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# Review Paper on the Diagnosis, Treatment and Prevention of Cancer

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**Abstract:** *Cancer is a disease that occurs when cells in the body grow uncontrollably and spread to other parts of the body. Cancer can start in almost any organ or tissue, and there are more than 277 different types of cancer. Cancer can take decades to develop, and most people diagnosed with cancer are 65 or older. However, cancer can be diagnosed at any age. Cancer is characterized by proliferation of cells that have managed to evade central endogenous control mechanisms. Cancers are grouped according to their organ or tissue of origin, but increasingly also based on molecular characteristics of the respective cancer cells. Due to the rapid technological advances of the last years, it is now possible to analyze the molecular makeup of different cancer types in detail within short time periods. The accumulating knowledge about development and progression of cancer can be used to develop more precise diagnostics and more effective and/or less toxic cancer therapies. In the long run, the goal is to offer to every cancer patient a therapeutic regimen that is tailored to his individual disease and situation in an optimal way..*

**Keywords:** Cancer

## I. INTRODUCTION

Blood Cancer are also known as Leukemia . The production of abnormal leukocytes defines leukemia as either a primary or secondary process. They can be classified as acute or chronic based on the rapidity of proliferation and myeloid or lymphoid based on the cell of origin. Other less common variants, such as mature B-cell and T-cell leukemias, and NK cell-related leukemias, to name a few, arise from mature white blood cells. However, with the advent of next-generation sequencing (NGS) and the identification of various biomarkers, the World Health Organization (WHO) classification was updated in 2016, bringing multiple changes to the traditional classification for acute leukemias and myeloid neoplasms.

They can be classified as acute or chronic based on the rapidity of proliferation and myeloid or lymphoid based on the cell of origin. Predominant subtypes are acute myeloid leukemia (AML) and chronic myeloid leukemia (CML), involving the myeloid lineage; acute lymphoblastic leukemia (ALL); and chronic lymphocytic leukemia (CLL), involving the lymphoid chain. Acute lymphocytic leukemia (ALL), also called acute lymphoblastic leukemia, is a cancer that starts from the early version of white blood cells called lymphocytes in the bone marrow (the soft inner part of the bones, where new blood cells are made). Leukemia cells usually invade the blood fairly quickly. They can then spread to other parts of the body, including the lymph nodes, liver, spleen, central nervous system (brain and spinal cord), and testicles (in males).Our paper also focuses on health-related QoL (QoL), a factor reflecting the individual's assessment of his/her life at any one time relative to his/her previous state and prior experience As liquid tumours moving in the blood or lymph, acute or chronic diseases, with side effects induced by different treatments, are unique.

However, the medical cost is not the only cost for families; several other associated costs contribute to the overall burden of cancer, namely, direct (e.g., medical care), indirect (loss of resources and opportunities), and psychosocial. The latter encompasses intangible costs associated with cancer, such as pain and suffering, and the additional cost to individuals' well-being.Initial advances in MDS/AML therapy came with the development of cytotoxic chemotherapy and allogeneic stem cell transplant.Myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML), the two most common myeloid malignancies, have recently seen a wave of novel therapeutics approved. While the outcomes for MDS/AML have historically been poor, this is now starting to change.While these agents were not necessarily developed with the intent of manipulating cellular differentiation, new data suggest that a central part of the mechanism for several of these drugs (e.g., IDH inhibitors) is inducing cellular differentiation, with subsequent apoptosis of the

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differentiated malignant cells.This suggests that targeting cellular differentiation programs may be a fruitful area to be further explored in both myeloid malignancies and other cancers.Myeloproliferative neoplasms (MPNs) are a group of blood cancers in which the bone marrow overproduces one or more types of blood cells- red blood cells, white blood cells and platelets. MPNs usually develop slowly over time, and different types of MPNs affect different types of blood cells These blood cancers are also called “myeloproliferative diseases” and “chronic myeloproliferative neoplasms.

**WHAT IS BLOOD CANCER :-**

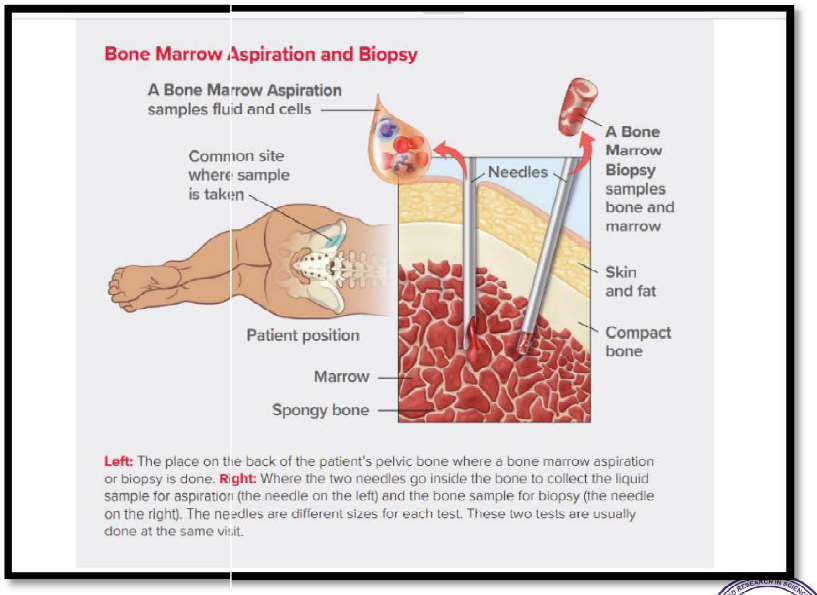
1. Cancer arising from cells responsible for blood formation or immune function.
2. Commonly occurs in your bone marrow and lymphatic system where stem cells and immune cells are located and mature.
3. In the bone marrow, normal cell production is interrupted and abnormal cells begin to grow .

PATHOPHISIOLOGY OF BLOOD CACNER

Leukemia occurs due to the malignant transformation of pluripotent (i.e., it can give rise to both myeloid and lymphoid precursors) hematopoietic stem cells. Rarely, it can also involve a more committed stem cell with limited self-renewal capacity. In acute leukemias, these malignant cells are generally immature, poorly differentiated, abnormal leukocytes (blasts) that can either be lymphoblasts or myeloblasts. These blasts can undergo clonal expansion and proliferation, leading to replacement and interference with the development and function of normal blood cells, leading to clinical symptoms.

HOW DIAGNOSIS

Blood Test. Blood is taken from the patient’s arm with a needle. The blood is collected in tubes and sent to a lab for testing. Bone Marrow Aspiration. A sample of fluid with cells is removed from the bone marrow and sent to a lab for testing. Bone Marrow Biopsy. A very small amount of bone filled with bone marrow cells is taken from the body and sent to a lab for testing. Both bone marrow tests are done with special needles. Some patients are awake for the procedure. They get medication first to numb the part of the body that will be used to get the sample of cells. Some patients are given a drug that makes them “sleep” during this procedure. The sample of cells is usually taken from the patient’s hip bone. Blood and marrow tests may be done in the doctor’s office or in a hospital. A bone marrow aspiration and biopsy are almost always done at the same visit. Blood and bone marrow tests may be done both during and after treatment. The tests are repeated to see if treatment is working.



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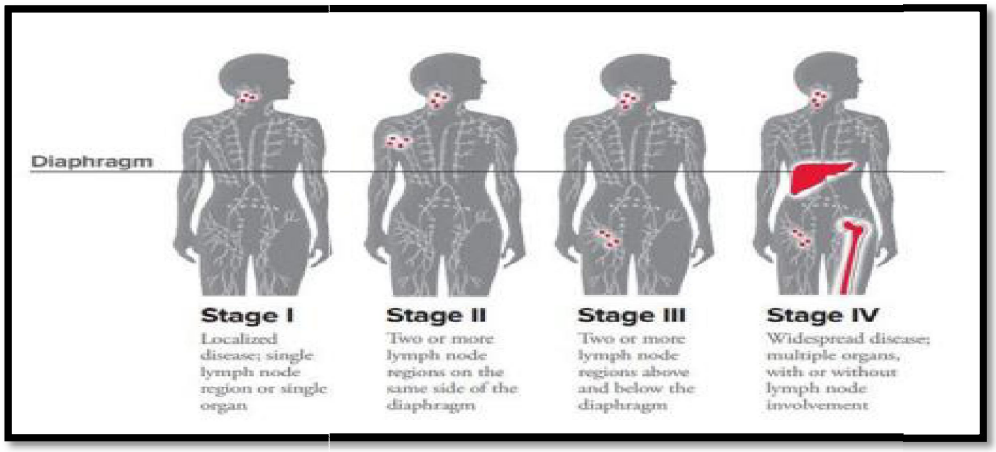
Bone Marrow Aspiration and Biopsy:-
These are two procedures that remove bone marrow cells and test them for abnormalities. They are generally done at the same visit, either at the doctor's office or in a hospital. After medicine has been given to numb the skin and the surface of the bone, the aspiration and biopsy samples are taken separately, using two different needles. The samples are removed from the patient's pelvis or "hip bone," generally from the area right above the buttocks.

**STAGE OF BLOOD CANCER :-**
STAGE I.
STAGE II.
STAGE III.
STAGE IV

STAGE I :- Localized diseased single lymph node region or single organ.
STAGE II :- Two or more lymph node region on the diaphragm .
STAGE III :- Two or more lymph node region above and below the diaphragm .
STAGE IV :- Widespread disease multiple organs with or without lymph node involvement




**PROGNOSIS**
Long-term survival with leukemia varies tremendously based on leukemia subtype, cytogenetic and molecular findings, patient age, and comorbid conditions.
Broadly, leukemia's 5-year cancer survival rate increased from 33% in 1975 to 59% in 2005.

**TYPES OF BLOOD CANCER :- ( LEUKEMIA )**
**Acute vs. chronic myeloid leukemia:** Blasts, which are immature and dysfunctional cells, normally make up 1% to 5% of marrow cells. Acute leukemias are characterized by greater than 20% blasts in the peripheral blood smear or on bone marrow leading to a more rapid onset of symptoms. In contrast, chronic leukemia has less than 20% blasts with a relatively chronic onset of symptoms. The accelerated/blast phase is a transformation of chronic myeloid leukemia into an acute phase with a significantly higher degree of blasts

What type of blood cancer:
Acute vs. Chronic:-
• Acute lymphoblastic leukemia (ALL): ALL is seen in patients with the blastic transformation of B and T cells. It is the most common leukemia in the pediatric population, accounting for up to 80% of cases in this group vs. 20% of cases in adults. Treatment among adolescents and young adults is predominantly inspired by pediatric regimens with better survival rates.

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• Acute myelogenous leukemia (AML): AML is characterized by greater than 20% myeloid blasts and is the most common acute leukemia in adults. It is the most aggressive cancer with a variable prognosis depending upon the molecular subtypes.
• Chronic lymphocytic leukemia (CLL): CLL occurs from the proliferation of monoclonal lymphoid cells. Most cases occur in people between the ages of 60 and 70. CLL is considered an indolent disease, for the most part, meaning not all patients with a diagnosis will need to start treatment until symptomatic from the disease.
• Chronic myelogenous leukemia (CML): CML typically arises from reciprocal translocation and fusion of BCR on chromosome 22 and ABL1 on chromosome 9, resulting in dysregulated tyrosine kinase on chromosome 22 called the Philadelphia (Ph) chromosome. This, in turn, causes a monoclonal population of dysfunctional granulocytes, predominantly neutrophils, basophils, and eosinophils.

• Lymphocytic Leukemia
• Myelogenous Leukemia

• ACUTE LYMPHOCYTIC LEUKEMIA :-
1. Basic Symptoms:-
2. Feeling tired, weak or lightheaded
3. Shortness of breath
4. Fever
5. Infections that don't go away or keep coming back
6. Bruising easily
7. Bleeding, such as frequent or severe
8. nosebleeds and bleeding gums.
9. General symptom :-
10. Weight loss
11. Fever
• Night sweats
• Fatigue

ACUTE MYELOGENOUS LEUKEMIA (AML)
The main symptoms are:-
• Pale look and feeling tired and breathless – mostly due to anemia caused by reduction in RBCs.
• Prone to more infection than usual – Due to lack of WBCs.
• Unusual bleeding caused by very few platelets - bruises may appear without any injury, heavy periods in women, bleeding gums, nose bleeds and blood spots or rashes on the skin.
• Feeling Generally Unwell And Run Down.
• Having a fever and sweats, which may be due.

1. SYMPTOMS OF BLOOD CANCER :-
When fibrosis develops in the bone marrow, the bone marrow is unable to produce enough normal blood cells. The lack of blood cells causes many of the signs and symptoms of MF.
These include:
1. Fatigue
2. Weakness
3. shortness of breath
4. pale skin
5. low red blood cell count Frequent infections due to a low white blood cell count
6. Bleeding
7. bruising easily due to a low platelet count

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8. Abdominal pain
9. feeling of fullness
10. decreased appetite
11. weight loss as a result of splenomegaly (an enlarged spleen) or hepatomegaly (enlarged liver)
12. Night sweats
13. Itching skin
14. Fever
15. Bone or joint pain
16. Weight loss When MF causes symptoms, they can be troublesome.
17. Reducing symptoms is a key goal of treatment.
18. Therefore, it is important to take an active role in monitoring your MF symptoms.

HOW MANY THERPAY OF BLOOD CANCER TREATED :-
1. Chemo Therapy .
2. Targeted Therapy .
3. Immuno Therapy .
4. Stem Cell Trasplantation .
5. Radiation Therapy .
6. Surgery .
7. Watchful Waiting .
8. Clinical Trials .

TREATMENT OF BLOOD CANCER :-
Treatment for blood cancer, also known as hematologic cancer, depends on the type and stage of the disease, as well as the patient's overall health.
Here are some common treatment options for blood cancer:
1. Chemotherapy: Uses drugs to kill cancer cells, often in combination with other treatments.
2. Targeted therapy: Focuses on specific molecules that help cancer cells grow and survive.
3. Immunotherapy: Boosts the immune system to recognize and attack cancer cells.
4. Stem cell transplantation: Replaces damaged bone marrow with healthy stem cells.
5. Radiation therapy: Uses high-energy radiation to kill cancer cells or relieve symptoms.
6. Surgery: May be used to remove the spleen or other affected organs.
7. Watchful waiting: Closely monitoring the disease without immediate treatment.
8. Clinical trials: Experimental treatments, such as new drugs or therapies, may be available.

1. CHEMOTHERAPY :-

- Chemotherapy:- Treatment that stops the growth of cancer cells, either by killing the cancer cells or by stopping them from dividing.
- Used in combinations to make other treatments more effective Can be used with surgery or radiation Can be given by many different routes o PO, IV, IM, IT, IP
- In addition to targeted therapies and immunotherapies, researchers are also working to develop new chemotherapy drugs for leukemia and find better ways to use existing drugs. In 2018, a large clinical trial showed that adding the drug nelarabine (Arranon) to standard chemotherapy improves survival for children and young adults newly diagnosed with T-cell ALL.
- Other drugs are being tested that may make standard chemotherapy drugs more effective. These drugs include venetoclax, which has been approved for older adults with some types of leukemia and is now being tested in children.

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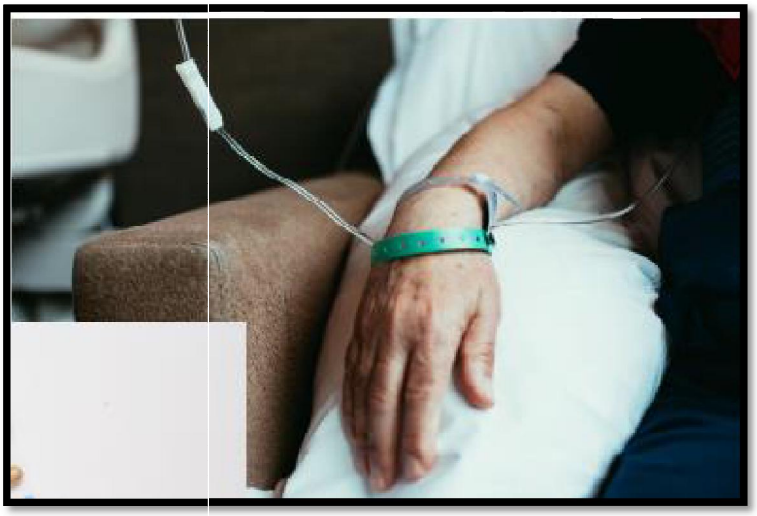

CHEMOTHERAPY SIDE EFFECT

- Fatigue
- Alopecia
- Neuropathy/Confusion
- Mouth sores
- Nausea/Diarrhea
- Cytopenia - Neutropenia, Anemia Thrombocytopenia o Infection o Bleeding
- Skin and nail changes
- Mood changes
- Infertility and changes in libido

2. TARGETED THERAPY :-

• Specifically targets the changes found in cancer cells' DNA which makes it become cancerous

Types:-

1. Monoclonal antibodies
2. Small molecule inhibitors:
3. Tyrosine kinase inhibitors: dasatinib, imatinib, nilotinib
4. Proteasome inhibitors: bortezomib
5. PI3K inhibitors: idelalisib
6. HDAC inhibitors: panobinostat, vorinostat
7. mTOR inhibitors: sirolimus, everolimus
8. Hedgehog pathway inhibitors: glasdegib

TARGETEDT THERAPY SIDE EFFECTS :-

1. Fatigue
2. Low blood counts
3. Neuropathy, headache
4. Gastrointestinal effects – nausea, vomiting, diarrhea, decreased appetite
5. Liver abnormalities
6. Skin changes – rash
7. Fluid retention, weight gain, swelling

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3.Immunotherapy :-

- CAR T-cell therapy has recently generated great excitement for the treatment of children with relapsed ALL. One CAR T-cell therapy, tisagenlecleucel (Kymriah), was approved in 2017 for some children with relapsed ALL.
- Researchers continue to address remaining challenges about the use of CAR T-cell therapy in children with leukemia:-
- Sometimes, leukemia can become resistant to tisagenlecleucel. Researchers in NCI's Pediatric Oncology Branch have developed CAR T cells that target leukemia cells in a different way. An ongoing clinical trial is testing whether the combination of these two types of CAR T cells can provide longer-lasting remissions.
- CAR T cells are currently only approved for use in leukemia that has relapsed or proved resistant to standard treatment. A clinical trial from the Children's Oncology Group (COG) is now testing tisagenlecleucel as part of first-line therapy in children with ALL at high risk of relapse.
- More research is needed to understand which children who receive CAR T cells are at high risk of developing resistance to treatment. Researchers also plan to test whether strategies such as combining CAR T-cell therapy with other immunotherapies may help prevent resistance from developing.
- Other research, both in NCI's Pediatric Oncology Branch and at other institutions, is focused on creating CAR T-cell therapies that work for children with other types of childhood leukemia, such as AML. Several clinical trials of these treatments, including one led by NCI researchers, are now under way.
- Two other drugs that use the body's immune system to fight cancer have shown promise for children with leukemia:
- A drug called blinatumomab (Blincyto) is a type of immunotherapy called a bispecific T-cell engager (BiTE). These drugs attach to immune cells and cancer cells, enabling the immune cells to easily find and destroy the cancer cell by bringing them closer together. Blinatumomab has been approved by the FDA for children with ALL who have relapsed after initial treatment. In clinical trials, the drug was shown to be more effective than chemotherapy in treating ALL that has relapsed in children and young adults.
- An NCI-sponsored trial is now testing the drug as part of treatment for newly diagnosed ALL in children, adolescents, and young adults.
- A drug called inotuzumab ozogamicin (Besponsa) is being tested in children with relapsed B-cell ALL. This drug consists of an antibody that can bind to cancer cells linked to a drug that can kill those cells. An NCI-sponsored trial is also testing the drug as part of treatment for newly diagnosed ALL in children and adolescents at higher risk of relapse.

SIDE EFFECTS OF IMMUNOTHERAPY :-

1. Fatigue.
2. Skin rash.
3. Itching.
4. Diarrhea.
5. Nausea.
6. Vomiting.
7. Headache.
8. Muscle pain.
9. Joint pain.

STEM CELL TRANSPLANTATION :-

Stem cell transplantation, also known as bone marrow transplantation, is a medical procedure that replaces damaged or diseased bone marrow with healthy stem cells.

Chemotherapy is administered in high dosages to eradicate cancerous cells. Although chemotherapy is typically administered along with total-body irradiation, it is occasionally not given to newborns or extremely young children.

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Blood-forming cells are among the healthy cells that are destroyed by these therapies. One method of treating the loss of blood-forming cells is a stem cell transplant. After being extracted from a donor's blood or bone marrow, stem cells—immature blood cells—are frozen and kept.[6]

. A type of allogeneic stem cell transplantation in which patients receive lower doses of chemotherapy drugs and/or radiation as preparation for the transplant. The chemotherapy and radiation do not completely kill all the cancer cells. Instead, the new immune cells that the patient receives in the transplant may attack the cancer cells. This protocol may be safer than a traditional high-dose or myeloablative allogeneic stem cell transplant— especially for older patients.

RADIATION THERAPY:-

1. Works by damaging DNA of cancer cells so that they cannot replicate Types:-
2. Internal: put inside the target, ie: brachytherapy
3. External: comes from a machine, targets certain area of your body
4. Used in combination with chemotherapy and surgery.

**RADIATION THERAPY SIDE EFFECTS :-**

Fatigue
Localized skin changes .
Specific side effects related to the area being treated:-
Lung: fatigue, SOB, cough .
Brain: fatigue, hair loss, nausea/vomiting.
GI: nausea/vomiting, diarrhea, abdominal pain, bladder, fertility .
Head/neck: sore throat, dry mouth, taste alteration, hair loss .

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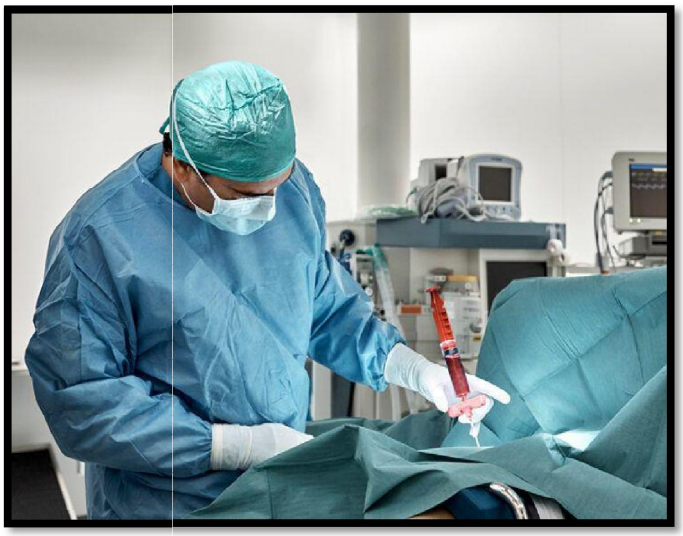
**SURGERY FOR BLOOD CANCER**

Surgery for blood cancer is typically used in conjunction with other treatments, such as chemotherapy, radiation therapy, or stem cell transplantation.

The goals of surgery may include:-

1. Debulking: Removing as much of the tumor as possible to reduce symptoms and improve treatment effectiveness.
2. Diagnosis: Biopsy or removal of lymph nodes or bone marrow to confirm diagnosis.
3. Staging: Determining the extent of cancer spread.
4. Relieving symptoms: Removing tumors or affected organs to alleviate symptoms like pain or bleeding.



**TYPES OF SURGERY FOR BLOOD CANCER :-**

1. Bone marrow biopsy: Removing a bone marrow sample for diagnosis or monitoring.
2. Lymph node biopsy: Removing lymph nodes to diagnose or stage cancer.
3. Splenectomy: Removing the spleen, often for lymphoma or leukemia.
4. Organ removal: Removing affected organs like the liver, kidney, or brain.
5. Stem cell harvest: Collecting stem cells from the bloodstream or bone marrow for transplantation.

**SURGERY BENEFITS**

Improved diagnosis: Accurate diagnosis and staging

Symptom relief: Alleviating symptoms like pain, bleeding, or organ dysfunction.

3. Enhanced treatment effectiveness: Debulking tumors can improve chemotherapy or radiation therapy outcomes.
4. Potential cure: Surgery can be curative for some blood cancers, like lymphoma or leukemia.

SURGERY SIDE EFFECTS :-

1. Infection.
2. Bleeding.
3. Organ damage.
4. Scarring.
5. Recovery time.

CLINICAL TRIALS :-

Every new drug or treatment regimen goes through a series of studies called “clinical trials” before it becomes part of the standard treatment for a disease. Clinical trials are carefully designed and reviewed by expert clinicians and

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researchers as well as patient advocates to ensure safety and scientific. Participation in a carefully conducted clinical trial may be the best available treatment option and should be considered each time you discuss treatment with your doctor. Patient participation in past clinical trials has resulted in the FDA-approved therapies we have today. LLS Information Specialists, available guidance on how patients can work with their doctors to determine if a specific clinical trial in an appropriate treatment option. patients and caregivers in understanding, identifying and accessing clinical trials. Patients and their caregivers can work with Clinical Trial Nurse Navigators who will help find clinical trials and personally assist them throughout the entire clinical trial process.

A research study that is carefully planned and monitored to evaluate how well new medical approaches work in patients. The goal of clinical trials for blood cancers is to develop new treatments, improve quality of life and increase survival time. A treatment that is proven to be safe and effective in a clinical trial is often approved by the United States Food and Drug Administration (FDA) for use as a standard treatment for a disease, if it is either more effective or has fewer side effects than the current standard treatment for that disease.

## II. CONCLUSION

The major strength of our review is the reliability of the selected studies. It shows that haematological cancer patients have a poor QoL or health-related QoL compared with the general population. These findings hold regardless of the type of disease, the treatment modality and the stage of the disease. Generally, we found similar outcomes in other cancers, such as fatigue, which was greater in haematological patients. In theoretical terms, QoL is a complex concept that encompasses various aspects of life and is similar to well-being, so the very meaning of the notion is debatable. Clinically, it is important to analyse QoL early in the course of care. Some types of intervention may prove helpful such as physical programmes, which may be considered as a form of functional care intervention, and other supportive actions, such as psychotherapy which can improve physical and mental functioning.

Our results highlight the broad impact on the families of children with blood-related cancer following diagnosis, in a country in which this topic has not been previously studied. Most families reported a negative impact upon diagnosis, which was related to disruptions in family dynamics, depressive symptoms in the patient, a poor relationship between the patient's siblings and their parents, deterioration within the caregiver's spouse/partner relationship, as well as a worsening of the primary caregiver's economic condition. Promoting the creation of interventions that can help patients, siblings, and parents cope with distress and promote emotional health and well-being, and developing policies that minimize barriers to access and the need to move across regions for medical treatment, is important.

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