

## A MINI REVIEW: CANCER, TYPES AND ITS TREATMENT ALONGWITH ITS COMPLICATIONS

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### ABSTRACT

People differ from one another in many ways, including how our bodies work. How our bodies differ is still being studied; but some key differences are already known. Cancer can cause symptoms like pain and fatigue. Cancer treatment is used to remove or destroy cancer cells either by chemotherapy, surgery radiation but can also cause side effects. Side effects are unhealthy or unpleasant physical or emotional reactions to treatment. Side effects can also include pain or fatigue as well as many other symptoms. Not every patient with cancer gets symptoms. It depends on many factors. Such factors include the type and stage of cancer, and the type, length, and amount of treatment. In any case, relief from symptoms is often possible.

**Keyword:** Cancer treatment, Types and stages, Cancer complications.

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### INTRODUCTION

Abnormal and unregulated proliferation (growth) of cells, arising from cells of a specific organ. In cancer cells the normal control systems that prevent cell overgrowth and the invasion of other tissues are disabled. These altered cells divide and grow in the presence of signals that normally inhibit cell growth; therefore, they no longer require special signals to induce cell growth and division. As these cells grow they develop new characteristics, including changes in cell structure, decreased cell adhesion, and production of new enzymes. The abnormalities in cancer cells usually result from mutations in protein-encoding genes that regulate cell division. Over time more genes become mutated Alterations in the same gene often are associated with different forms of cancer [1].

These malfunctioning genes can be broadly classified into three groups. 1. The first group, called proto-oncogenes, produces protein products that normally enhance cell division or inhibit normal cell death. The mutated forms of these genes are called oncogenes, 2. The second group, called tumor suppressors, makes proteins that normally prevent cell division or cause cell death, 3. The third group contains DNA repair genes, which help prevent mutations that lead to cancer. Cancer cells have the

ability to create their own blood supply, break away from the organ of origin, travel, and spread to other organs of the body [2].

### TYPES OF CANCER

#### Carcinoma

Carcinoma or “Solid” tumors refers to cancers that arise from epithelial surfaces and cells that line glands. Its major types are Adenocarcinoma (any gland - breast, prostate, lung, pancreas, ovary, colon), Squamous cell carcinoma (any surface or lining of mucous membrane - skin, lung, head and neck), and Others (urothelial -bladder, islet - pancreas).

#### Lymphomas

Lymphoma (also termed lymphatic cancer) is a type of cancer involving cells of the immune system, called lymphocytes. Hodgkin’s lymphoma (Hodgkin’s disease develops from a specific abnormal B lymphocyte lineage) and Non-Hodgkin’s lymphoma (NHL may derive from either abnormal B or T cells and are distinguished by unique genetic markers).

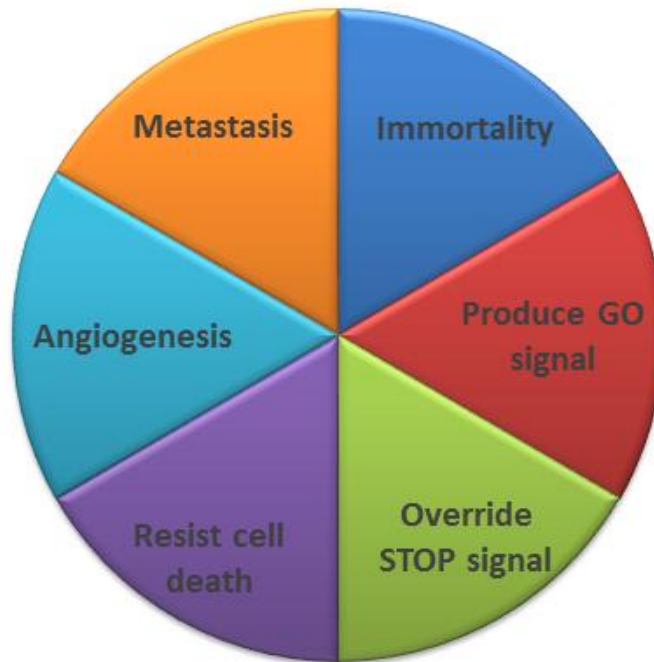
#### Leukemia

Malignant cells arising from cells of the bone marrow. White cells (myeloid cells, lymphoid cells, monocytes), Red cells (erythroleukemia), Platelets (megakaryocytic leukemia), Plasma cells (myeloma).

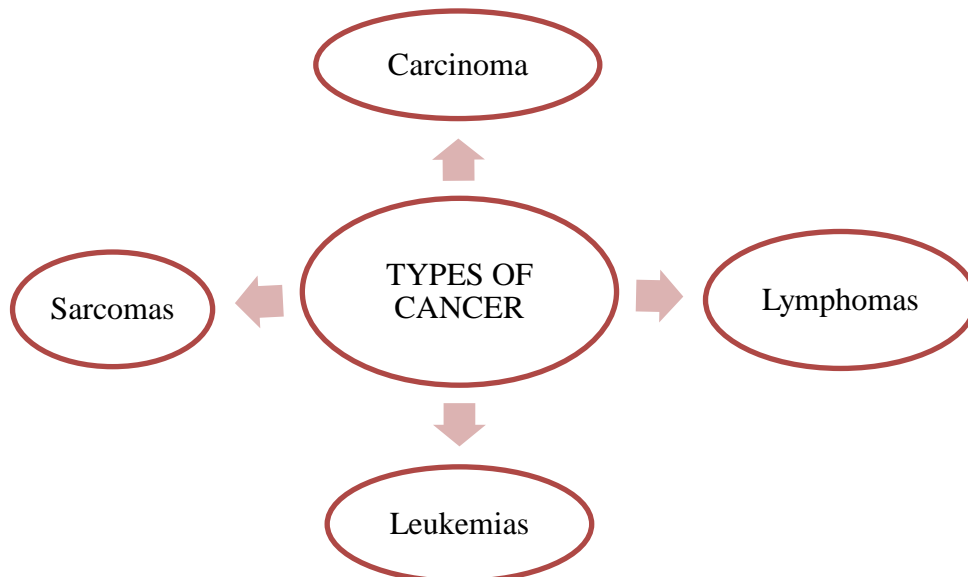
**Sarcomas**

Arise from soft tissues or bone, osteosarcoma (bone), chondrosarcoma (cartilage), synovial cell sarcoma

(joint), leiomyosarcoma (muscle), liposarcoma (fat), rhabdomyosarcoma (primitive muscle), angiosarcoma (blood vessel, Kaposi's) [3].



**Figure 1:** Hallmarks of cancer. [3]



**Figure 2:** Types of cancer.

## CANCER TREATMENT

### Chemotherapy

Chemotherapy is the use of medicines or drugs to treat a disease, such as cancer. Many times this treatment is just called chemo. Chemo can work throughout the whole body. Chemo can kill cancer cells that have metastasized or spread to parts of the body far away from the primary (original) tumor. More than 100 chemo drugs are used in many combinations. A single chemo drug can be used to treat cancer, but often multiple drugs are used in a certain order or in certain combinations called combination chemotherapy. Multiple drugs with different actions can work together to kill more cancer cells. This can also reduce the chance that the cancer may become resistant to any one chemo drug [4].

#### Goal of Chemotherapy

Depending on the type of cancer, its stage and where you are in the treatment process, chemo can be used to: 1. Cure the cancer, 2. Keep the cancer from spreading, 3. Slow the cancer's growth, 4. Kill cancer cells that may have spread to other parts of the body, 5. Relieve symptoms caused by cancer.

#### Chemotherapy Routes

##### Intravenous

Most chemo drugs are put right into your bloodstream through a tiny, soft, plastic tube called a *catheter*. A needle is used to put the catheter into a vein in your forearm or hand; then the needle is taken out, leaving the catheter behind. This is called IV treatment. Intravenous drugs are given in these ways. The drugs can be given quickly through the catheter right from a syringe over a few minutes. This is called an IV push. An IV infusion can last from 30 minutes to a few hours. A mixed drug solution flows from a plastic bag through tubing that's attached to the catheter. The flow is often controlled by a machine called an IV pump. Continuous infusions are sometimes needed and can last from 1 to 7 days. These are always controlled by electronic IV pumps. Another option is the central venous catheter (CVC). The CVC is a bigger catheter that's put into a large vein in the chest or upper arm. It stays in as long as you're getting treatment so you won't need to be stuck with a needle each time. With a CVC, IV medicines can be given more easily. Blood can also be drawn from CVCs.

##### Oral Route

This means by mouth. You swallow the chemo as a pill, capsule, or liquid. This is usually more convenient because the chemo can often be taken at home. If you take chemo drugs by mouth, it's very important to take the exact dosage, at the right time, for as long as you're supposed to do so.

##### Intrathecal

The chemo is put into the spinal canal and goes into the fluid that surrounds your brain and spinal cord. This fluid is called the cerebrospinal fluid or CSF. Chemo put into the CSF is carried throughout the brain and spinal cord. It may either have a needle put right into your spine to quickly give the drug, or a long-term catheter and port can be put under the skin on your head during surgery. This port is called an Ommaya reservoir. The Ommaya is a small drum-like device that has a small tube attached to it. The tube goes into the CSF in a cavity of your brain. The Ommaya stays in place under your scalp until treatment is done.

##### Intra-arterial

The chemo drug is put right into an artery to treat a single area (such as the liver, an arm, or leg). This method helps limit the effect the drug has on other parts of the body and is called *regional chemo*.

##### Intracavitary

Chemo drugs may be given through a catheter into the abdominal cavity (the space around the bowels and other organs in the belly; this is called intraperitoneal *chemo*) or chest cavity (the space around the lungs and other organs in the chest).

##### Intramuscular

The drug is put in through a needle into a muscle (as an injection or shot).

##### Intralesional

A needle is used to put the drug right into a tumor in the skin, under the skin, or in an internal organ.

##### Topical

The drug is put right on an area of cancer on the skin as a cream, gel or ointment [4].

## CLASSIFICATION OF ANTICANCER DRUGS

### According to Chemical Structure

Examples: Alkylating agents, Antimetabolites, Plant derivatives, Antibiotics, Hormones, Miscellaneous etc.

### According to Cycle or Phase Specificity of Drugs

Cancer drugs can be divided into two classes. 1. Cell Cycle Specific Agents (e.g., Plant Alkaloids, Antimetabolite, Antitumor Antibiotics, 2. Cell Cycle Non-Specific Agents (e.g., Alkylating Agents, Antibiotics, Platinum Compounds [5, 6].

### ALKYLATING AGENTS

Alkylating agents work by reacting with protein that bond together to form very delicate double helix structure of DNA molecule, adding an alkyl group to some or all of them. This prevents the proteins from linking up as they should, & cause breakage of the DNA strands and eventually, the death of the cancer cells [7-9].

### ANTIMETABOLITES

Antimetabolites induce cell death during S phase of cell growth, when incorporated into RNA and DNA

or inhibit enzymes needed for nucleic acid production.

### GENERAL NUCLEAR MEDICINE

Nuclear medicine imaging uses small amounts of radioactive materials called radiotracers that are typically injected into the bloodstream, inhaled or swallowed. The radiotracer travels through the area being examined and gives off energy in the form of gamma rays which are detected by a special camera and a computer to create images of the inside of your

body. Nuclear medicine imaging provides unique information that often cannot be obtained using other imaging procedures and offers the potential to identify disease in its earliest stages. It uses small amounts of radioactive material to diagnose and determine the severity of or treat a variety of diseases (many types of cancers, heart disease, gastrointestinal, endocrine, neurological disorders and other abnormalities within the body).

**Table 1:** Alkylating agents for cancer treatment.

Class	Examples	Route	Use in cancer	Adverse drug effects
Nitrogen Mustard	Cyclophosphamide	Oral (tablet, liquid), IV	Lymphoma, Leukemia	Neutropenia, Fever, Vomiting, Alopecia, Diarrhea
	Ifosfamide	IV	Lymphoma, Leukemia, Bladder cancer	Alopecia, Vomiting, Leukopenia, Thrombocytopenia, Hematuria
Alkyl Sulfonate	Busulfan	Oral	CML (chronic myeloid leukemia)	Myelosuppression, Nausea, Stomatitis, Anorexia, Lymphopenia
Nitrosoureas	Carmustine,	IV	Lymphoma, Multiple Myeloma, Glioma	Dark urine, Abdominal pain, dizziness, Nausea, Vomiting, Trouble breathing
	Lomustine	Oral	Cancer of Brain, Hodgkin Lymphoma	Slurred speech, Hair loss, loss of appetite, Decreased urination, SOB
Triazine	Dacarbazine	IV	Hodgkin Lymphoma, Malignant Melanoma	Leukopenia, Nausea, Vomiting, Anorexia, Injection site pain
Ethylenimine	Thio-TEPA	IV, Intrabladder	Lymphoma, Cancer of Breast, Ovary, Bladder	Dizziness, Irregular heartbeat, Nose bleed, Sore throat, Vomiting, Nausea

**Table 2:** Antimetabolites for cancer treatment.

Class	Examples	Route	Use in cancer	Adverse drug effects
Folate Antagonists	Methotrexate	Oral, IV, IM	Use in Breast, Head, Neck & colorectal carcinoma, Non-Hodgkin Lymphoma	Mouth sores, Anemia, Bone pain, Dizziness, Discoloration of skin, Kidney problems
Purine Antagonists	Fludarabine	IV	Non-Hodgkin Lymphoma, T-cell Lymphoma	Jaw pain, Vomiting, Ulcer, Difficult urination, Chest pain
	6-MP (6-Mercaptopurine)	Oral	Lymphoblastic Leukemia	
Pyrimidine Antagonists	5-FU (5-fluorouracil)	IV	Use in Breast, Head, Neck, Colon, Rectal, Pancreatic carcinoma	
	Cytarabine	Intrathecal	Acute Myelogenous Leukemia	

Nuclear medicine imaging procedures are noninvasive and, with the exception of intravenous injections, are usually painless medical tests that help physicians diagnose and evaluate medical conditions. These imaging scans use radioactive materials called radiopharmaceuticals or radiotracers. Depending on the type of nuclear medicine exam, the radiotracer is either injected into the body, swallowed or inhaled as a gas and eventually accumulates in the organ or area of the body. Radioactive emissions from the radiotracer are detected by a special camera or imaging device that produces pictures and provides molecular information.

Nuclear medicine images can be superimposed with computed tomography (CT) or magnetic resonance imaging (MRI) to produce special views, a practice known as image fusion or co-registration. In addition, manufacturers are now making single photon emission computed tomography/computed tomography (SPECT/CT).

#### **Computed Tomography**

A CT (computed tomography) scan, also known as a “CAT” scan, uses x-rays to form pictures of the inside of the body. During a regular x-ray procedure, a stationary machine sends x-rays through the body to make a single “shadow” picture. In CT, the x-ray machine rotates around the body, taking multiple pictures at different angles that allow a computer to make a detailed image of the patient’s anatomy. This 3-D imaging system provides much more information than a regular x-ray

#### **Magnetic Resonance Imaging (MRI)**

MRI scans use magnets and radio waves to make detailed cross-sectional images of the inside of the body. MRI scans may be used; 1. to diagnose and assess lymphomas of the central nervous system, the head and neck, 2. to assess whether the bone marrow is affected by lymphoma, and 3. to assess lymphoma in pregnant women and children, instead of using scans that use radiation to assess lymphoma in people who are allergic to the contrast agents used in CT scans and PET/CT scans.

#### **Single Photon Emission Computed Tomography/Computed Tomography (SPECT)**

SPECT involves the rotation of the gamma camera heads around the patient's body to produce more detailed, three-dimensional images.

#### **Benefits of Nuclear Medicine**

Nuclear medicine examinations provide unique information including details on both function and anatomic structure of the body that is often unattainable using other imaging procedures. For many diseases, nuclear medicine scans yield the most useful information needed to make a diagnosis or to determine appropriate treatment, if any. Nuclear medicine is less expensive and may yield more

precise information than exploratory surgery. Nuclear medicine offers the potential to identify disease in its earliest stage, often before symptoms occur or abnormalities can be detected with other diagnostic tests. By detecting whether lesions are likely benign or malignant, PET scans may eliminate the need for surgical biopsy or identify the best biopsy location. PET scans may provide additional information that is used for radiation therapy planning.

#### **Risks of Nuclear Medicine**

Because the doses of radiotracer administered are small, diagnostic nuclear medicine procedures result in relatively low radiation exposure to the patient, acceptable for diagnostic exams. Thus, the radiation risk is very low compared with the potential benefits. Allergic reactions to radiopharmaceuticals may occur but are extremely rare and are usually mild. Injection of the radiotracer may cause slight pain and redness which should rapidly resolve [16].

#### **RADIATION THERAPY FOR CANCER TREATMENT**

Radiation therapy is a local treatment it affects cancer cells only in treated area. The use of high energy rays to damage cancer cells stopping them from growing and dividing. X rays, Gamma rays. Sometimes also known as external beam therapy. That focuses the radiation from a source outside the body on the Cancer.

#### **Radiation Therapy for Kidney Cancer**

Radiation therapy is more often used to palliate or ease symptoms of kidney cancer such as pain, bleeding or other problem caused by cancer spreading to brain and bones. This procedure is usually painless. Before the treatment the medical team takes measurements to determine correct angle for aiming radiation beams and proper dose of radiation. Each treatment lasts only a few minutes. A special type of radiation therapy known as stereotactic radiosurgery. This does not actually involve surgery; they both use same type of pinpoint radiation. In one technique; many thin beams of radiations are focused on the tumour from different angles over a few minutes to hours. The second technique; uses a movable linear accelerator (A machine that produces X RAY beams) that is controlled by a computer.

#### **Radiation Therapy for Breast Cancer**

There are two main types of radiation therapy that can be used to treat breast cancer.

#### **External Beam Radiation**

This type of radiation comes from a machine outside the body.

#### **Internal Radiation**

For this treatment a radioactive source is put inside the body for a short time. Not all the women with breast cancer need radiation therapy but it may be used in several situations: 1. After breast conserving

surgery to help lower the chances that the cancer will come back in the breast or nearby lymph nodes, 2. After a Mastectomy, especially if the cancer was larger than 5cm (about 2 inches), 3. If the cancer is spread to Bone and Brain, 4. If the lymph nodes are found under the arm (Axillary lymph nodes) radiation may be given to this area as well. In some cases, the area treated may include the nodes above the collarbone (Supraclavical lymph nodes) and the node beneath the breastbone in the center of the chest (internal mammary lymph nodes) [17].

**Possible Side Effects of Radiation Therapy**

This includes skin changes, hair loss, nausea, diarrhea, tiredness. Radiation therapy for chest area can damage the lungs and cause shortness of breath.

**COMPLICATIONS OF CANCER**

**Neutropenia**

It is defined as decrease in number of White blood cells (WBCs). These cells fight off against infection [18]. It is particularly lower level of neutrophils, type of WBCs. These cells protect body from bacterial infection (first line defense) [19]. Cancer fighting drugs work by killing rapidly growing cells in body. These drugs kill cancer cells as well as healthy white blood cells in body [20]. Chemotherapy induced neutropenia (CIN) is the major dose limiting toxicity of systematic cancer, and it is associated with substantial morbidity, mortality, and costs [21]

**Chemotherapy Induced Neutropenia**

Normal absolute neutrophil count (ANC) ranges from 2500-6000 neutrophils per cubic millimeter [22]. On the basis of level of neutrophils, neutropenia can be categorized into three degrees (Table 4) [23]. The type and dose of chemotherapy drugs affect neutrophil level, which is decreased. Generally, they start to drop about a week after chemotherapy begins. Neutrophil level reaches a low point about 7 to 14 days after treatment. At that low point, infection

develops. Neutrophil count starts to rise again. This occurs when bone marrow resumes normal production of neutrophils. However, it may take 3 to 4 weeks to reach a normal level again. At that point, body is ready for the next cycle of chemotherapy [24].

**Signs and Symptoms of Neutropenia**

Symptoms of neutropenia are related to infections that can develop when body does not have enough neutrophils to fight off bacteria. These may include, fever greater than 100.5 °F, shaking chills, sore throat, cough, shortness of breath, burning with urination or blood in urine, diarrhea, rashes, Redness, swelling, or drainage around an injury [19].

**Risk Factors for Neutropenia**

Patients can have multiple risk factors for developing neutropenia, including type of chemotherapy or radiation, doses, and administration schedule of the treatment regimen. Additionally, high dose density (administration of chemotherapy with less time between treatments), dose intensity (giving the maximum tolerable dose at each administration), and relative dose intensity (a percentage of the dose intensity that is given as a portion of the dose that is planned) also increase the potential for developing neutropenia [25].

**Management of Neutropenia**

Management of neutropenia is most likely supportive and based on severity and duration of neutropenia. Fever and infections occur as complications of neutropenia, require specific treatment [26-28]. In neutropenia, take steps to prevent infection. For example, avoid being around people who have a cold, flu, or other illness. Wash your hands frequently, especially before eating and after using the restroom. During periods of prolonged neutropenia, doctor may recommend antibiotics to prevent infections.

**Table. 3: Types of cancer treatment.**

<b>Treatment of cancer</b>	<b>Agents used</b>	<b>Advantages</b>	<b>Disadvantages</b>
Chemotherapy	Alkylating agents, Antimetabolites	It helpful in cancer cells elimination & also prevents reoccurrence. It can shrink tumor. It slows the cancer cells growth.	It shows side effects like alopecia, constipation etc. It is costly therapy.
Nuclear medicine	Radioactive iodine (I-131)	Sensitive parts of body can be examined in detail. It provides expanded treatment plan for cancer patients.	Cost of these medicines is high. Side effects also appear due to excessive use.
Radiation therapy	X-Rays, Gamma Rays	It is unpainfull. Anesthesia cannot be given during this therapy. It shrinks tumor.	It can damage the surrounding cells & tissues. It kills the tumor cells poorly where oxygen supply is not proper [29-34].

**Table 4:** Categories of neutropenia & absolute neutrophil count.

Category of neutropenia	ANC/mm <sup>3</sup>	Risk infection
Mild neutropenia	1000-1500	No significant risk of infection
Moderate neutropenia	500-1000	Some risk of infection
Severe neutropenia	Less than 500	Significant risk of infection

## CONCLUSION

Cancer is one of the important causes of morbidity. It puts burden on the economy for providing health care. For treatment of cancer patients, hospital beds, sophisticated equipment, & other health care facilities such as trained nurse, oncologists are also provided. Cancer prevention & control is also the most appropriate measure in cancer treatment. Different types of strategies are adopted for treatment of cancer. E.g. use of chemotherapy, nuclear medicines & radiation therapy. In chemotherapy different drugs are used in combination to avoid any complication.

Our study tells about cancer, major types of cancer and their prevalence, treatment of cancer & complications. Survey of cancer hospital shows that, people awareness is insufficient about cancer. So, there is a need to provide awareness to the general public about cancer, its prevention, treatment and side effects. The registration of cancer patient is also not fully controlled so, efforts are required to develop & maintain registries of cancer patients in order to avoid the biasness.

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