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Understanding Leukemia: Types, Symptoms, and Treatment Options

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ABSTRACT:

Leukemia is Cancer of body's blood forming tissues including the bone marrow and the lymphatic system. Many types of leukemia exist some form of leukemia are more common in children. Leukemia is an amalgam of cancer and arises due to malignancy of any element of blood. In other term they are abnormal white blood cell which are not fully developed and are called leukemia cells. The growth of leukemia cell are rapid than normal cell. Leukemia is classified as either Acute or Chronic based on rapidity of disease. Acute Leukemia can be classified to Acute Lymphoblastic Leukemia (ALL) and Acute Myeloid Leukemia (AML). Also the Chronic leukemia can be classified as Chronic Myeloid Leukemia (CML) and Chronic Lymphoblastic Leukemia (CLL). ALL is the second most common leukemia in adult. The ALL is chromosomal abnormalities and genetic alternative precursor cell. The cells may proliferate in liver and spleen as well as they they may infiltrate other organs such as meninges, gums, lymph nodes and skin. It should be treated at earlier stage and leads to death if left untreated. CLL is Cancer of lymphocytes. Lymphocytes are type of white blood cells involved in body immune system. In some cases it grow slowly means it may take year for symptoms to appear. It requires to take treatment as soon as possible. CML is Cancer of blood forming cell called as myeloid cell. These cells are found in Bone marrow. CML is most often causes an increase in the WBC such as neutrophils and granulocytes.

KEYWORDS: Leukemia, cancer, Malignancy, White Blood Cells, classification.

I. INTRODUCTION:

What is Cancer ?

Cancer start when cell in the body change and grows out of control. Our body is made up of tiny building blocks called cells. Normal cell grow when our body need them. Cancer is made up of abnormal cell grow even tough our body doesn't need them. In most of cancer the abnormal cell grow to form a lumps or mass called a Tumor.

The haematological system consist of blood and site where blood is produced including bone marrow and reticuloendothelial system. Blood is composed of plasma and various type of cell. In our body Blood is approximately 7-10% of normal body weight and near about 7-10 liter in the volume. In our body blood carries oxygen from lung and also carries hormones, antibodies and other substance to their site of action. Blood carries waste product produced by cellular metabolism to lungs, liver, skin and kidney where they are transformed and eliminated from the body.

Blood is made up of liquid is called plasma and three main kind of cell they are as follow –

1. White Blood Cell (WBC) :-

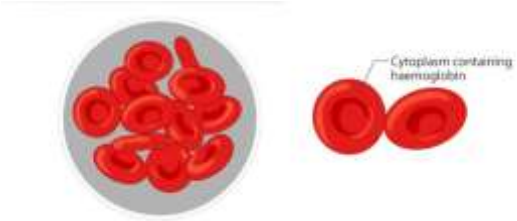
- It is also called as Leucocytes.

- These help the body fight with infection and disease.

2. Red Blood Cell (RBC) :-

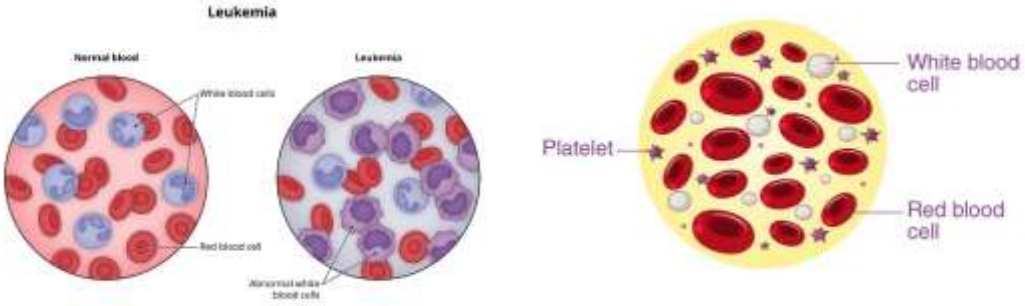
- It is also called as Erythrocytes

- It carries oxygen from lungs to body tissue and carry carbondioxide from the tissue to lungs.



3.Platelets :-

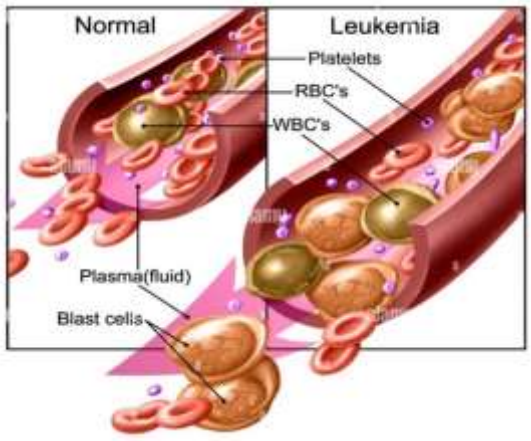
- It is fragment of ccell.
- These help to form blood clots and control bleeding.
- It is also called as Thrombocytes.



Leukemia :-

Leukemia is a group of disease with different biological background. It is characterized by Malignant transformation of hematopoietic cell which produces clone of cell. The term leukemia which originate from Greek word Leuka means white and Hema means blood it is an abnormalities of white blood cell.

Leukemia is a group of heterogeneous blood related cancer, differing in its aetiology pathogenesis and response to treatment leukemia is considered as a serious issue in modern society as it affect both children and adults and even sometimes infants under the age of 12 months. In children, leukemia is considered as the most common type of cancer, while in adult the World Health Organisation report shows that leukemia is one of the top 15 most common type of cancer.

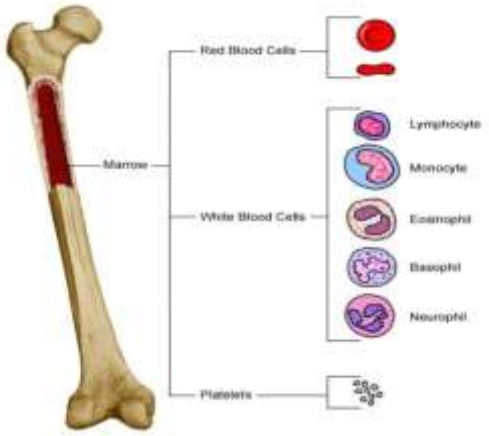


Leukemia was first described by anatomist and surgeon *Alfred-Armand* in 1827. A more complete description was given by pathologist *Rudolf virchow* in 1845. Around ten year's after Virchow's finding pathologist Neumann found that one decreased leukemia patient's bone marrow was coloured dirty green-yellow as opposed to normal red.

In 1947 by Boston pathologist Sidney Farber believed from past experiment that amino protein, folic acid mimic could potentially cute leukemia in children. In 1962 researcher Email Frei used combination chemotherapy attempt to cure Leukemia. The test were successful with some patients surviving long after tests.

Pathophysiology of Leukemia:-

Leukemia is malignant neoplasms of the cells derived from either the myeloid or lymphoid line of the hematopoietic stem cells in the bone marrow. Proliferating abnormal and immature cells (blast) spill out into the blood and infiltrate the spleen, lymph nodes, and other tissue. Acute leukemias are characterized by rapid progression of symptoms. High numbers (greater than 50,000/mm3) of circulating blast weaken blood vessel walls, with high risk for rupture and bleeding, including intracranial hemorrhage.



Lymphocytic leukemias involve immature lymphocytes and their progenitors. They arise in the bone marrows but infiltrate the spleen, lymph nodes, central nervous system (CNS), and other tissues. Myelogenous leukemias involve the pluripotent myeloid stem cells and, thus, interfere with the maturation of granulocytes, erythrocytes, and thrombocytes. Acute myelogenous leukemias (AML) and acute lymphatic leukemia (ALL) have similar presentations and courses. Approximately half of new leukemias are acute. Approximately 85% of acute leukemias in adults are AML, and incidence of AML increases with age. ALL is the most common cancer in children, with peak incidence between ages 2 and 9. Although the cause of leukemias is unknown, predisposing factors include genetic susceptibility, exposure to ionizing radiation or certain chemicals and toxins, some genetic disorder (Down syndromes, Fanconi's anemia), and human T-cell leukemia-lymphoma virus.

Complications include infection, leukostasis leading to hemorrhage, renal failure, tumor lysis syndrome, and disseminating intravascular coagulation.

Types of Leukemia

There are Two types of Leukemia

1. Acute Leukemia
2. Chronic Leukemia

Acute Leukemia

These are again sub-divided in 2 types

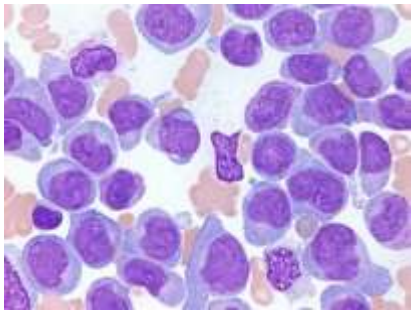
A. Acute Myeloid Leukemia (AML)

B. Acute Lymphoblastic Leukemia (ALL)

Acute Myeloid Leukemia (AML) :-

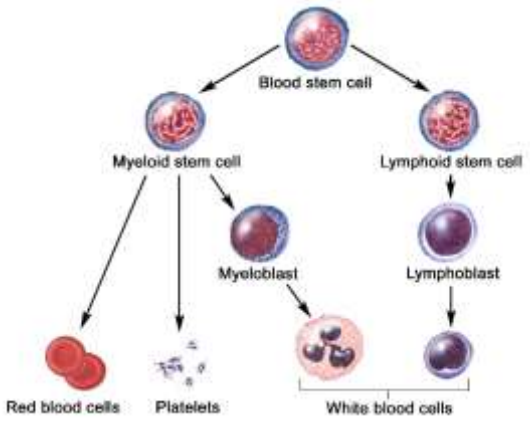
It is an cancer of blood and bone marrow. It usually progresses quickly if it is not treated. It is second most common type of leukemia in children. It is characterized by uncontrolled proliferation of myeloblast which are pre cursor of granulocytes. AML is rapidly progressive Malignant disease represents a group of clonal hematopoietic stem cell disorder characterized by an increase in number of myeloid cell in marrow and arrest in their maturation. In

2005 it stated as clonal disorder. Symptoms of AML are caused by replacement of normal bone marrow with leukemia cell, platelets and normal white blood cells. AML usually progresses rapidly and may be fatal within week or months if left untreated.



Pathophysiology of AML :-

AML can arises in patient with an underlying haematological disorder or as result in exposure to topoisomerase II. But in many cases it involve the activation of abnormal gene through chromosomal translocation and other genetic abnormalities which is manifested by accumulation of immature precursor of myeloid white blood cell. Which is result of maturation arrest or bone marrow cell in earliest stage of development. It decrease in production of normal blood cell resulting in anemia, thrombocytopenia and neutropenia are consequence of AML. Most of chromosomal abnormalities in AML usually have prognostic significance.



According to French American British (FAB) AML is classified in different sub-types :-

- M0 :- Myeloblastic without differentiation.
- M1 :- Myeloblastic with little or no maturation.
- M2 :- Myeloblastic with Maturation.
- M3 :- Promyelocytic.
- M4 :- Myelomonocytic.
- M5a :- Monocytic without differentiation.
- M5b :- Monocytic with differentiation.
- M6 :- Erythroleukemic.
- M7 :- Megakaryocytic.

M0 :-

The bone marrow show >90% blast and <10% promyelocytes.

This disease occur only in adult.

M1 :-

Blast cell have new azurophilic granules.

Bone marrow show 30-90% blasts and >10% promyelocytes.

This occur in older.

M2 :-

Multiple granules.

May have auer rods.

With granulocytic differentiation

M3 :-

Abnormal promyelocytes.

Prominent granules.

Multiple auer rods.

M4 :-

Have monocytoid differentiation.

>20% or more monocytoid cells.

M5a :-

Monoblastic.

>80% of blasts are monoblastic.

M5b :-

Monocytic.

<80% of blasts are monoblasts.

M6 :-

Predominance of erythro blast.

Dyserythropoiesis.

M7 :-

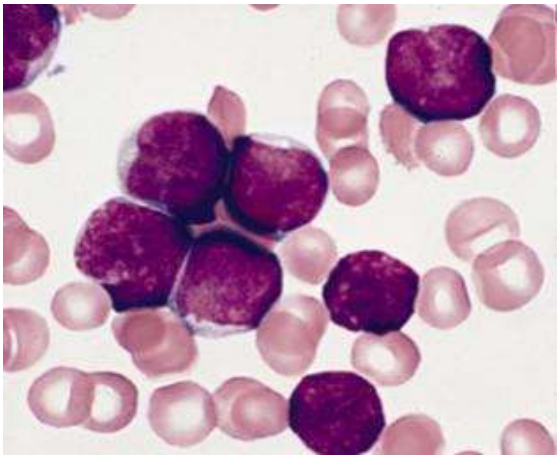
Megakaryoblast with cytoplasmic blebs.

Sign and symptoms:-

- Bone marrow failure.
- Fatigue and Anemia.
- Bleeding after dental procedure.
- Patient with low platelets count develop mucocutaneous type of bleeding.
- Fever, sepsis, pneumonia, peri rectal abscess
- Low neutrophil count.
- Bacterial and fungal infection.
- Bone pain due to infiltration of bone marrow.

Acute Lymphoblastic Leukemia (ALL) :-

Acute Lymphoblastic Leukemia (ALL) is a clonal disease characterized by Malignal accumulation of Lymphoblast. The Malignant transformation and multiplication of lymphoid progenitor cell in bone marrow. Blood and extra medullary location is known as Acute Lymphoblastic Leukemia (ALL). As 80% of ALL cases happen in youngsters. ALL is fast growing, aberrant a Tumor growth of cell that are precede. In every year there are near about 3800 cases of ALL although it is most common type type of leukemia in young children and also in adult.



The Frenchman American British (FAB) works on 3 categories by the group of

Lymphoblast L1, L2, L3.

- ALL L1 :-

The blast of cell is small is about 14-16 μm in diameter.

The cytoplasm is visible and the nucleus occupies the whole cell, has condensed chromatin and nucleoli are not seen.

This is most common form of leukemia found in children.

- ALL L2 :-

The blast is 15-16 μm in diameter.

Nucleus occupies most of cell.

The nuclear membrane is thick, the chromatic around the nucleolus is condensed.

The cytoplasm is pale blue and it does not contain any inclusion.

This is most frequent found in adult.

- ALL L3 :-

The blast is 18-20 μm in diameter.

Nucleus has reticular chromatin, cytoplasm is moderate in amount, blue in colour and there are punched out vacuoles in the cytoplasm and overlying the nucleus.

This is the rarest form of ALL.

The nucleus is regular oval to round shaped.

Sign and symptoms:-

People with ALL not have any different changes.

- Fatigue.
- Weakness.
- Bleeding that do not stop eeasily.
- Pale skin
- Red, pink coloured spot on skin.
- Weight loss.
- Fever
- Bones, Back and abdominal pain.

- Difficulty in breathing or shortness of breath.
- Bizziness.
- Headache.
- Blurred vision.
- Nausea and vomiting.

Chronic Leukemia :

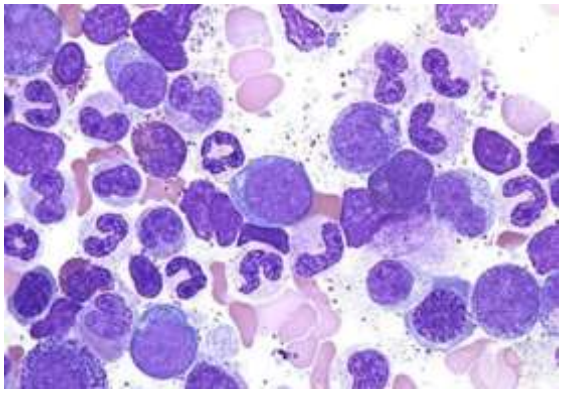
These are again sub-divided in two types-

a) chronic myeloid leukemia.

b) chronic lymphocytic leukemia.

a) chronic myeloid leukemia :

Myeloid leukemia is form of cancer characterized by penetrating bone marrow . blood and other tissue by proliferative ,clonal, abnormally differentiate and sometimes poorely differentiated cell of hematopoietic system.



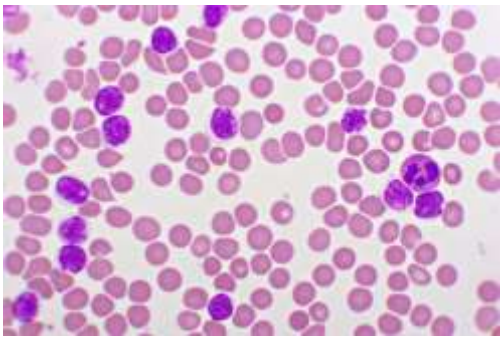
Chronic myeloid leukemia CML is a WBC cell cancer.it occurs due to the unregulated growth of myeloid cell in bone marrow and accumulation of these cell in blood.massive amount of aberrant cell cause the bone marrow to swell travel into the periferal circulation and eventually enter the liver and spleen, where they begin to produce new cell in process referred as extra medullary hemus to poiesis leading to enlargement of organ upto 95% CML.patient have these aberrant cell which includes a genetic marker that makes them distinct philadelphia chromosome.

Sign and symptoms:

- Asymptomatic (50% of patients).
- Fatigue.
- Weight loss.
- Abdominal fullness and anorexia.
- Abdominal pain, especially splenic area.
- Increase sweating.
- Easy bruising and bleeding
- Hepatomegaly (50%).
- Sternal tenderness is a reliable sign of disease is usually limited to small area most commonly with mild body.

b) chronic lymphocytic leukemia :-

Chronic lymphocytic leukemia CLL is monoclonal disorder characterized by a progressive accumulation of functionally incompetent lymphocytes.CLL is most common form of Leukemia found in adult.some patient die rapidly within 2-3 years of diagnosis because of compliance from CLL but most patients survive for 5-10 years.



CLL is due to proliferation and accumulation of immune. incompetent B-lymphocytes arrested at an early stage of their differentiation.clinical feature of CLL reflected the accumulation of leukemic cell in bone marrow and lymphoid organs and immune disturbance that accompany the disease.the diagnosis of patients with CLL varies. some patients survive for a long time.In last two decades important advances have been made in biology.

Clinical staging :-

- Stage 1 : lymphocytosis: lymphnodes
- Stage 2 : LNS + hepatosplenomegaly
- Stage 3 : anemia HB < 10g/l
- Stage 4 : thrombocytopenia.

Sign and symptoms :

- Weakness.
- Fatigue.
- Vague sense of being ill.
- Night sweats.
- Feeling of lumps.
- Infections especially pneumonia.
- Presence of B symptoms like fever.

Diagnosis of Leukemia:-

The diagnosis of Leukemia includes the following points –

- Physical Exam.
- Blood Test.
- Bone marrow Biopsy.
- Imaging Test

A. Physical Exam :-

The personal physician will look for physical sign of Leukemia like

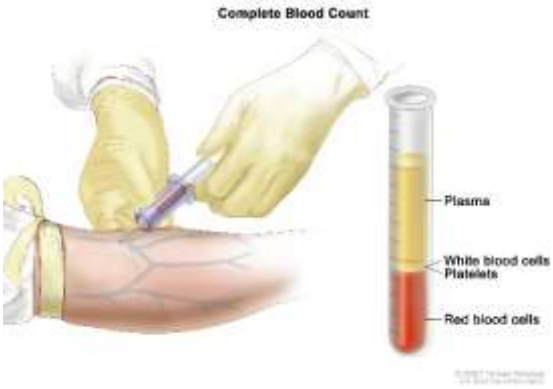
- Enlarged liver or spleen.
- Pale skin.
- Swollen lymph node.

During this Doctor or nurse will ask you about

- Symptoms.
- How long they have been happening.
- Personal and family history of cancer.
- Whether you smoke.

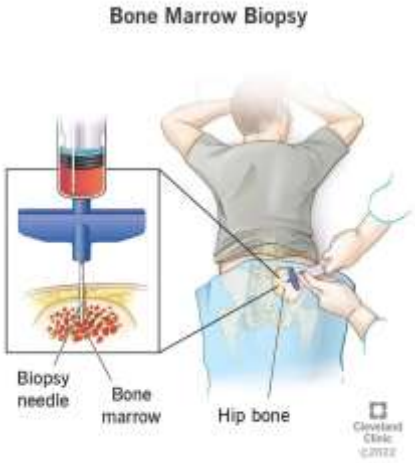
B. Complete blood count (CBC) :-

This blood test tells your doctor if you have abnormal levels of red blood cells, white blood cells, and platelets. If you have leukemia, you will likely have a higher than normal number of white blood cells. Blood cell test: Your doctor may take additional blood samples to check for markers that indicate the presence of leukemia cells or certain types of leukemia. Flow cytometry and peripheral blood tests are additional tests your doctor may order. This blood test tells your doctor if you have abnormal levels of red blood cells, white blood cells, and platelets. If you have leukemia, you will likely have a higher than normal number of white blood cells.



C. Bone marrow biopsy (bone marrow aspiration) :-

A doctor may do a biopsy if you have an abnormal white blood cell count. A long needle inserted into the bone marrow (usually the pelvic bone) draws fluid during the procedure. The fluid sample is analyzed in a laboratory for leukemia cells. A bone marrow biopsy can help determine the percentage of abnormal cells in your bone marrow, confirming a diagnosis of leukemia. Imaging and other tests: Your doctor may order a chest X-ray, CT scan, or magnetic resonance imaging (MRI) if symptoms indicate that the leukemia has affected the bones, organs, or tissues. Leukemia cells are not visible on imaging.



D. Imaging Tests:-

A doctor may order a chest X-ray, CT scan, or magnetic resonance imaging (MRI) if symptoms indicate that the leukemia has affected the bones, organs, or tissues. Leukemia cells are not visible on imaging. Your hematologist may also order imaging tests to determine if and how much leukemia has spread in the body. The tests can also detect infections or other problems. Imaging tests include X-rays, computed tomography (or CT), magnetic resonance imaging (or MRI), ultrasound, and positron emission tomography (or PET).

Treatment of Leukemia :-

Although the reported incidence of leukemia has not changed much since the 1950s, more people are living longer, largely because of advances in chemotherapy. For example, childhood leukemia (3 out of 4 cases in children have ALL) is one of the most dramatic success stories in cancer treatment. The five-year survival rate for ALL patients has risen to about 85 percent today.

The immediate goal of acute leukemia therapy is remission. The patient receives chemotherapy in the hospital and stays in a private room to reduce the chance of infection. Because patients with acute leukemia have very few healthy blood cells, they receive transfusions of blood and platelets to prevent or stop bleeding. They are given antibiotics to prevent or treat infections. Medications are also given to control treatment-related side effects.

People with acute leukemia are more likely to go into remission when chemotherapy is used as first-line treatment. To control the disease, they then receive 1 to 4 months of consolidation chemotherapy to get rid of any remaining malignant cells..

A. Chemotherapy :-

Chemotherapy is the most common form of treatment for leukemia. This involves using chemicals to kill leukemia cells or prevent them from multiplying. During treatment, you may receive chemicals (medicines) as pills, intravenously or injected under the skin. You will usually receive a combination of chemotherapy drugs.

B. Immunotherapy (biologic therapy) :-

This treatment uses certain medications to strengthen your body's defense system – the immune system – against leukemia. Immunotherapy helps your immune system recognize cancer cells and produce more immune cells to fight them.

C. Targeted therapy :-

This treatment uses drugs designed to attack certain parts of the leukemia cell, such as a protein or gene, that cause these normal blood cells to die. Targeted therapies can prevent leukemia cells from multiplying, cut off the cells' blood supply, or kill them outright. Targeted therapy is unlikely to harm normal cells. Examples of targeted therapy drugs include monoclonal antibodies and tyrosine kinase inhibitors. Radiotherapy: This treatment uses high-energy beams or X-rays to kill leukemia cells or stop their growth. During the treatment, the machine directs the radiation precisely to the parts of the body where the cancer cells are, or distributes the radiation throughout the body.

D. Induction therapy :-

The goal is to kill as many leukemia cells as possible in your blood and bone marrow to achieve remission. During remission, your blood cell count returns to normal, your blood is free of leukemia cells, and all signs and symptoms of the disease disappear. Induction therapy usually lasts four to six weeks. Consolidation (also called streamlining). The goal is to kill any remaining undetected leukemia cells to prevent the cancer from returning. You usually receive consolidation treatment in cycles of four to six months. Maintenance treatment. The goal is to kill any leukemia cells that may have survived the first two phases of treatment and prevent the cancer from coming back (recurring). Treatment lasts about two years. Your doctor may continue or change your treatment if your leukemia comes back.

Conclusion :-

Both the developed and developing worlds are starting to pay. More attention toward Leukemia. The most common form of leukemia is CLL observed in adults. Treatment begins when the disease becomes symptomatic and survival is high after treatment. Many advanced treatments such as mentioned in the review are available for treatment of leukemia. Hematologists meet frequently difficulties in identifying subtypes of AML similarities in their morphological characteristics. Once AML is diagnosed, blast cells must be present. The Diagnosis and treatment of hematoma Logical malignant show that progress Is also treated for other malignant tumors Through hematological malignancies.

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