

## Cancer review article

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**Abstract - At present, in the modern oncology the damage of the genetic material of the cell is considered to be the primary cause of cancer, and the pathogenesis of cancer is seen as a process of transformation of a normal cell into a tumor cell, as evidenced by deep fundamental research of the pathogenesis of cancer, which is held exclusively at the cellular, molecular and genetic levels. A new growth of tissue called as cancer and the generated new growth called as tumour or any abnormal growths of new tissue called as neoplasm. This is result of excessive, uncontrolled, autonomous, proliferation of tissues as compare to normal tissues of the body.**

Neoplasia is a Latin word means the new growth of tissues. Neoplasm can be recognised by formation of masses of tissues which may be benign or malignant tumor. And the study of tumor called as oncology. Surprisingly, this unfavourable prognosis has been made while the annual financing of scientific research of the cancer problem in the world is increasing enormously, as well as the scholars' optimism regarding the rapid creation of effective cancer drugs. Despite the availability of the important basic knowledge about the cancer biology, the obstacle to the creation of effective cancer treatment in humans exists. In our opinion, this obstacle is the lack of the true pathogenesis of malignant tumor.

**Index Terms - Neoplasia, genetic material, malignant tumor, normal tissues.**

### INTRODUCTION

Neoplasia means a new growth of tissue ,the produced new growth called as neoplasm or tumor. Neoplasm is an abnormal new growth of tissue. This is result of the

excessive, uncontrolled autonomous proliferation of cells or tissues as compare with normal cell of body. Neoplasia is a Latin word means the new growth of tissue .This produced new growth of tissue known as neoplasm or tumor or cancer . Neoplasm can be recognised by formation of masses of tissues.it may be benign or malignant the study of tumor called as oncology. Leounces -tumor, logos-study. Hippocrat establish the term carries for breast cancer in 460-377 bc. Defination of cancer or neoplasm is first proposed by British pathologist Rupert Willis in 1950at molecular level, neoplasm is disorder of growth regulatory genes (proto oncogene and tumor suppressor genes. Different hypotheses have been developed to explain the neoplasia, many of them response to advance in the basic sciences current at the time.[6]

Types of cancer :-

Lung cancer:- Lung cancer is a type of cancer that begins in the lungs. Your lungs are two spongy organs in your chest that take in oxygen when you inhale and release carbon dioxide when you exhale.



Figure (1): lungs cancer

**Breast cancer:** Breast cancer is the most common cancer among American women. One in every eight women in the United States develops breast cancer. There are many types of breast cancer that differ in their capability of spreading (metastasize) to other body tissues. The causes of breast cancer are not yet fully known, although a number of risk factors have been identified. There are many different types of breast cancer. Breast and signs include lump in the breast or armpit, bloody nipple discharge, inverted nipple, orange-peel texture or dimpling of the breast's skin, breast pain or sore nipple, swollen in the neck or armpit, and change in the size or shape of the breast or nipple. Breast cancer is diagnosed during a physical exam, by self-examination of the breasts, mammography, ultrasound testing, and biopsy. Treatment of breast cancer depends on the type of cancer and its stage (0-IV) and may involve surgery, radiation, or chemotherapy.

**Prostate cancer**[20] [21] Prostate cancer affects the prostate gland, the gland that produces some of the fluid in semen and plays a role in urine control in men. The prostate gland is located below the bladder and in front of the rectum.

specific antigen (PSA), helps semen retain its liquid state. An excess of this protein in the blood is one of the first signs of prostate cancer. The urethra is tube through which sperm and urine exit the body. It also passes through the prostate. As such, the prostate is also responsible for urine control. It can tighten and restrict the flow of urine through the urethra using thousands of tiny muscle fibres.

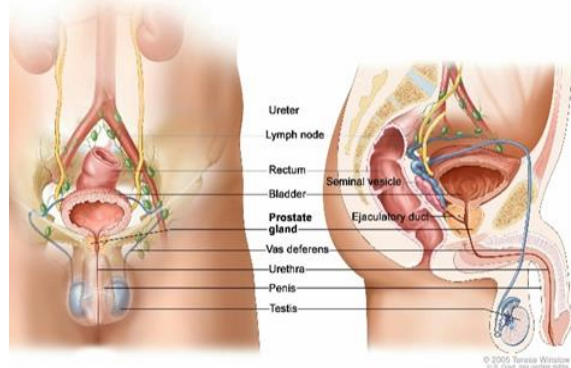


Figure : colon cancer

**Colon cancer:**-The colon, or large intestine, is where the body extracts water and salt from solid wastes. The waste then moves through the rectum and exits the

body through the anus. Colon cancer happens when tumorous growths develop in the large intestine. Colon cancer happens when out-of-control cell growth occurs in the large intestine. Most colon cancer originates from noncancerous, or benign, tumors called adenomatous polyps that form on the inner walls of the large intestine.

Cancerous cells may spread from malignant tumors to other parts of the body through the blood and lymph systems. These cancer cells can grow and invade healthy tissue nearby and throughout the body, in a process called metastasis. The result is a more serious, less treatable condition.

**Basal cell carcinoma** :-[4] it is also known as basal-cell cancer, is the most common type of skin cancer. It often appears as a painless raised area of skin, that may be shiny with small blood vessels running over it or it may present as a raised area with ulceration. Basal-cell cancer grows slowly and can damage the tissue around it but is unlikely to spread to distant areas or result in death.

**Melanoma**:-[12] also known as malignant melanoma, is a type of cancer that develops from the pigment-containing cells known as melanocytes. Melanomas typically occur in the skin but may rarely occur in the mouth, intestines, or eye. In women they most commonly occur on the legs, while in men they are most common on the back.

**Leukemia**:-[25] it also spelled leukaemia, is a group of cancers that usually begin in the bone marrow and result in high numbers of abnormal white blood cells. These white blood cells are not fully developed and are called blasts or leukemia cells.

Types of tumour and its characteristics

#### A. Malignant Neoplasms[2]

Characteristics :

- Less differentiation (or lack of differentiation, called anaplasia)
- Tendency to invade surrounding tissues, Ability to metastasize to distant tissues
- Cytologic features, Increased nuclear size (with increased nuclear/cytoplasmic ratio--N/C ratio). Variation in nuclear or cell size (pleomorphic), Lack of differentiation (anaplasia). Increased

nuclear DNA content with subsequent dark staining on H and E slides (hyperchromatic)

- Prominent nucleoli or irregular chromatin distribution within nuclei.
- Mitoses (especially irregular or bizarre mitoses).

Malignant tumor are of two types :

- carcinoma malignant tumor: if it is derived from epithelial cells or tissues .
- sarcoma malignant tumor : if is derived from the mesenchymal cell

B. Benign tumor .

Characteristics :-[1]

- Similar to tissue of origin (well differentiated)
- Circumscription, Lack of ability of invasion
- Capsulated, Absence of metastases (don't shows metastasize)

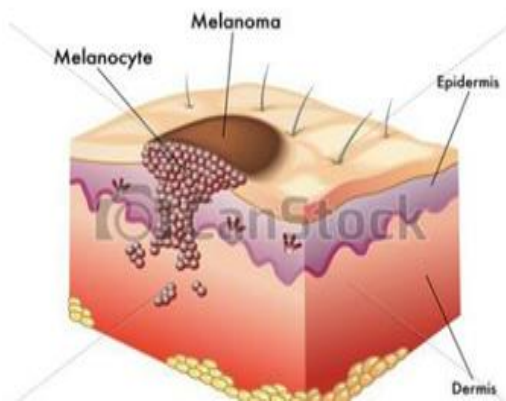


Figure (2): Benign tumor

- Nomenclature of cancer
- In general nomenclature of the neoplasia is depends on the types of tissue origin :-
- Formula: i) Tissue name + oma indicates benign tumor ii) Tissue name + sarcoma or carcinoma indicates malignant tumor

Sign And Symptoms of Neoplasia :

- When a person has a neoplasm in the lymph tissues, known as lymphoma, the most common symptom is an enlargement of the lymph nodes. These manifest themselves in painless lumps or mass in the areas of the neck, armpits, or in the groin. A person with lymphoma will experience rapid and unexplained

- weight loss over the course of a few months, often as much as fifteen pounds. Intermittent and
- Frequent fever is another symptom of lymphoma, often stemming from no known infection.
- Itching all over the body caused by the chemicals secreted by lymphoma cells; a significant loss of appetite;
- weakness caused by the cancer cells consuming an increasing amount of the body's nutrients;
- breathlessness from the obstruction caused by the neoplasm;
- When symptoms do appear, they start as swelling, tenderness and discomfort in the affected limb.
- Depending on where the sarcoma starts to grow, a patient may experience such symptoms as breathlessness and coughing if the neoplasm starts in the lungs
- abdominal pain, constipation and vomiting if in the abdomen, and lower abdominal pain and bleeding from the vagina if the growth is in the womb.

Etiology / Causes of cancer :-[8]

A. Physical agents

1. Radiation- ionising radiation eg. Random gas and non ionising radiation eg. Mobile phone, electric power transmission.
2. Fiber material: glass wool ,rock wool and non Fibrous material like cobalt ,nickel, crystalline silica
3. Asbestos
4. Gel like substances
5. Glass material
6. Air pollution

B. Chemical agents:

- C. Gene mutations due to tobacco chewing, alcohol consumption,
- D. Diet and exercise: high salt eat , obesity, lack of physical activity.
- E. Viral and bacterial infection: hepatitis B, hepatitis C , human T cell leukemia virus , H.pylori infection, schistoma haemabium, opisthorchis viverrini, Clonorchis sinensis.
- F. Hormones eg Estrogens
- G. Immuno system dysfunction: eg .H IV
- H. Genetic or inheritance: eg. bone cancer due to p53 gene

Diagnosis of Neoplasia :-There are many methods of diagnosing the different kinds of malignant neoplasms. Lymphoma is first diagnosed by subjecting the patient to a physical exam to determine the presence of lumps, swollen lymph nodes, and an enlarged spleen or liver. The doctor will also determine a patient's medical history and general health.

The most common diagnostic methods include:

1. Biopsy: This is a test where a small sample of tissue is taken from the suspected cancer with the help of a fine tipped needle (fine needle aspiration – FNA), or with a thicker hollow needle (core biopsy) or by surgical excision. The tissues are then examined under a microscope for the presence of cancer cells. Depending on tumor location, some biopsies can be done on an outpatient basis with only local anesthesia.
2. Computed tomography: Doctors use a computed tomography (CT) scan, also called a CAT scan, to find cancer.
3. Endoscopy:-In this imaging technique a thin, flexible tube with a tiny camera on the end is inserted into the body cavities. This allows the doctors to view the suspicious area. There are many types of scopes, each designed to view particular areas of the body. For example, a colonoscope looks at the colon and large intestine and a laparoscope is used to look within the abdomen etc.
4. Blood tests:-Blood tests can be performed to detect the normal blood cells as well as for specific tumor markers. Some tumors release substances called tumor markers, which can be detected in the blood. A blood test for prostate cancer determines the amount of prostate specific antigen (PSA). Higher than normal PSA levels can indicate cancer. Similarly in ovarian cancer a tumor marker CA-125 is released.
5. Colonoscopy :-A colonoscopy is a diagnostic examination used to look inside the entire large intestine, which plays an important role in the body's ability to process waste. The colon makes up the first five to six feet of the large intestine, and the rectum makes up the last six inches, ending at the anus.
6. Ultrasounds :-An ultrasound may be used to find a tumor. It can also help a doctor perform a biopsy

because it shows the tumor's exact location in the body. A biopsy is the removal of a small amount of tissue for examination.

7. Tumour marker and cancer:-High tumor marker levels can be a sign of cancer. Along with other tests, tumor marker tests can help doctors diagnose cancer and plan treatment
8. Sigmoidoscopy:- A sigmoidoscopy is a way to view the lower 20 inches of a patient's sigmoid colon and rectum. The sigmoid colon and rectum are part of the large intestine. The large intestine helps the body process waste. The first 5 to 6 feet of the large intestine is the colon. The last 6 inches of the large intestine is the rectum, ending at the anus.
9. Magnetic resonance imaging:-MRI creates cross-section pictures of your insides. But MRI uses strong magnets to make the images – not radiation. An MRI scan takes cross-sectional slices (views) from many angles, as if someone were looking at a slice of your body from the front, from the side, or from above your head. MRI creates pictures of soft tissue parts of the body that are sometimes hard to see using other imaging tests. MRI is very good at finding and pinpointing some cancers.

Complication of Neoplasia :-[11] Cancer and its treatment can cause several complications including:

- Pain :- Pain can be caused by cancer or by cancer treatment, though not all cancer is painful. Medications and other approaches can effectively treat cancer-related pain.
- Fatigue:- fatigue in people with cancer has many causes, but it can often be managed. Fatigue associated with chemotherapy or radiation therapy treatments is common, but it's usually temporary.
- Breathing problem :- Cancer or cancer treatment may cause a feeling of being short of breath. Treatments may bring relief.
- Nausea:- Certain cancers and cancer treatments can cause nausea. Your doctor can sometimes predict if your treatment is likely to cause nausea. Medications and other treatments may help you prevent or decrease nausea.

- Diarrhoea or constipation :- Cancer and cancer treatment can affect your bowels and cause diarrhoea or constipation.
- Weight loss :- Cancer and cancer treatment may cause weight loss. Cancer steals food from normal cells and deprives them of nutrients. This is often not affected by how many calories or what kind of food is eaten; it's difficult to treat. In most cases, using artificial nutrition through tubes into the stomach or vein does not help change the weight loss.
- Chemical changes in your body :- Cancer can upset the normal chemical balance in your body and increase your risk of serious complications. Signs and symptoms of chemical imbalances might include excessive thirst, frequent urination, constipation and confusion.
- Brain and nervous system problems:- Cancer can press on nearby nerves and cause pain and loss of function of one part of your body. Cancer that involves the brain can cause headaches and stroke-like signs and symptoms, such as weakness on one side of your body.
- Unusual immune system reactions to cancer:- In some cases the body's immune system may react to the presence of cancer by attacking healthy cells. Called paraneoplastic syndrome, these very rare reactions can lead to a variety of signs and symptoms, such as difficulty walking and seizures.
- Cancer that spreads: - As cancer advances, it may spread (metastasize) to other parts of the body. Where cancer spreads depends on the type of cancer.
- Cancer that returns: - Cancer survivors have a risk of cancer recurrence. Some cancers are more likely to recur than others. Ask your doctor about what you can do to reduce your risk of cancer recurrence. Your doctor may devise a follow-up care plan for you after treatment. This plan may include periodic scans and exams in the months and years after your treatment, to look for cancer recurrence.

Pathogenesis of neoplasia :-[19]

- Carcinogenesis, also called oncogenesis or tumorigenesis, is the formation of a cancer. It is

process in which normal cells are transformed into cancer cells

- The process is characterized by changes at the cellular, genetic, and epigenetic levels and abnormal cell division.
- Cell division is a physiological process that occurs in almost all tissues and under a variety of circumstances.
- Normally the balance between proliferation and programmed cell death, in the form of apoptosis, is maintained to ensure the integrity of tissues and organs.
- According to the prevailing accepted theory of carcinogens is the somatic mutation theory, mutations in DNA and epimutations that lead to cancer disrupt these orderly processes by disrupting the programming regulating the processes, upsetting the normal balance between proliferation and cell death.
- This results in uncontrolled cell division and the evolution of those cells by natural selection in the body.
- Only certain mutations lead to cancer whereas the majority of mutations do not. Variants of inherited genes may predispose individuals to cancer.

There are four types of pathogenesis of cancer are discussed under following heading:

1. Chemical carcinogens and chemical carcinogenesis
2. Physical carcinogens and radiation carcinogenesis
3. Biologic carcinogens and viral oncogenesis.
4. Molecular pathogenesis of cancer (gene and cancer)

1) Chemical Carcinogenesis:-[18]

- Most carcinogens, singly or in combination, produce cancer by interacting with DNA in cells and thereby interfering with normal cellular function.
- This ultimately results in the formation of a tumour (an abnormal tissue growth) that has the ability to spread (metastasize) from its site of origin and invade and cause dysfunction of other tissues, culminating in organ failure and death.
- The two primary mechanisms by which carcinogens initiate the formation of such tumours

is via alterations in DNA that encourage cell division and that prevents cells from being able to self-destruct when stimulated by normal triggers, such as DNA damage or cellular injury (a process known as apoptosis).

- There also exist carcinogens that induce cancer through non geotaxis mechanisms, such as immunosuppressant and induction of tissue-specific inflammation.

Examples:

- Acetaldehyde (from consuming alcoholic beverages)
- Aflatoxins, Alcoholic beverages, Arsenic and inorganic arsenic compound
- Azathioprine, Benzene, Formaldehyde

## 2) Physical Carcinogenesis: -[14]

Methods of carcinogenesis:

- The biochemical mechanisms of cancer development associated with physical agents is uncertain, and several different theories exist.
- One theory holds that the physical particles cause irritation in the surrounding tissue, resulting in inflammation.
- The body's normal inflammatory response involved proliferation of surrounding cells and infiltration of the tissue with new cells.
- As the particle remains in place and the normal tissue continues to undergo proliferation, some cells mutate into neoplastic (cancer) cells.
- On a molecular level, the chemical reactions of some carcinogens are known, although incompletely.
- Ultimately, carcinogens result in damage to DNA within cells. This damage has a number of effects, including prolonged growth and spread of cancer cells throughout the body.
- One way that DNA can be damaged is by reactive oxygen species (ROS) and reactive nitrogen species (RNS).
- ROS and RNS are produced by certain chemical reactions and are capable of physically damaging DNA.
- A number of studies have shown physical carcinogens, including fibers such as asbestos and metals such as nickel and copper, to produce ROS and RNS within cells.

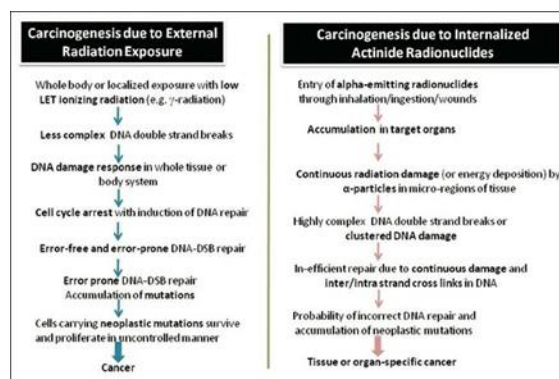


Figure [3] pathogenesis of cancer by radiation

Examples of physical agents:

- Radiation- ionising radiation eg. Random gas and non ionising radiation eg. Mobile phone, electric power transmission.
- Fiber material: glass wool, rock wool and non-Fibrous material like cobalt, nickel, crystalline silica
- Asbestos
- Gel like substances
- Glass material
- Air pollution

Treatments of Neoplasia: -[3]

1. Systemic chemotherapy: When the chemotherapeutic drug has to travel through the bloodstream to reach the cells which are cancerous, it is called systemic chemotherapy.
2. Regional chemotherapy: When the chemotherapeutic drug is directed to a specific area of the body it is called regional chemotherapy.

The aim of treatment of cancer by Chemotherapy:

Normal cells follow a controlled mechanism to grow and die. Cancer cells grow without control. Chemotherapy is a drug therapy that either slows or stops the growth of cancer cells. An oncologist, the doctor that specializes in the treatment of cancer helps manage the side effects of the treatment, takes care of the amount of dosage given during chemotherapy treatment and plans a treatment regime for particular cancer.

Depending upon the type of cancer and its stage, chemotherapy is aimed at: Curing cancer: It destroys cancer cells and certain healthy cells near the area so that the doctor can no longer detect them in the body

and the cancer patient is cured. Controlling cancer: Chemotherapy is aimed at controlling the rapidly dividing cancer cells from spreading to any other areas of the body (metastatic cancer). Ease cancer symptoms: Chemotherapy is aimed at shrinking tumors (a swelling caused by the growth of abnormal cells) that cause pain and pressure.

Treatment of advanced cancers: It helps in destroying the cancer cells that have recurred back. Chemotherapy for cancer:

- Chemotherapy can be used only for cancer treatment. It can often be used in conjugation with surgery, radiation therapy or biological therapy (use of living organisms to restore immunity).
- It can make a tumor smaller in size before radiotherapy can be started for a patient. This is called neo-adjuvant chemotherapy.
- It can destroy remaining cancerous cells after radiation therapy or surgery. This is called adjuvant chemotherapy.
- Chemotherapy dose along with radiation therapy helps the treatment to be effective

Chemotherapy is decided by the treating oncologist based on:

- The type of Cancer
- Stage of Cancer
- The patient's age
- Other treatments being given along with chemotherapy like surgery, radiation, etc.
- Underlying medical conditions in the body.
- If chemotherapy was given before, for cancer occurred in an earlier part of the lifetime.

Side effects of chemotherapy :

- Nausea and vomiting, Fatigue (tiredness)
- Hair loss
- Diarrhea or constipation
- Weight gain or weight loss
- Mouth ulcers and infections
- Skin or nail changes
- Menopausal symptoms (temporary or permanent)
- Depression or anxiety
- Sexual difficulties
- Nerve or muscle problems
- Hearing impairment (ototoxicity)

- Depression
- Loss of appetite
- Problems in swallowing food
- Mood Changes
- Changes in concentration and focus that happens during chemo given to treat brain cancer
- Swelling in the arms or legs
- Anemia
- Bleeding and bruising
- Constipation
- Infections due to low level of blood counts
- Kidney problems, heart problems, bone marrow problems.

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