

Acute Myeloblastic Leukaemia

What is
acute myeloblastic
leukaemia?

Let us explain
it to you.

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ACUTE MYELOBLASTIC LEUKAEMIA: A GUIDE FOR PATIENTS

PATIENT INFORMATION BASED ON ESMO CLINICAL PRACTICE GUIDELINES

This guide for patients has been prepared by the Anticancer Fund as a service to patients, to help patients and their relatives better understand the nature of Acute Myeloblastic Leukaemia (AML) and appreciate the best treatment choices available according to the subtype of AML. We recommend that patients talk to their doctors about the tests or treatments that are needed for their type and stage of disease. The medical information described in this document is based on the clinical practice guidelines of the European Society for Medical Oncology (ESMO) for the management of Acute Myeloblastic Leukaemia in adults. This guide for patients has been produced in collaboration with ESMO and is disseminated with the permission of ESMO. It has been written by a medical doctor and reviewed by two oncologists from ESMO including the lead author of the clinical practice guidelines for professionals. It has also been reviewed by patients' representatives from ESMO's Cancer Patient Working Group.

More information about the Anticancer Fund: www.anticancerfund.org

More information about the European Society for Medical Oncology: www.esmo.org

For words marked with an asterisk, a definition is provided at the end of the document.

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DEFINITION OF ACUTE MYELOBLASTIC LEUKAEMIA (AML)

Leukaemia is a type of cancer of the blood. There are different forms of leukaemia depending on the type of blood cell affected. “Acute” describes a rapid progression, and “myeloblastic” denotes the origin from myeloid cells. Myeloid cells are immature cells that normally become mature red blood cells*, white blood cells*, or platelets. In acute myeloid leukaemia, the bone marrow produces too many early (immature) blood cells which do not go on to become mature blood cells. Platelets* play a critical role in stopping bleeding and red blood cells* are important in delivering oxygen to all cells in the body. Excess production of immature myeloid blood cells in the bone marrow ultimately prevents the normal production of red blood cells*, resulting in anaemia and decreased production of platelets* or thrombocytopenia. Patients with AML seek medical care due to lack of energy and fatigue from anaemia* or bleeding and bruising from insufficient platelets*. Without enough normally functioning white blood cells* the body’s immune system* also becomes weak and susceptible to infection. Other symptoms include fever, shortness of breath and bone pain. At diagnosis, most patients - though not all - have a white blood cell count (the number of white blood cells* circulating in the blood) that is above normal.

IS ACUTE MYELOBLASTIC LEUKAEMIA FREQUENT?

Compared to breast cancer in women or prostate cancer in men, acute myeloid leukaemia is not common. In the European Union, 5 to 8 cases will be diagnosed among 100,000 people every year. AML is more common in older people, with an almost 10-fold increase in the number of cases among elderly patients.

WHAT CAUSES ACUTE MYELOBLASTIC LEUKAEMIA?

The cause of acute myeloblastic leukaemia (AML) is not understood. A small number of predisposing risk factors* have been identified due to catastrophic events, including the atomic bombing of Hiroshima and the nuclear reactor accident in Chernobyl. A risk factor* increases the chance of cancer occurring, but it in itself does not cause cancer. If you have a risk factor* it does not necessarily mean you will develop cancer. A risk factor* is not a cause in itself.

Some people with these risks factors* will never develop AML and some people without any of these risk factors* will still develop AML.

Potential exposure-related risk factors* for AML include exposure to radiation*, chemicals and prior chemotherapy.

- **Exposure to radiation***: ionizing radiation* directly damages the cell's DNA* creating mutations* which either prevent a cell from maturing or cause a cell to proliferate beyond normal. Atomic bomb survivors and radiology technicians prior to 1950 (when protective shielding was first introduced) are at increased risk of developing AML.
- **Exposure to chemicals**: chemicals are associated with increased risk when the exposure is significant in either duration of exposure (such as tobacco smoke) or severity of exposure (benzene and petrochemical exposure involving direct chemical contact).
- **Chemotherapy**: previous treatment with high doses of certain anticancer drugs increases the risk of developing AML.

Genetic abnormalities and mutations* in the DNA* of the cancer cell commonly occur in AML, however these mutations* are usually not found in other cells of the body. This suggests that the cause of AML is only rarely inherited from one generation to the next. Potential hereditary (passed down genetically from parent to child) risk factors* for AML include:

- **Trisomy**: This is a genetic abnormality when one has an extra third copy of a chromosome*, i.e. one in addition to those inherited from your mother and father. Normal inheritance patterns result in two copies of each gene. However, as a result of early developmental accidents, a third copy can be inherited. In some cases, a third copy of an entire chromosome* (a collection of genes) is inherited. This is known as a *trisomy*. Two common trisomies associated with AML are:
 - o **Trisomy 8**: Inheriting a third copy of chromosome* 8 results in many skeletal abnormalities as well as increased risk of AML.
 - o **Trisomy 21**: Trisomy 21, also known as Down's syndrome, increases the risk of leukaemia 10 to 18-fold.
- **Hereditary syndromes**: A few rare inherited cancer predisposition syndromes, which are due to known or unknown genetic causes, are associated with increased risk of developing AML. Such hereditary cancer predisposition syndromes include Fanconi's anaemia* and Li Fraumeni* syndrome*.

Prior blood diseases can change or evolve into leukaemia over time. For some blood diseases the evolution into AML can be prevented by treatment. Myelodysplasia (white blood cells* that are

abnormal in their shape and size) and myeloproliferative diseases (white blood cells* that are overproduced) are the most common blood diseases with an increased risk of developing into AML.

HOW IS ACUTE MYELOBLASTIC LEUKAEMIA DIAGNOSED?

Acute myeloid leukaemia can be suspected in patients due to symptoms or laboratory abnormalities in patients with and without symptoms (asymptomatic*). **Symptoms** may include:

1. **Fatigue.** Fatigue is a common symptom due to anaemia (a decreased red blood cell count, often measured as haematocrit or low haemoglobin level). Patients who are physically active may not notice the effects of being anaemic until it is severe.
2. **Infections.** Due to replacement of an important part of the normal immune system* by cancer, patients can experience recurrent infections or infections which are unusually difficult to treat.
3. **Bleeding.** A low platelet count resulting from replacement of the bone marrow with leukaemia results in easy bruising, bleeding from the nose or gums, petechiae* (red spots seen on the skin commonly over the shins and ankles), and purpura (groups of petechiae* resulting in larger red skin spots).



Patients who have the above symptoms will have a complete blood count done to check the three types of cells made in the bone marrow: 1) white blood cells*, 2) red blood cells*, and 3) platelets*. Occasionally a patient may have a complete blood count done for another reason, which will be the first indication of a possible leukaemia based on **laboratory** findings alone. In addition to identifying a low red blood cell count or platelet count, the **complete blood count** may detect, as part

of the white blood cell count, leukaemia cells circulating in the blood. Immature white blood cells* which are proliferating at an abnormal rate are larger than the more mature normal white blood cells* found in circulation.

If a diagnosis of AML is suspected based on symptoms and the white blood cell count, a bone marrow biopsy* is performed. In rare cases when the leukaemia cells are found on the complete blood count and the type of AML (see below under treatment of AML) can be determined, treatment may begin prior to a **bone marrow biopsy***.



A bone marrow biopsy* is a minimally uncomfortable procedure lasting about fifteen minutes. Local anaesthesia* is used for the procedure and sharp pain is usually not experienced. The procedure allows the **pathologist** (a doctor trained in diagnosing the disease based on the appearance of cells or tissues in the microscope) to diagnose AML. The pathologist can also determine what type of AML a patient has and further identify the genetic abnormalities of the leukaemia by looking closely at the chromosomes*.

PCR (polymerase chain reaction*, a scientific technique in molecular biology to amplify a single or a few copies of a piece of DNA*) and FISH (fluorescent in-situ hybridisation*, is a cytogenetic* technique that is used to detect and localize the presence or absence of specific DNA* sequences on chromosomes*) tests are recommended to identify these abnormalities in the laboratory. Prognosis, or the likely outcome, and treatment is based, in part, on the specific mutations* identified when examining the chromosomes* within the cancer cells. The chromosomes* of the leukaemia cells are known as the leukaemia's karyotype.

WHAT IS IMPORTANT TO KNOW TO GET THE OPTIMAL TREATMENT?

Doctors will need to consider many aspects of both the patient and the cancer in order to decide on the best treatment.



Relevant information about the patient

- Personal medical history
- History of cancer in relatives
- Results from the clinical examination* by the doctor
- General well-being
- Typing for bone marrow transplant*. Many patients with AML may require a bone marrow transplant* after their initial treatment. This therapy involves using the bone marrow cells of someone else to replace a patient's own bone marrow. To prevent the donor's immune system* from damaging the patient's body (a condition known as *graft-versus-host disease*), HLA (Human Leukocyte* Antigen, a unique set of proteins* on each cell) typing must be performed to determine if a donor and a patient have similar HLA types and are a 'match.' Since the process of finding a bone marrow donor that *matches* the patient may take a few months, it is helpful to know the patient's type when he or she is first diagnosed. HLA typing of the available first-degree family members (parents, siblings and children) who are possible donors should also be performed. If siblings or children are not a *match*, unrelated donors will be screened. This is one reason that volunteering to be a bone marrow donor is very important.
- In addition to clinical examination*, other exams may be performed to assess the risks of complications due to the treatment. To assess the cardiac function, an echocardiogram is recommended. To ensure that no infection is currently active in the body, a CT-scan* of the chest and abdomen* and radiologic examinations* of the teeth and jaw is also recommended. Blood coagulation tests must be performed for patients with acute promyelocytic leukaemia (APL) since coagulation disorders are very frequent in this type of AML. Such tests must be performed before insertion of central intravenous* lines.
- If severe headaches, problems with vision, sensation, or muscle function are present, an assessment of the cerebrospinal fluid* (the fluid around the brain and spinal cord) may be necessary. This is performed by performing a lumbar puncture and sending the fluid to the pathologist to be looked at under the microscope. Imaging examinations including a CT scan* or MRI* of the head are also often done at the same time as the lumbar puncture. In rare cases the lumbar puncture will not identify any cancer cells and the CT or MRI* will show an area of leukaemia inside the brain which will require additional treatment which is specific to this site of tumor .

Relevant information about the cancer

- **Classification**

Doctors use a classification system to help determine prognosis and treatment. The differentiation* of **acute promyelocytic leukaemia** (APL) from other types of AML is of critical importance to therapy. A specific genetic mutation, resulting from abnormal translocation or an abnormal rearrangement of genetic material from one chromosome* to another (chromosomes* 15 and 17) results in this unique form of leukaemia known as APL. The movement of two chromosomes* next to each other is known as *translocation*.

The movement of the two chromosomes* into this new position results in two genes being placed next to each other that are normally separated. The new mutant gene is the cause of APL. The diagnosis of APL is associated with a favourable prognosis and specific treatment regimen including a vitamin therapy, which causes the leukaemia cells to mature.

- **Prognosis and risk classification**

Unlike other cancers, which develop at a single site (such as breast cancer within the breast, or prostate cancer within the prostate) and then spread or metastasise*, cancer in patients with leukaemia is considered to be present throughout the body at diagnosis due to its normal circulation in the bloodstream. For this reason the prognosis* is not determined by the extent of spread of the disease. The prognosis* of a patient is best predicted by characteristics of the patient (including, and most importantly, age) and characteristics of the leukaemia cells. The specific mutations* identified within the chromosomes* of the leukaemia will classify a patient's prognosis* as good or favourable, normal or intermediate, or poor or unfavourable risk. New mutations* are identified by doctors and their prognosis* is classified into one of these three levels of risk. APL, for example, as discussed above, is the result of a translocation of chromosomes* 15 and 17, which is a favourable risk mutation*, meaning it responds well to treatment. Other favourable mutations* include translocation of chromosomes* 8 and 21, and inversion of chromosome* 16. The presence of multiple, typically greater than three, chromosome* abnormalities is associated with or unfavourable risk. If no mutations* are observed, the degree of risk is considered intermediate.



WHAT ARE THE TREATMENT OPTIONS?

The treatment should take place only in centres used to treat AML and offering an adequate multidisciplinary infrastructure. Whenever possible, the treatment should be offered in the form of clinical trials*.

Treatment of AML is tailored to the individual based on diagnosis of AML or APL, risk classification based on genetic mutations*, and patient characteristics including age and other conditions that the patient may have, such as diabetes, coronary heart disease* or chronic* obstructive pulmonary* disease. Unlike solid tumours, surgical resection and radiation therapy do not typically serve a major role in the treatment of AML.

Immediate (emergency) therapy is needed for patients who present with either extremely high white blood cell* counts or with APL.

- **Leukostasis:** Normal blood flow to vital organs can be disrupted when the white blood count is extremely high due to circulating leukemia cells. Particularly important is proper blood flow to the lungs, brain, and kidneys. Immediate treatment to reduce the white blood cell* count may be necessary. This includes use of a machine, which removes the white blood cells from the blood and returns the red blood cells and platelets to the patient. This is called leukapheresis and is only necessary in emergency situations.
- **APL:** Patients who present APL are at increased risk of bleeding. Unlike AML, the bleeding risk is a result of not only low platelets, but also a loss of the proteins* that are necessary for the blood to clot appropriately. This condition can be prevented by immediate initiation of treatment with all-trans retinoic acid* (a vitamin A derivative) that causes the immature leukaemia cells to mature. The missing proteins* can also be replaced by blood transfusions in emergency cases.

Chemotherapy is effective in treating leukaemia since the leukaemia cells are dividing more rapidly than other cells in the body. Side effects of chemotherapy are also mostly limited to dividing cells such as hair, the gastrointestinal tract, the bone marrow (including normal cells in the bone marrow), skin and nails. Chemotherapy for AML is generally grouped into two categories based on level of intensity: intensive chemotherapy and non-intensive chemotherapy.



- **Intensive Chemotherapy**
 - **Induction chemotherapy** requires patients be admitted to the hospital for treatment. The goal of intensive chemotherapy is complete removal of all leukaemia cells within the bone marrow. This allows doctors to provide blood transfusions as necessary and continuous observation for side effects of the intensive chemotherapy. The duration of the initial hospitalisation may be about 4 weeks. Two chemotherapy agents are used most commonly: cytarabine and an anthracycline* (known as idarubicin or daunorubicin). The duration of the treatment is approximately 1 week of intravenous* infusions. In this process, the normal bone marrow cells are temporarily removed and patients are at risk of infection and may require

transfusions of red blood cells* and platelets* since the body temporarily stops producing its own.

One to two weeks after the completion of chemotherapy a bone marrow biopsy* is repeated to determine if the response to treatment was appropriate. If no evidence of leukaemia is seen on the bone marrow biopsy*, then patients proceed to *consolidation chemotherapy*. Otherwise a repeat of the induction chemotherapy may be necessary.

Once the patient's own normal white blood cells return to normal values, patients are able to safely leave the hospital. Patients may need to see their doctor frequently, however, since additional transfusions of red blood cells* and platelets* are often still needed for up to 8 weeks after induction chemotherapy.

If there is still more than 5% immature cells in the bone marrow as seen in the bone marrow biopsy* after 1 or 2 induction chemotherapies, the patient is considered as refractory*, i.e. not responsive to treatment. In this case, it is believed that only a bone marrow transplant* offers a chance of cure.

- **Consolidation chemotherapy** begins once the blood counts recover from induction chemotherapy. The goal of consolidation chemotherapy is to provide a therapy which decreases the chance that the disease will come back in the future. Some patients may be admitted to the hospital for consolidation chemotherapy, which is usually also done with cytarabine (one of the two chemotherapy agents used during the initial induction). The treatment is done over a period of approximately 5 days and repeated monthly for three to four months. The effect of the chemotherapy is not as severe as with the induction chemotherapy and patients do not need to stay in the hospital after the chemotherapy is given. During this time, however, risk of infection is still very high and patients must return to the hospital if a fever develops when the body's own immune system* is weak from the recent chemotherapy.
- **Maintenance/Post-remission* therapy** is established for APL, but is not well-established for the other types of AML. This therapy is unique for each individual based on their prognosis* (described above).
 - **APL** requires maintenance therapy for approximately one to two years. The therapy combines all-trans retinoic acid* (the vitamin A derivative) with two chemotherapies (6-mercaptopurine and methotrexate).
 - **AML (non-APL)**
 - *Good risk or favourable risk*: following consolidation chemotherapy no additional treatment is recommended since the risk of relapse* is considered to be less than 35%. A bone marrow stem cell transplant is not justified in first remission because the risk of toxicity and severe complications exceeds the benefit.
 - *Poor risk or unfavourable risk*: additional therapy including a **bone marrow stem cell transplant** is recommended. This is the process of transferring someone else's bone marrow stem cells into the patient. The patient's white blood cells, red blood cells and platelets are replaced by the donor's cells. As the donor's cells are new to the patient's body they can recognise the patient's cells as foreign, resulting in damage to the patient's own cells (known as the *graft-versus-host disease*). During the same process the donor's cells also recognise the patient's leukaemia as foreign and will destroy it, which is the main beneficial effect of a bone marrow transplant* (known as the *graft-versus-leukaemia effect*). Bone marrow stem cell

transplants provide an opportunity to eradicate the tumour completely and cure the patient.

- *Intermediate risk or normal risk*: a standard therapy for this level of risk has not been established and patients should seek multiple doctors' opinions as the treatment should be tailored to the individual. Some studies suggest that a bone marrow transplant* should be considered for healthy patients with intermediate-risk disease
- **Non-intensive chemotherapy**
 - Older patients (over 60 years of age) and patients with other medical problems who are not healthy enough to receive intensive chemotherapy can avail of multiple treatment options. These are less intensive and some do not require admission to the hospital. None of these approaches have been established as standard of care and clinical trials* should be considered for all patients pursuing non-intensive chemotherapy. Treatment options include:
 - Clinical trial*
 - Low-dose chemotherapy (such as cytarabine)
 - Hypomethylating agents (drugs that inhibits the methylation of DNA* such as azacytidine), which effect the genetics of the leukaemia attempting to turn on and off genes which cause the cells to proliferate
 - Therapies which target the immune system* (such as lenalidomide, which is in clinical trials* for AML), which modulate the body's normal immune system* to fight the leukaemia and at the same time directly affect the leukaemia cells to cause them to stop dividing and to mature.
 - Supportive care*, including growth factors* to help improve the red blood cell* count normal as well as blood transfusions with red blood cells and platelets. Depending on how aggressive the leukaemia is, life expectancy is very limited without treatment (in some cases only a few weeks or months).

Managing symptoms of the disease and of the treatment

Leukaemia and its treatment can cause severe side effects including diarrhea, nausea, vomiting, hair loss; lack of energy, appetite and sexual interest, and severe infections. Effective therapies for these side effects exist and patients can expect that some of these problems can be treated.

WHAT HAPPENS AFTER THE TREATMENT?

It is not unusual to continue to experience treatment-related symptoms once the treatment is over.



- It is not rare that anxiety, sleeping problems or depression are experienced in the post-treatment phase. Patients with these symptoms may require psychological support.
- Memory loss and lack of ability to concentrate are not uncommon side effects of chemotherapy and are generally reversible within a few months.

Follow-up* with doctors

After the treatment has been completed, doctors will propose a follow-up* program, aiming to:

- detect possible relapse* or return of leukemia as soon as possible
- evaluate adverse effects of the treatment and treat them
- provide psychological support and information to enhance returning to normal life

Follow-up* visits with the doctor should include:

- History-taking (a review of the patient's medical history) , eliciting of symptoms and physical examination*
- A repeat bone marrow biopsy*
- A routine evaluation of the complete blood count every three months

Return to normal life

It can be hard to live with the idea that the cancer can come back. Based on what is known today, no specific way of decreasing the risk of recurrence after completion of the treatment can be recommended. As a consequence of the cancer itself and of the treatment, return to normal life may not be easy for some people. Questions related to body-image, sexuality, fatigue, work, emotions or lifestyle may be a concern for you. Discussing these questions with relatives, friends, other patients or doctors may be helpful. Support from patients' organisations providing advice on dealing with the effects of treatments, as well as psycho-oncologist services or telephone information services and helplines are available in many countries.

What if the leukaemia comes back?

If the cancer comes back, it is called a relapse* or recurrence. The treatment depends on the age of the patient, prior treatment, and possibility of a bone marrow transplant*.

Patients who are able to tolerate intensive chemotherapy similar to intensive induction chemotherapy will repeat a similar course of treatment. The chances of success of a new induction therapy are better when the relapse* occurs a long time after the first induction therapy. Another possibility for patients with APL is to be treated with arsenic trioxide, which can induce remission*.

Following induction for relapsed* leukemia, if a sibling or unrelated bone marrow donor can be identified, a bone marrow transplant* is recommended. If the leukaemia relapses* it is believed that only a bone marrow transplant* offers a chance of cure. Patients who relapse following a bone marrow transplant* are usually not considered for a second transplant. A clinical trial* is the preferred option for patients who relapse following a bone marrow transplant*.

Should I consider clinical trials*?

Despite the best current therapies, the prognosis* for patients with leukemia is poor. The majority of patients will have their disease return after their initial treatment. For this reason, doctors and scientists are researching new therapies. Promising therapies must first be tested among small groups of patients in clinical trials* before they are accepted and given to all patients. Clinical trials* provide an opportunity to try a new therapy before it would otherwise be available. New therapies also pose risks as many of the side effects are unknown until tested. Because of these positive and negative aspects of clinical trials*, it is very important that you speak with your doctor about clinical trials*, including if and when a clinical trial* might be appropriate for you.

DEFINITIONS OF DIFFICULT WORDS

Abdomen

The part of the body between the chest and hips. The muscles corresponding to this area enclose a cavity containing the stomach, intestines, liver, spleen, and pancreas. It is also known as the belly.

All-trans retinoic acid or tretinoin

A nutrient that the body needs in small amounts to function and stay healthy. Tretinoin is produced in the body from vitamin A and helps cells to grow and develop.

Anaemia

The condition characterized by a shortage of *red blood cells* or hemoglobin. The iron that contains the hemoglobin carries oxygen from the lungs to the whole body. This process is diminished by this condition.

Anaesthesia

The reversible state of loss of awareness in which the patient feels no pain, has no normal reflexes, and responds less to stress. It is induced artificially by the employment of certain substances known as *anaesthetics*. It can be complete or partial and allows patients to undergo surgical procedures, such as collecting cells from the bone marrow.

Anthracycline

An antibiotic drug used in *chemotherapy* to treat a wide range of cancers.

Asymptomatic

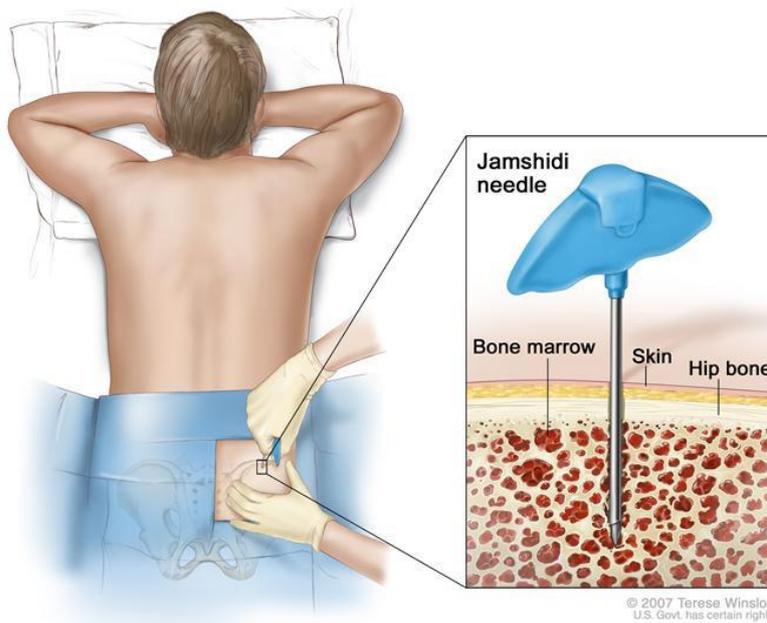
The absence of symptoms, such as pain, or subjective manifestations of the illness or disease.

Blast

Leukemia cells are often referred to as *blasts* as they can appear larger than normal white blood cells found circulating in blood. The way the *blasts* look can give a pathologist clues to help diagnose what type of leukemia a patient has.

Bone marrow biopsy

A procedure in which a small sample of bone with bone marrow inside it is removed, usually from the hip bone. A small area of skin and the surface of the bone underneath are numbed with an anesthetic. Then a special, wide needle is pushed into the bone and rotated to remove a sample of bone with the bone marrow inside it. This procedure may be done at the same time as a bone marrow aspiration. The removed cells or tissues will be examined by a pathologist. The pathologist may study the tissue under a microscope or perform other tests on the cells or tissue. The pathologist will determine if the bone marrow is affected by or free of leukemia.



Bone marrow aspiration and biopsy. After a small area of skin is numbed, a *Jamshidi needle* (a long, hollow needle) is inserted into the patient's hip bone. Samples of blood, bone and bone marrow are removed for examination under a microscope.

Bone marrow transplant

A procedure to replace bone marrow that has been destroyed by treatment with high doses of anticancer drugs or radiation. Transplantation may be autologous (an individual's own marrow saved before treatment), allogeneic (marrow donated by someone else), or syngeneic (marrow donated by an identical twin).

Cerebrospinal fluid

The fluid that surrounds and bathes the spinal cord and brain. Its main function is to protect the brain and the spinal cord.

Chemotherapy

A type of cancer treatment using drugs that kill cancer cells and/or limit their growth. These drugs are usually administered to the patient by slow infusion into a *vein* but can also be administered orally, by direct infusion to the limb or by infusion to the liver, according to cancer location.

Chromosome

An organized structure which encodes genes. Genes are the body's code for characteristics such as hair color or gender. Human cells have 23 pairs of chromosomes* (a total of 46 chromosomes*). Cancer or leukemia cells often have a **chromosomal abnormality** which is a change to their chromosomes* such as **chromosomal duplication**, meaning an extra chromosome (47 chromosomes*) or have **chromosomal deletion**, meaning a loss of a chromosome (45 chromosomes*). A **chromosomal** or **genetic inversion** is when no extra chromosomes* are added or deleted, but instead a portion is backwards. .

Chronic

Of long duration. When it is used to describe a disease or a condition, it means that it persists or progresses over a long period of time.

Clinical examination

The examination of the body to search for signs of disease.

Clinical trial

A type of research study that tests how well new medical approaches work in people. These studies test new methods of screening, prevention, diagnosis or treatment of a disease.

Coronary heart disease

A disease in which there is a narrowing or blockage of the blood vessels that carry blood and oxygen to the heart. Coronary heart disease is usually caused by a build up of fatty material and plaque inside the coronary arteries. The disease may cause chest pain, shortness of breath during exercise, and heart attacks. The risk of developing coronary heart disease is higher in males and also increases if there is a family history of coronary heart disease before the age of 50, as well as with old age, smoking tobacco, high blood pressure, high cholesterol, diabetes, lack of exercise, and obesity.

CT-scan

A form of radiography in which body organs are scanned with *X-rays* and the results are synthesised by a computer to generate images of parts of the body.

Cytogenetics

The study of genes and chromosomes*. Studying the changes to genes or chromosomes* can determine if a cell is normal or leukemic. Some types of leukemia have common cytogenetic abnormalities (changes to genes or chromosomes*) that are like a fingerprint and can tell a pathologist which specific type of leukemia a patient has.

Differentiation

The biological process in which a less specialized cell becomes a more specialized cell type. Differentiation is a common process and can change the cell's shape, size, activity, and potential. Differentiated tumor cells look like normal cells and usually grow at a slower rate than undifferentiated or poorly differentiated tumor cells, which look very different from normal cells and grow rapidly.

DNA

Abbreviation for deoxyribonucleic acid. DNA serves as the carrier of genetic information.

Fanconi's syndrome

A disease of the *renal* tubules of the kidney where various substances are passed into the urine. This syndrome affects the first part of the tubule. Different forms can result in different complications. For example, phosphate can be lost in the urine. This can cause bone disease, because phosphate is needed for bone development.

FISH/Fluorescence in situ hybridisation

A technique used by pathologists to identify changes to genes and chromosomes*. Unique changes to genes or chromosomes* can be detected by FISH and help a pathologist know what type of leukemia a patient has.

Follow-up

Monitoring a person's health over time after treatment. This includes keeping track of the health of people who participate in a *clinical study* or *clinical trial** for a period of time, both during the study and after the study ends.

Immune system

The immune system is a biological system of structures and processes that protects the body from diseases by identifying and killing tumor cells and foreign invaders such as viruses and bacteria.

Intravenous

Into or within a *vein*. Intravenous usually refers to a way of giving a drug or other substance through a needle or tube inserted into a vein.

Leukocyte An alternative terms for a white blood cell*. White blood cells are the cells of the *immune system** that are involved in the body's defence against infections.

Li Fraumeni syndrome

A rare, inherited predisposition to multiple cancers, caused by an alteration in the p53 tumor suppressor gene.

Magnetic Resonance Imaging (MRI)

An imaging technique that is used in medicine. It uses magnetic resonance. Sometimes, a fluid is injected that enhances the contrast between different tissues to make structures more clearly visible.

Metastasis

The spread of cancer from one part of the body to another. A tumor formed by cells that have spread is called a metastatic tumor or a *metastasis*. The metastatic tumor contains cells that are like those in the original tumor.

Mutation

A change in the sequence of base pairs in the *DNA** that makes up a gene. Mutations* in a gene do not necessarily change the gene permanently.

PCR/Polymerase Chain Reaction

A technique to determine the sequence which codes for a gene. Pathologists use PCR to identify unique mutations* (changes to the coding sequence) which are the fingerprint for certain types of leukemia.

Petechiae

A small red or purple spot caused by a broken capillary blood vessel.

Platelet

Small cell fragments that play a fundamental role in the formation of blood clots. Patients with a low *platelet* count are at risk of severe bleeding. Patients with a high count are at risk of thrombosis, the formation of blood clots that can block blood vessels and result in stroke or other severe conditions and can also be at risk of severe bleeding because of *platelet* dysfunction.

Prognosis

The likely outcome or course of a disease; the chance of recovery or *recurrence*.

Protein

Essential nutrients that are made of *amino acids*. They are essential for the working of many organisms, including the human body. They are responsible for transport and communication between cells, for chemical changes and maintaining the structure of e.g. cells.

Pulmonary

Having to do with the lungs.

Radiation

Can be defined as energy travelling through space. Examples of *radiation* include *UV*, and X-rays which are commonly used in medicine.

Red blood cell

The most common type of blood cell. It is the substance that makes the blood appear red. Their main function is the transport of oxygen.

Refractory (to treatment)

In medicine, it describes a disease or condition that does not respond to treatment.

Relapse

Return of the manifestations of a disease after a period of improvement. In cancer, return of the cancer after a *remission**

Remission

A decrease in or disappearance of signs and symptoms of cancer. In partial *remission*, some but not all signs and symptoms of cancer have disappeared or diminished. In complete *remission*, all signs and symptoms of cancer have disappeared, although cancer may still be in the body.

Risk factor

Something that increases the chance of developing a disease. Some examples of risk factors* for cancer are age, a family history of certain cancers, use of tobacco products, being exposed to *radiation** or certain chemicals, infection with certain viruses or bacteria, and certain genetic changes.

Supportive care

Care given to improve the quality of life of patients who have a serious or life-threatening disease. The goal of supportive care is to prevent or treat as early as possible the symptoms of a disease, side effects caused by treatment of a disease, and psychological, social, and spiritual problems related to a disease or its treatment.

White blood cell

Cells of the *immune system** that are involved in the body's defence against infections.

The ESMO / Anticancer Fund Guides for Patients are designed to assist patients, their relatives and caregivers to understand the nature of different types of cancer and evaluate the best available treatment choices. The medical information described in the Guides for Patients is based on the ESMO Clinical Practice Guidelines, which are designed to guide medical oncologists in the diagnosis, follow-up and treatment in different cancer types.

These guides are produced by the Anticancer Fund in close collaboration with the ESMO Guidelines Working Group and the ESMO Cancer Patient Working Group.

For more information please visit www.esmo.org and www.anticancerfund.org

