

## REVIEW: HEMATOLOGICAL CANCER

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### ABSTRACT

This article aims to do just that by providing a thorough examination of Hematological Cancer. These days, more and more people are diagnosed with haematological cancer. This research will educate you on haematological cancer, including its many subtypes, symptoms, and potential causes, as well as its diagnosis, treatment options, and drugs. All three kinds of haematological cancer share common symptoms, including weight loss and fever (leukaemia, lymphoma, and myeloma). Hematological cancer is most often found in the elderly and has many causes. A blood test is often used to diagnose haematological cancers. Blood and bone marrow cancers, known as haematological malignancies, are treatable or at least manageable by a stem cell transplant. Patients with haematological cancers receive treatments such cyclophosphamide, doxorubicin, vincristine, and prednisone. Hematological cancer has reached critical proportions because of our inability to diagnose it early or provide appropriate treatment or a cure.

**KEYWORD:** Hematological cancer, Treatment, SPA, Vincristine, Chemotherapy, radiation therapy, stem cell transplantation.

### INTRODUCTION

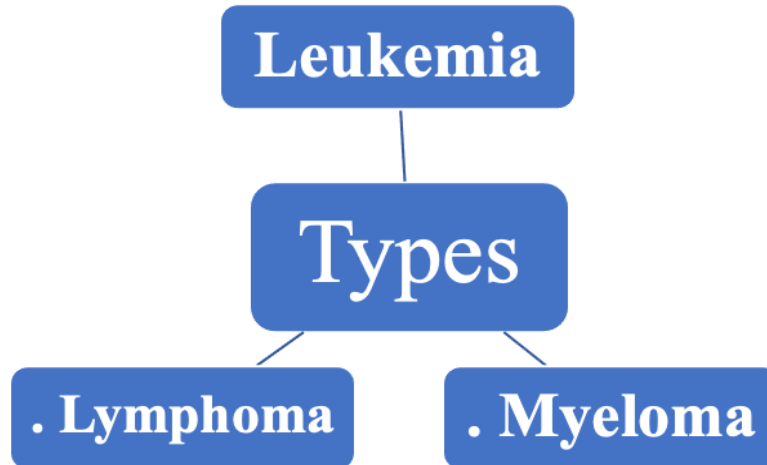
The blood and bone marrow are vulnerable to many different types of cancer. Lymphoid cancers include those that form in the lymph nodes, lymph vessels, tonsils, thymus, spleen, and lymphoid tissue of the digestive tract. Leukemia, myeloma, and lymphoma are the most common kinds of haematological malignancy. All three of these diseases originate in the bone marrow or lymphatic system.

Cancers of the bone marrow, such as leukaemia and myeloma, can spread throughout the organ and limit normal production of white blood cells, red blood cells, and platelets. There is a risk of developing long-term infections, anaemia, and excessive bleeding as a result of this. An enlarged lymph node is the most common symptom of

lymphoma, but the disease can also weaken the immune system and make it harder for the body to fight off infections. Myelomas create both an abnormal protein that could lead to systemic symptoms and a substance that weakens bones.

Major progress has been made in the treatment of blood cancers, resulting in improved remission and survival rates. Remission is defined as the complete resolution of cancer symptoms. In the United States, almost a million people are either coping with or have overcome a diagnosis of haematological cancer. Bleeding and infections are more common in patients with blood cancer.

### Types of Hematological Cancer



#### 1. Leukaemia

When there is an increase in the number of cancer cells in the bone marrow or the blood, the body's ability to generate new blood is significantly hampered.

#### 2. Lymphoma

Lymphoma describes the malignant growth that affects lymphocytes. One type of white blood cell is the lymphocyte.

#### 3. Myeloma

Myeloma is a malignancy that affects plasma, which is another type of white blood cell.

#### A. Leukaemia

Leukemia is a malignancy of the white blood cells. White blood cells are present in the blood of all humans. Antibiotics help the body's immune system do its job, which is to fight off infections. During a leukaemia infection, the DNA in the cells mutates in a way that causes the body to produce an abundance of immature white blood cells. The term "blast" is used to describe these types of cells. Depending on which types of blood cells they target, there are four distinct types of leukaemia. A gradual takeover of bone marrow occurs as a result of these malignant cells.

#### Epidemiology

In the year 2000, around 256,000 people of all ages were diagnosed with leukaemia, and 209,000 people ultimately lost their lives to the disease. Cancer was responsible for about 7 million fatalities worldwide in that year, or around 0.35 percent of all deaths. Leukemia was the twelfth most common neoplastic disease in the sixteen anatomical sites studied,

and the eleventh major cause of cancer-related death overall. Without counting those who have been cured, there are roughly 245,000 people in the United States who have been diagnosed with leukaemia. An estimated 44,270 new cases of leukaemia were diagnosed in the United States in 2008. As a percentage of total cancer cases, this represents 29.6% in the US, and 29.1% of haematological cancers. Acute lymphoblastic leukaemia (ALL) accounts for around a third of all childhood cancer diagnoses. Type o leukaemia is the second most common cancer in infants and the most common malignancy in older children (those younger than 12 months). Leukemia affects somewhat more boys than girls, and it's roughly twice as common in white American children as in black American youngsters. "The great majority of cancer diagnoses are in adults, yet only about 3% of them are for leukaemia. One of the threats is one's sense of racial identity. Hispanics, especially those under the age of 20, have the highest risk for leukaemia. This is true regardless of race, with whites, Native Americans, Asians, and Alaska Natives all having a higher risk than blacks. Sex is also an important factor. Males are at a far higher risk for developing leukaemia, and the disease kills many more males than females each year. Men have a nearly 30% higher risk of developing leukaemia than women do.

#### Prevalence of the disease

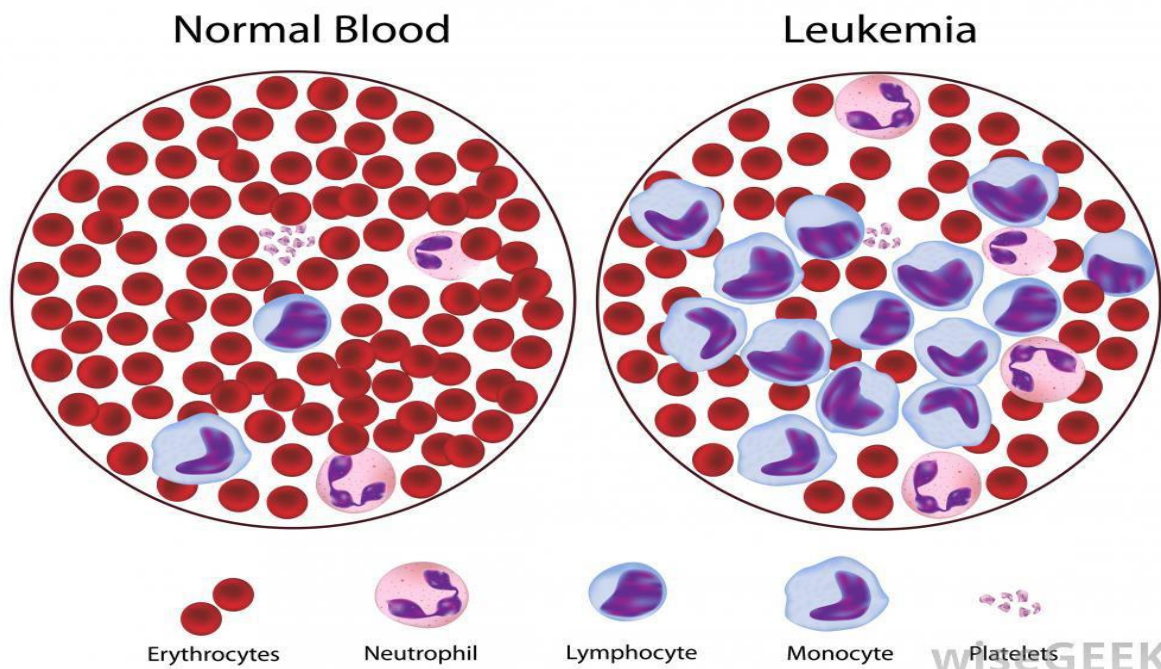
Rate of incidence of leukaemia in USA	1 in 8831 Person
Annual rate of incidence of leukemia in USA	30800
New cases of leukemia detected in USA 2004	Male-19020 Female-14420
Estimated number of deaths from leukemia in USA in 2004	Male-1900 Female-10310

#### Types of Leukaemia and their Causes

Types of leukemia	Description	Causes
Acute lymphocytic lymphoma (ALL)	This type of leukaemia affects the lymphocytes. A large number of immature Lymphocytes are produced and they hinder the functioning of the bone marrow.	Though the exact cause is not known, exposure to toxins like benzene and radiation, Chemotherapy and chromosomal abnormality can increase the risk of ALL.
Acute hypogenous leukaemia (AML)	Acute hypogenous leukaemia (AML) This cancer develops from inside the bone marrow involving immature cells that would have turned to white Blood cells.	Acute hypogenous leukaemia (AML) This cancer develops from inside the bone marrow involving immature cells that would have turned to white Blood cells. It is caused by exposure to harmful chemicals and rays, Blood disorders or weakened Immune system. It is most common type and the disease Progresses rapidly.
Chronic lymphocytic leukaemia (CLL)	It is a slow increase in lymphocytes affecting the Lymph nodes and the spleen. Ultimately it causes the bone marrow to stop functioning	The reason is not known and it is not linked to radiation. However, exposure to Agent Orange during Vietnam war increased the risk of CLL
Chronic mylogenous leukaemia (CML)	It is a slow build-up of immature white blood cells Hampering the function of the bone marrow.	CML is related to the presence of an abnormal chromosome called Philadelphia chromosome. Radiation exposure may also be a cause.
Hairy cell leukaemia (HEMAZTOLOGICAL CANCERL)	This is a rare type of cancer Affecting white blood cells. The cells look hairy under a microscope.	The cause is unknown.

### Pathophysiology of Leukaemia

Myeloid and lymphoid lineage leukaemias are malignant neoplasms that originate in the bone marrow. The abnormal, immature cells (blast) multiply and eventually find their way into the bloodstream, where they can then travel to other parts of the body. Acute leukaemia is characterised by a rapid worsening of symptoms. The signs and course of Acute Myeloid Leukaemia (AML) and Acute Lymphoblastic Leukaemia (ALL) are identical. Fifty percent of all newly diagnosed cases of leukaemia are classified as acute. Acute myeloid leukaemia (AML) accounts for around 85% of all cases of acute leukaemia, and its incidence increases with age. The peak incidence of acute lymphoblastic leukaemia (ALL) occurs between the ages of 2 and 9, making it the most common form of childhood cancer. Human T-cell leukemia-lymphoma virus, ionising radiation, some chemicals and poisons, Down syndrome, Falcone's anaemia, and other inherited illnesses are also risk factors. Some examples of potential consequences are infection, leukostasis leading to haemorrhage, renal failure, tumour lysis syndrome, and disseminated intravascular coagulation.



**Figure 1: Normal blood cell and Leukaemia.**

### Signs and Symptoms of Leukaemia

The cancerous cells of leukaemia originate in the bone marrow. With time, its effects diminish the bone marrow's ability to do its job. Because of this, patients with leukaemia are more likely to suffer from excessive bruising and bleeding.

- Loss of appetite, nausea, and/or vomiting are often prevalent, as are fever, chills, lethargy, and other flu-like symptoms.
- Bone and joint discomfort are another symptom of leukaemia.
- In addition to this, you may also experience: loss of appetite; paleness; skin patches; swollen glands; etc.

## Diagnosis

It's based on

- However, in exceedingly rare cases, blood tests may not show if a patient has leukaemia, often because the leukaemia is in the early stages or has entered remission.
- A biopsy of the lymph nodes may be required to make a conclusive diagnosis of leukaemia in some patients.
- After a diagnosis has been determined, blood chemistry testing can evaluate the effectiveness of chemotherapy on the liver and kidneys. X-rays, magnetic resonance imaging, and ultrasounds are just some of the imaging methods that doctors may use to look for signs of leukemia-related tissue damage. Imaging tools such as X-ray, MRI, and ultrasound can be used to detect and track the development of leukaemia in different body parts (ultrasound).
- Last but not least, a CT scan of the chest is rarely used to assess lymph nodes.
- Evidence suggests that mutations in the SPRED1 gene elevate susceptibility to childhood leukaemia. Mutations in the SPRED1 gene can be found using DNA sequencing..

## Treatment

Leukemia treatment entails eliminating abnormal blood cells and allowing the body to replace them with healthy ones.

Chemotherapy is the most widely used treatment of leukemia. It occurs as follow:

- Induction is the initial phase, during which all blood aberrant cells are eliminated.
- The following phase is consolidation. It eliminates aberrant cells that may be so uncommon that they are missed by routine blood tests.
- The third and last phase is upkeep, which is implemented especially for ALL. As a result, the recovery process is not jeopardised by the return of leukaemia cells.

If leukaemia has spread to the brain or spinal cord, treatment is done with an intracerebrospinal catheter.

Radiation therapy is used in conjunction with chemotherapy to treat leukaemia. To get cancer cells to go into remission, a high dose of radiation is focused directly at them.

In life-or-death situations, doctors may try a stem cell transplant. A compatible donor is identified and the tainted bone marrow is removed. After that, normal stem cells take over.

## 1. LYMPHOMA

Lymphoma is a malignant blood cancer caused by the uncontrolled growth of lymphocytes. These tumours frequently manifest in lymph nodes, bone marrow, the spleen, and occasionally in other organs. The underlying causes are frequently unknown. Symptoms usually include a high temperature, chills, fatigue, and pain or discomfort in the lymph nodes and other areas. In most cases, one of three approaches is used to treat lymphoma: treatments include chemotherapy, radiation, and bone marrow transplants.

**Risk factors for lymphoma**

Age & Gender	Epstein Barr virus	Breastfeeding	Non-Hodgkin lymphoma risk factors HIV/AIDS
Previous non Hodgkin lymphoma	Contact with common infections	Workplace chemicals	Other infections
Lowered immunity	Hepatitis C virus	Alcohol and smoking	Autoimmune conditions
Previous non Hodgkin lymphoma	Family history	Being very overweight	Genetics

**Types of Lymphoma**

Name	Description	Causes
Hodgkin lymphoma	It is the cancer of the lymph tissue found in spleen, lymph nodes, bone marrow etc.	The cause is unknown. Prior infection with HIV or Epstein Barr virus is seen to increase the risk of this disease.
Non Hodgkin lymphoma	It is the cancer of the B lymphocytes found in lymph tissues	The cause is unknown. The disease mostly develops in people with weakened immune system. Prior HIV infection or organ transplantation increases the risk.
Burkitt lymphoma	It is a rare type of disease mostly observed in African children. It is common in males.	In Africa, it is linked to the Epstein Barr virus, but no such link has been found in the USA. Weakened immune system increases the risk.

**Pathophysiology**

Lymphatic tissue is composed mainly of lymphocytes. There are two main types of lymphocytes:

- B cells make antibodies that kill bacteria and viruses.
- T cells fight infections using other chemicals and processes.

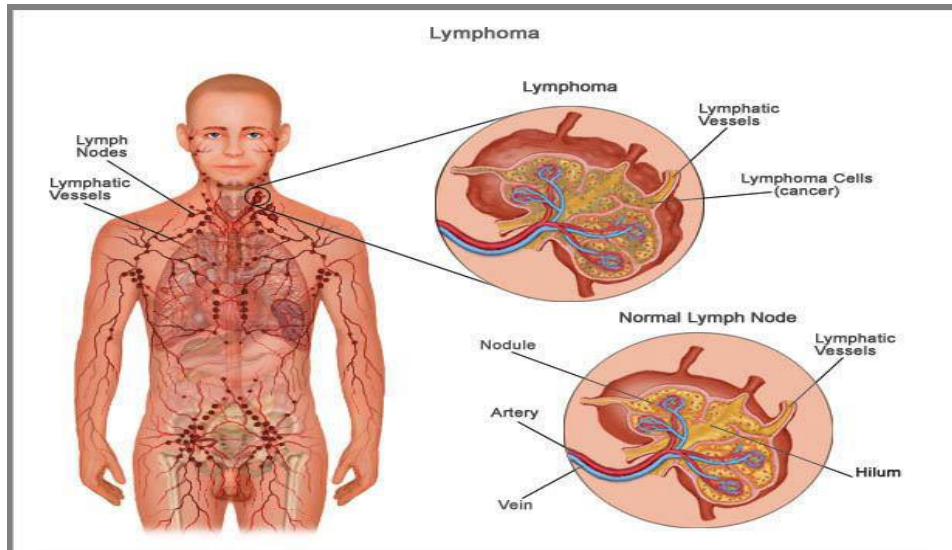
A lymphocyte becomes lymphoma when it undergoes an aberrant transformation and begins to proliferate uncontrollably.

In many cases, these rogue cells aggregate to create lumps (tumours) in the lymph nodes or elsewhere. Lymph tissue is widely distributed, making any part of the body a potential lymphoma incubator. Its metastasis can invade and destroy virtually every organ.

**Signs and Symptoms of Lymphoma**

The most common signs and symptoms of lymphoma:-

- Intermittent fever, night sweat and chills.
- Swelling of lymph glands in neck, groin or armpit.
- Unexplained weight loss.
- Flushed skin
- Coughing and itching
- Excessive sweating
- Loss of appetite.



**Figure 2: Lymphoma.**

### Diagnosis of Lymphoma

- The first step is a physical exam where the doctor checks your lymph nodes to make sure
- Whether there are pain and swelling.
- If he suspects lymphoma, he will order a biopsy of the lymph tissue.
- Certain blood tests are done. These include complete blood count and testing for protein,
- Urea, kidney function etc.
- CT scan of chest, abdomen and pelvis may be done.
- PET scan and Gallium scan (in case of non-Hodgkin lymphoma) are done.
- In certain cases, bone marrow biopsy has to be done.

### Treatment of Lymphoma

Lymphoma can be treated and cured if found and treated early. Factors such as the patient's age, gender, and disease stage help establish the best lymphoma therapy plan.

- **Chemotherapy**

Drug therapy can eradicate the abnormal cells floating about in the circulation.

Secondly, the drugs will hopefully stop the body from making any more abnormal lymphocytes.

For the third, they have regular occurrences. After overcoming obstacles like anaemia, the patient can shift their attention to producing new, healthy white blood cells.

It is common practise to combine ABVD and MOPP for treating Hodgkin lymphoma. Moreover, each of BEACOPP's seven parts has been shown to be effective in and of itself.

Treatment for non-Hodgkin lymphoma often consists of cyclophosphamide, doxorubicin, vincristine, and prednisone. Possible differences also depend on the severity and type of illness.

Methods involving the transfer of embryonic stem cells Radiation-based medical treatments On occasion, immunotherapy is also attempted.

Radiation therapy is used to destroy tumours, while immunotherapy is used to generate blood plasma antibodies that boost the efficacy of chemotherapy.

Acupressure or other complementary and alternative medicine techniques can be used to increase lymphatic flow. Recent scientific interest has focused on the seaweed compound fucoid a for its possible use as an alternative therapy for lymphoma.

## B. MYELOMA

Plasma cells, which can be found in the bone marrow, help the immune system fight off infections and diseases by producing antibodies. Myeloma, a cancer that targets plasma cells, can spread easily through the body. Outside of the bone, they exhibit abnormal behaviours and grow tumours". This causes gradual bone loss over time. It also prevents healthy bone marrow from producing blood cells. The origins of this disease are unknown.

Blood cells are created in the connective tissue of the bone marrow. One type of cell produced in this area is the B lymphocyte, also called a plasma cell. Without these cells, the production of antibodies in the blood would be impossible. Antibodies serve as the first line of defence in the body's immune system. Myeloma is brought on by the abnormal behaviour of these plasma cells. Fast development of these tumours can be seen on the surface of otherwise healthy bones. After extensive injury, the bone can no longer serve its function.

### Causes of Myeloma

Origins of myeloma are, at best, obscure. Myeloma has been associated in some research to prolonged contact with potentially harmful substances or radiation. In many of the cases when this is said to have happened, however, no such exposure really occurred. In such cases, pinpointing the precise causes is an impossibility.

Male	7.4 per 100000
Female	4.7 per 100000
Blacks	11.7 per 10000
Whites	5.3 per 100000
Highest incidence found among Black males aged 85 years and above	93.1 per 100000
Number of people living with myeloma	81089
Number of new cases expected to be diagnosed with myeloma in 2012	Male – 12190 Female – 9510

### Signs and Symptoms

- Unable to formation of healthy blood cells (Anaemia)
- Paleness,
- Fatigue
- Shortness of breath

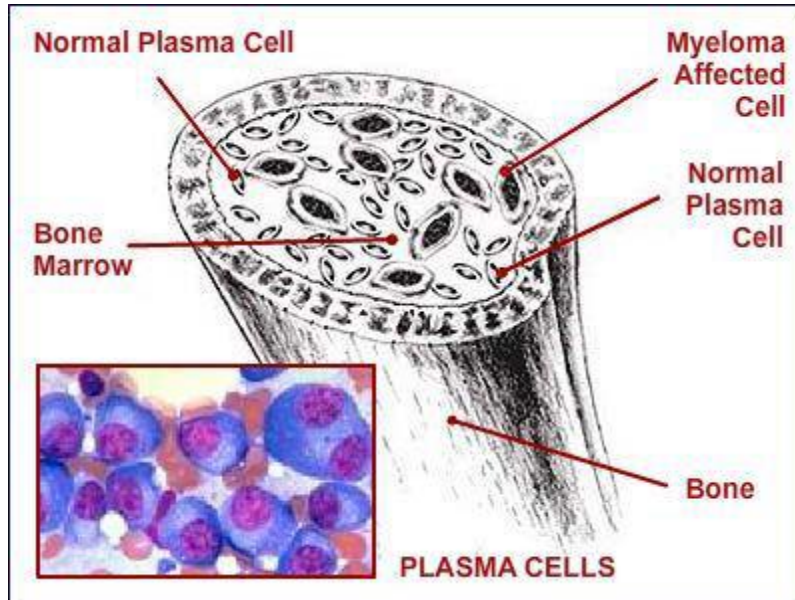
### Diagnosis of Myeloma

A diagnosis of myeloma. These are as follows:

- A complete blood count can reveal your albumin, calcium, and total protein levels.
- Antibodies and proteins can be detected in the body by testing blood and urine.



- The diagnosis is confirmed by checking for excessive calcium levels, low blood counts, renal failure, and bone abnormalities.
- Diagnostic procedures include a bone marrow sample and x-rays of the skeleton.
- Bone density tests are performed to track bone loss.



**Figure 3: Myeloma in Bone.**

### Treatment of Myeloma

Myeloma comes in two flavours, smouldering and aggressive, and each has different therapeutic options. Despite thorough monitoring, no medication is given for smouldering myeloma. Treatment for aggressive myeloma consists of the following chemotherapy and radiation treatments:

- Bisphosphonates are utilised to restore a healthy equilibrium to the bones during chemotherapy. The use of steroid medication is not uncommon.
- Tumor-causing cells can be eradicated by radiotherapy.
- Bone fractures may often be repaired with surgery, although this is an exception to the rule.
- There are times when a bone marrow transplant is necessary. Possibly two distinct varieties exist:
  1. The procedure of using a patient's own stem cells is known as autologous bone marrow or stem cell transplantation.
  2. The use of donor stem cells in a bone marrow transplant is referred to as an allogeneic transplant.
 There are significant dangers associated with this treatment, but the potential for a complete recovery is promising.

### Risk Factor for Hematological Cancer

- Certain types of infections:
- Patients with HIV are a high-risk demographic for developing haematological malignancy.
- Direct exposure to certain compounds Radiation therapy, certain chemotherapy regimens, etc.
- The presence of a family history of haematological malignancy indicates an increased risk of developing blood cancer.

- Immune system suppression owing to HIV/AIDS, corticosteroids, or an organ transplant.
- Blood cancer rates by race. It has been noted that white people have a higher risk of developing lymphoma than people of other races.
- The presence of a family history of a specific blood condition.
- Smoking.
- Haematological cancer occurs primarily in the elderly.

## CONCLUSION

Haematological cancer can take many shapes and this review has covered the symptoms, causes, and diagnostics and treatment options for each. Blood cell cancer tends to run in families. Effective therapies include radiation therapy, chemotherapy, and stem cell transplantation. With a doctor's care and the prescribed medication, you will get better. The negative routines and routine actions the most common cause of haematological cancer in the elderly is the use of harmful substances.

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