Cancer in children

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Introduction

Every cell in our bodies is tightly regulated with respect to growth, interaction with other cells, and even its life span. Cancer occurs when a type of cell has lost these normal control mechanisms and grows in a way that the body can no longer regulate. All kinds of cancer, including childhood cancer, have a common disease process-cells grow out of control, develop abnormal sizes and shapes, ignore their typical boundaries inside the body, destroy their neighbor cells, and can ultimately spread or metastasize to other organs and tissues.

Definition of cancer

Cancer is defined as a group of diseases characterized by uncontrolled growth of tissue cells in the body and the invasion by these cells into nearby tissue and migration to distant sites.

Cancer cells spread in one of two ways:

(1) by invasion, in which cells grow in an unrestricted disorderly fashion at the sites of origin

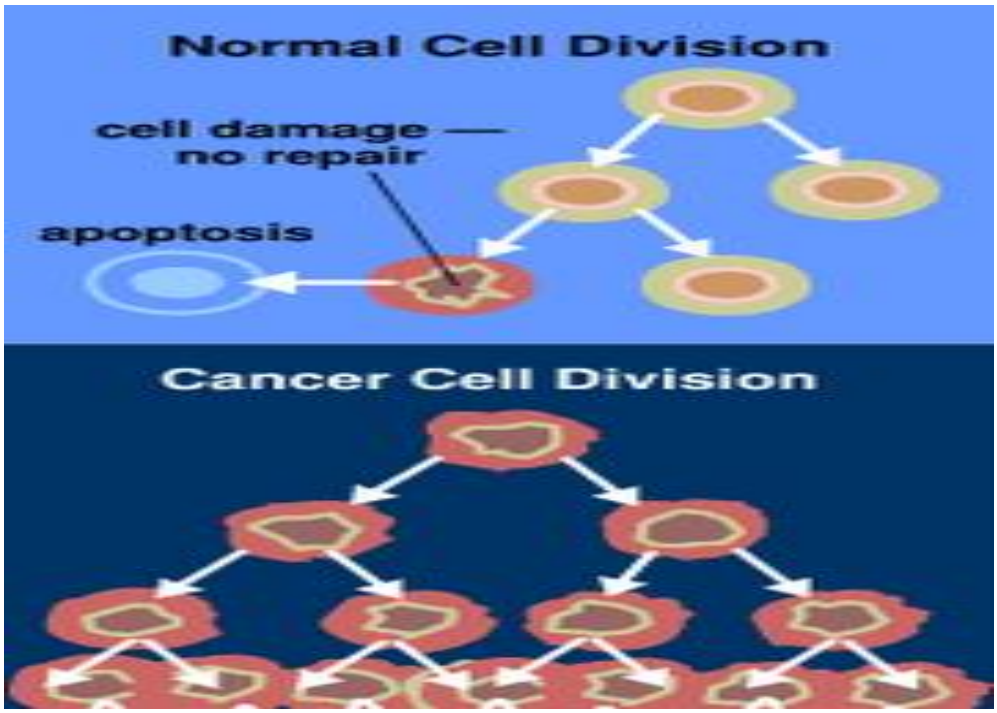
(2) by metastasis, in which the cells grow in sites other than the site of the primary cancer.

The cancerous cells grow progressively, which cells have lost the ability to perform their intended functions because changes in the cells deoxyribonucleic acid (DNA) cause wrong information to be transmitted. As the cancerous cells continue to proliferate, they crowd out normal cells and compress vascular structures and vital organs, which result in symptoms.

Types of tumors:

Tumors can be benign or malignant.

- **A benign tumor** is not cancer, and it is slow growing, does not invade surrounding tissue, and once removed, does not usually recur.
- A **malignant tumor** is cancerous, it invades surrounding tissue and spreads to nearby or distant organs (metastasis). If the cancerous cells have spread to surrounding tissue, even after the malignant tumor is removed, it will typically recur.



Causes of Childhood Cancer

The cause of cancer is not known. While there are numerous hypotheses concerning its origin,

- Chromosome abnormalities have also been found in children with acute leukemia and lymphoma.
- Children with immune deficiencies, such as acquired immune deficiency syndrome (AIDS), or children whose immune system has been suppressed, such as following transplant procedures, are at a greater risk for developing various cancers.

- Drugs, particularly those containing radioisotopes and immunosuppressive agents, can increase the risk of developing childhood cancer.
- Several environmental agents that are carcinogenic. One of these (ionizing radiation) has been implicated in children.

- Other factors associated with increased risk of cancer are parental occupational exposures to chemicals, solvents, paints and pesticides, maternal alcohol use, cigarette smoking during pregnancy, and maternal history of prior fetal loss.

Signs and Symptoms of Cancer in Children

It may be:-

- Mass - Purpura
- Pallor - Weight loss
- Vomiting in early morning
- Recurrent or persistent fever
- Bone pain - Headache
- Persistent lymphadenopathy, change in balance, gait, or personality, fatigue, and malaise

The types of childhood cancer include:

- Bone marrow cancers as (Leukemia)
- Central nervous system cancers as (Brain tumors, Neuroblastoma)
- Lymphomas
- Kidney cancers as (Wilms' tumor)
- Bone cancers as (Osteosarcoma)
- Retinoblastoma

1- Leukemia:

Leukemia is a cancer of the bone marrow. It accounts for approximately 35% of all childhood cancers; approximately 1 in 1000 children will be diagnosed with leukemia by the age of 19, although it is more common in children under the age of 10.

In leukemia, the abnormal white blood cells are not mature, and therefore cannot carry out their infection-fighting function in the blood. These cells crowd out healthy white blood cells, as well as the red blood cells which carry oxygen to the body and the platelets which cause the blood to clot.

Types of leukemia include:

- **Acute Lymphoblastic Leukemia (ALL):** The most common childhood cancer. Almost 75% of children with leukemia have ALL, a cancer of the lymphoid cells in the bone marrow and the lymphoid organs of the body. They are involved in the body's immune system.
- **Acute Myelogenous Leukemia (AML):** AML (also called acute myeloid leukemia, acute nonlymphatic leukemia or ANLL) is cancer of the myeloid blood cells which are produced in the bone marrow and which help fight bacterial infections.

Causes of Leukemia:

The etiology for ALL and AML is genetic factors; chromosomal abnormalities, familial predisposition, environmental factors; ionizing radiation, chronic chemicals exposure, use of alkylating agents for treatment of malignant disease and possible viral infection.

Signs and Symptoms

- lethargy, weakness, paleness, dizziness
- back, leg, and joint pain, headache, trouble standing or walking
- easy bruising, unusual bleeding, frequent nose bleeds, bleeding gums, petechiae (red pinpoints on the skin)
- repeated, frequent infections
- fever that lasts for several days
- loss of appetite, weight loss
- swollen lymph nodes, bloated or tender stomach, swollen liver or spleen
- night sweats
- irritability

The doctor should:

- check for enlarged liver, spleen, or lymph nodes
- take blood for a complete blood test (CBC, with differential)

A child with leukemia will most likely show a blood test with:

- decreased red cells (low hemoglobin count)
- possible blast cells (lymphoblasts, leukemia cells)
- decreased platelets
- a low level of normal white blood cells
- increased lymphocytes

Keep in mind that about 10% of the patients with leukemia will show a normal blood test at the time of diagnosis. To confirm that the disease is leukemia, a bone marrow test must be done.

Diagnosis

- Hemogram shows: Anemia and thrombocytopenia. White blood count (WBCS): < 10,000/mm3 in 50%, >50,000/mm3 in 20%. Blast cells in peripheral hemogram are suggestive of diagnosis of leukemia.
- Blood tests. Tests such as a complete blood count, liver and kidney function panels, and blood chemistries can give important information about the number of normal blood cells in the body and how well the organs are functioning.
- Bone marrow aspiration.
- Imaging studies. These may include an X-ray, CT scan, MRI, or ultrasound to check for an enlarged spleen or liver, and also to rule out any other possible causes of a child's symptoms.
- Lumbar puncture. Also called a spinal tap
- Flow cytometry tests. By analyzing the properties of the cancer cells
- Chromosomal tests. By analyzing DNA from your child's blood or bone marrow
- Tissue typing or HLA (human leukocyte antigen) typing. If a child needs a stem cell transplant (also called a bone marrow transplant),
- a lymph node biopsy

Treatment of leukemia

Treatment of leukemia consists of different procedures, one of which is bone marrow transplantation (BMT). During this treatment, high doses of chemotherapy and sometimes radiation are administered to the patient to kill the existing bone marrow and its functioning. Then, the patient receives the infusion of the replacement bone marrow. After this

transfusion, the bone marrow does not function normally, putting the patient at risk for infection, so the patient is required to stay in protective isolation until normal bone marrow begins, which can take two or four weeks. The patient is at risk for serious complications or death due to the lack of bone marrow functioning for an extended period of time, the high-intensity therapy, or donor rejection or mismatch

2.Wilms tumor:

Wilms tumor (also called Wilms' tumor or nephroblastoma) is a type of cancer that starts in the kidneys. It is the most common type of kidney cancer in children. It is named after Max Wilms, a German doctor who wrote one of the first medical articles about the disease in 1899.

Signs and symptoms

- A swollen abdomen, which is usually painless. Sometimes a parent or carer may feel a lump in the abdomen which can be quite large. Occasionally, the tumour may bleed slightly and this can irritate the kidney and may be painful. There may be blood in your child's urine, or their blood pressure may be raised.
- The child may also have a high temperature (fever)
- upset stomach
- Weight loss or a lack of appetite.

Diagnosis

- An abdominal ultrasound scan is usually the first thing that is done.
- an MRI and/or CT scan of the abdomen and chest.
- Urine and blood samples
- A biopsy, where a sample of tissue is taken from the tumour to confirm the diagnosis.

Treatment of Wilms' tumour

Surgery: All children with Wilms' tumour will have surgery. Initially, this may only involve taking a small sample of cells from the tumour to confirm the diagnosis. This is called a biopsy and is usually done under a general anaesthetic using a needle inserted through the skin.

Chemotherapy: Chemotherapy is the use of anti-cancer (cytotoxic) drugs to destroy cancer cells. It's usually given as an injection or drip into a vein (intravenously). Chemotherapy given before surgery is called neoadjuvant chemotherapy.

Radiotherapy: Radiotherapy treats cancer by using high-energy rays to destroy the cancer cells, while doing as little harm as possible to normal cells. Radiotherapy may occasionally be used to shrink tumours that are too large to remove surgically. This will, ideally, allow an operation to be done. Radiotherapy can also be used when tumours have spread elsewhere in the body.

3. Lymphomas

lymphoma is a cancer of the lymph nodes,. There are two types of Lymphoma; Non Hodgkin lymphoma (NHL) and Hodgkin lymphoma differ from NHL.

1- **Non Hodgkin lymphoma (NHL):** It is the most common in preadolescents and adolescents.

Signs and symptoms

Its most common symptoms include:

- Enlarged lymph nodes.
- Difficulty breathing because of enlarged lymph nodes in the chest, an abdominal tumor from enlarged lymph nodes.
- Fever, weight loss, dysphagia,
- Dysapnea, and lethargy.
- This cancer tends to metastasize to other areas rapidly, most commonly to the bones, CNS, and the bone marrow due to the link between the lymph node system and the immune system. It has been predicted that the incidence of NHL may increase as the AIDs virus increases.

2- Hodgkin lymphoma (differ from NHL): It usually demonstrates a slower onset and an orderly progression, involving contiguous lymph node areas. Its peak incidence occurs in late adolescence, early adulthood and middle age.

Treatment

Treatments for lymphomas include chemotherapy, medication, radiation therapy and possibly Cranial Radiation Therapy (CRT) if the cancer has spread to the CNS. Treatment may be inpatient or outpatient, and although the survival rate depends on the type of lymphoma, the prognosis is generally excellent.

4. Retinoblastoma:

It is cancer of the eye, or is a malignant tumor of the retina. It is often present at birth, and 40% of the cases are hereditary. It is caused by a

genetic abnormality. This means that an abnormal gene, which can be passed from a parent to their child, allows the tumor to develop.

Signs and symptoms

- The first sign of the condition is often a white pupil that does not reflect the light (leukokoria),
- Squinting,
- Strabismus, orbital inflammation and other vision problems.

Treatment

It has various treatments; surgery (resection, enucleation with extensive disease; salvage of one eye attempted in bilateral disease); the most severe cases may require chemotherapy and/or radiation therapy; Cryotherapy, laser photocoagulation, .if it is treated early, a complete cure is possible.

5. Brain tumors:

Brain tumors are the second leading causes of childhood cancer, accounting for about 15% of all childhood malignancies, brain tumors occur mainly in children between ages of five and 10 years.There are many types of brain tumors, the most common are called gliomass

Treatment

Treatment of brain tumors requires surgical removal of the tumor; this includes laser surgery and microsurgery. Some tumors, however may not be completely removed due to their precarious location as, the brain stem, these tumors, in addition to recurring

tumors, may require chemotherapy and cranial radiation therapy

Diagnosis of cancer

The diagnosis of cancer includes any number of laboratory tests, but most often;

- **A complete blood count and chemistry**
- **Urine analysis should be done.** Malignancies of the blood-forming organs manifest signs early, and these frequently cause decreased elements of the blood, increased production of immature cells, or overproduction of some cells, such as leukocytosis. Because many of the chemotherapeutic agents depress bone marrow function, repeated blood counts are a constant feature of follow-up care

- **Blood chemistry:** It yields important information concerning renal and liver function and electrolyte balance. evaluation of renal and liver function is important not only for detection of cancer or metastasis to these organs, but also for monitoring during treatment because of the extra burden placed on these systems to metabolize and excrete the chemotherapeutic drugs. Consequently, regular blood chemistries and urinalysis are standard procedures through the course of the disease.

- **Lumbar puncture (LP):** It is a routine test employed in leukemia, brain tumors, and other cancers that may metastasize to the spinal cord and brain. An LP is also performed to administer intrathecal drugs, such as methotrexate and cytosine arabinoside when this mode of administration is part of the treatment.

- **Imaging studies:** Advances in imaging procedures have greatly aided in the diagnosis of solid tumors and have minimized the need for invasive techniques. Depending on the suspected site of the malignancy, the initial preliminary radiological studies include conventional films of the chest, abdomen, bone, and skull and more specialized tests such as the intravenous (IV) pyelogram for kidney involvement. However, these radiographs are generally followed by much more sophisticated imaging procedures, including

- **Computed Tomography (CT), ultrasound, nuclear scan**

- **Magnetic resonance imaging (MRI)**

- **Biopsy:** Biopsies are essential to determine the classification and stage of the disease. Classification refers to the biologic characteristics of the tumor, and staging refers to the extent of the disease at the time of diagnosis

Prognosis of Childhood Cancer

Most cancers show good cure rates if detected and treated at early stages. The prognosis involves the type of cancer, its degree of invasiveness, and the extent of metastasis at diagnosis. In addition, age, general health status, and response to treatment are important factors.

Treatment of Childhood Cancer

It includes chemotherapy, radiation, surgery, bone marrow and stem cell transplantation and biologic response modifiers.

Medical treatment of cancer

A- Chemotherapy

It is the use of drugs (anti-neoplastic agents) to kill cancerous cells. Different drugs have different side effect profiles and modes of action. Chemotherapy may be given orally, intravenously, intramuscularly, subcutaneously, or intrathecally (via the spinal column). Rarely, it may be given directly into a body cavity (i.e., intraarterial, intraperitoneal) for direct action. Depending on the protocol, a child may be hospitalized for chemotherapy, receive it on an outpatient basis, or be treated at home.

The Side Effects of Chemotherapeutic agents

-**Anemia:** Chemotherapy can reduce the bone marrow's ability to make red blood cells.

- Infection: Chemotherapy can make more likely to get infections. This happens because most anticancer drugs affect the bone marrow.

- Fever: It is frequently the only indication of infection. Health care providers and families must remain acutely aware of elevated body temperature.

- **Pain:** Chemotherapy drugs can cause some side effects that are painful. The drugs can damage nerves leading to burning, numbness and tingling or shooting pain, most often in the fingers or toes. Some

drugs can also cause mouth sores, headaches, muscle pains, and stomach pains .

- Constipation: Some anticancer medicines, pain medicines, and other medicines can cause constipation. It can also occur if the child is less active or if his diet lacks enough fluid or fiber. .

- Nausea and vomiting: Chemotherapy agents cause nausea and vomiting for a variety of reasons. One reason is irritating the lining of the stomach and duodenum.

- **Anorexia:** Decreased appetite is generally temporary and returns when chemotherapy is finished. It may take a few weeks after chemotherapy is finished for child' appetite to recover. Some chemotherapy may cause more severe loss of appetite (Internet publisher D, 2003).

- **Mucositis and esophagitis:** Certain chemotherapeutic agents cause sloughing of the mucosal tissue of the Gastro Intestinal (GI) tract, leading to the development of mucositis and esophagitis, this condition can be painful bacteria and yeasts, present as a part of the normal digestive process in the mouth and gut, may cross the open skin and are absorbed into the blood stream. The presence of breaks in the integument may lead to bacterial infections of the blood.

- Hair loss: It has a tremendous psychological effect, especially on the school-age and adolescent population. Hair Loss (alopecia) and scalp sensitivity are common side effects of chemotherapy because anticancer drugs often kill the healthy cells responsible for hair

growth. The child's hair may become thinner and then fall out completely or in clumps. Hair thinning and hair loss may occur all over the body during treatment including the head, face, arms, legs, underarms, and pubic area .

B- Radiation Therapy

The use of radiation as a treatment modality is not without risk. Radiation exposure has been linked to the development of certain types of cancer, and radiation exposure to treat cancer may lead to the development of a second malignancy. Radiation therapy slows the growth of tumors and kills rapidly dividing cells none selectively. Unfortunately, in a developing child normal cell development may not be complete when radiation exposure occurs.

Radiation may be given curatively to eradicate disease or plaintively in low doses to prevent further growth of a tumor. Total body irradiation given before some bone marrow transplantations (BMTs) attempts to eradicate microscopic diseases and promote bone marrow suppression. Radiation may be given in hyper fractionated doses, in which the daily dose is split into smaller doses given more frequently to minimize side effects .

The Possible Side Effects of Radiation:

The side effects usually appear 6 to 10 days after the initiation of therapy. Acute side effects usually dissipate within days or a few weeks of cessation of the radiation therapy.

- **Erythema:** Within the radiated area erythema is the most common side effect. **Fatigue** associated with therapy may necessitate more frequent rest periods than parents are used to their child taking **anorexia, nausea, and vomiting** commonly occurs. Radiation therapy will also cause bone marrow suppression, depending on the dose and site of therapy**,** and **alter cognitive potential** (Hockenberry and Kline, 2006).

C- Surgery

Surgery is frequently part of cancer therapy for children. The surgery may be limited to a biopsy or be used to remove a solid tumor mass. The purpose of a biopsy is to obtain a small piece of tumor for microscopic examination. Examination of the tissue by a pathologist confirms the tumor type and influences therapy decisions. Surgery may also be used to debulk or resects a solid tumor mass. In some diseases, the tumor cannot be resected at the beginning of therapy. After the child has received some chemotherapy the mass may decrease in size and a less extensive surgical procedure may be performed (Ashwill, 2002).

D- Bone Marrow and Stem Cell Transplantation

In recent years, the use of bone marrow or stem cell transplantation has become an accepted therapy for the treatment of several hematological and oncologic disorders. Transplantation

allows physicians to give extremely high doses of chemotherapy (with or without radiation) without regard for bone marrow recovery. BMT uses bone marrow to reconstitute the immunologic function of the patient after high dose chemotherapy. **Stem cell transplantation** uses a unique immature cell present in the peripheral circulation to restore immunologic function in a similar manner. Stem cells are able to differentiate into any type of hematological cell. The healthy bone marrow or stem cells are infused into the blood stream and migrate to the marrow space to replenish the patient's immunologic function.

E- Biologic Response Modifiers

The most recent additions to cancer therapy are the "biologic response modifiers". They are naturally occurring substances found in small quantities in the body that influence immune system functions (e.g., Colony-Stimulating Factors [CSFs]. Used to enhance cell recovery, different CSFs work on different types of blood cells to reduce the time and severity of bone marrow suppression.

The role of the nurse in cancer care

- Support the idea that cancer is a chronic illness that has acute exacerbations rather than one that is synonymous with death and suffering.
- Assess own level of knowledge relative to the pathophysiology of the disease process.
- Make use of current research findings and practices in the care of the patient with cancer and his or her family.
- Identify patients at high risk for cancer.
- Participate in primary and secondary prevention efforts.

- Assess the nursing care needs of the patient with cancer.
- Assess the learning needs, desires, and capabilities of the patient with cancer.
- Identify nursing problems of the patient and the family.
- Assess the social support networks available to the patient.
- Plan appropriate interventions with the patient and the family.
- Assist the patient to identify strengths and limitations.
- Assist the patient to design short-term and long-term goals for care.
- Implement a nursing care plan that interfaces with the medical care regimen and that is consistent with the established goals.
- Collaborate with members of a multidisciplinary team to foster continuity of care.
- Evaluate the goals and resultant outcomes of care with the patient, the family, and members of the multidisciplinary team.
- Reassess and redesign the direction of the care as determined by the evaluation.