

Causes, Types and Treatment Approaches for Leukemia

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DESCRIPTION

Leukemia is a form of cancer that affects the blood and bone marrow. It is characterized by the abnormal production of white blood cells, which impairs the body's ability to fight infections. This article provides a comprehensive overview of leukemia, including its causes, types, symptoms, diagnosis, and treatment options. By increasing the understanding of this disease, improved prevention, early detection, and effective treatment strategies can be taken.

Causes of leukemia

Leukemia arises from a combination of genetic and environmental factors. While the exact causes are not yet fully understood, several risk factors have been identified. Exposure to high levels of radiation, such as in survivors of atomic bomb explosions or nuclear accidents, increases the risk of developing leukemia. Certain chemicals, such as benzene and formaldehyde, found in industrial settings or tobacco smoke, have also been linked to the disease. Genetic factors play a significant role in some types of leukemia. Certain genetic mutations can disrupt the normal development and regulation of blood cells, leading to the development of leukemia. Inherited conditions, such as Down syndrome and Fanconi anemia, also increase the risk of leukemia.

Types of leukemia

Leukemia is classified into four main types based on the speed of disease progression and the type of blood cells affected: Acute Lymphoblastic Leukemia (ALL), Acute Myeloid Leukemia (AML), Chronic Lymphocytic Leukemia (CLL), and Chronic Myeloid Leukemia (CML).

(ALL) this type of leukemia primarily affects children and young adults. It develops rapidly, affecting immature lymphoid cells in the bone marrow and blood. AML can occur in both children and adults. It involves the rapid growth of abnormal myeloid cells, which normally develop into different types of mature blood cells. CLL is more common in older adults and progresses

slowly. It affects mature lymphocytes, causing them to accumulate in the blood, bone marrow, and lymph nodes. CML typically affects adults and develops gradually. It is characterized by the overproduction of abnormal myeloid cells and the presence of the Philadelphia chromosome, a genetic abnormality.

Symptoms and diagnosis

The symptoms of leukemia can vary depending on the type and stage of the disease. Common symptoms include fatigue, frequent infections, unexplained weight loss, easy bruising or bleeding, swollen lymph nodes, and bone or joint pain.

Diagnosis begins with a thorough medical history and physical examination. Blood tests are essential to evaluate the number and types of blood cells. A bone marrow biopsy may be performed to examine the cells in the bone marrow for abnormalities.

Additional tests, such as cytogenetics, Fluorescence *In Situ* Hybridization (FISH), and Polymerase Chain Reaction (PCR), help identify specific genetic abnormalities and assist in determining the most appropriate treatment options.

Treatment options

The treatment approach for leukemia depends on several factors, including the type of leukemia, its stage, the patient's age and overall health, and the presence of specific genetic mutations.

Chemotherapy: This is a common treatment for leukemia and involves the use of powerful drugs to kill cancer cells. Chemotherapy can be administered orally, intravenously, or directly into the cerebrospinal fluid in cases of central nervous system involvement.

Targeted therapy: Targeted drugs are designed to attack specific abnormalities in cancer cells, minimizing damage to healthy cells. For example, Tyrosine Kinase Inhibitors (TKIs) are effective in treating chronic myeloid leukemia by blocking the activity of the abnormal protein produced by the Philadelphia chromosome.

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Radiation therapy: It involves the use of high-energy X-rays or other types of radiation to destroy cancer cells or inhibit their growth. Radiation therapy is commonly used in combination with chemotherapy in certain cases, such as preparation for a stem cell transplant.

Immunotherapy: This approach harnesses the body's immune system to recognize and destroy cancer cells. Monoclonal

antibodies, checkpoint inhibitors, and Chimeric Antigen Receptor (CAR) T-cell therapy are examples of immunotherapy strategies being used in the treatment of leukemia.

Stem cell transplantation: This procedure involves replacing damaged or destroyed bone marrow with healthy stem cells. It is commonly used in cases where high-dose chemotherapy or radiation therapy is administered.