](#) are available to help you address these issues before, during and after treatment. To contact these programs, please call:

- Onco-Fertility Program: +961- 350000 ext. 7951
- Cardio-Oncology Program: +961-1-350 000 ext. 8989

Tips during treatment

Your health care team as well as the "[Palliative and Supportive Care Program](#)" and "[Psycho-Oncology Mental Health](#)" teams at the [Naef K. Basile Cancer Institute](#) are here to help you during and after treatment. To contact these programs, please call:

- Palliative and Supportive Care Program: +961-1-350 000 ext. 8092

- Psycho-Oncology Program: +961-1-759 620 ext. 5650

The 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:** 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 a balanced diet:** 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 your 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.**
- **Stay active:** Having ALL does not mean you cannot continue doing the things you usually like to do. If you feel well enough, stay active as much you can. Any type of exercise can be good. If you have been inactive, you can start slowly and build up your activity level. Balance between your rest and activities. Exercise can help you feel better, have more energy, and improve your appetite. It can also help relieve cancer-related fatigue.