

# PRINCIPLES OF CANCER



**Dr. Madhuri D Pandole**  
**Pharm D (PB)**  
**Associate Professor,**  
**Pharmacology and Pharmacy**  
**Practice Department,**  
**Saraswati Institute of**  
**Pharmaceutical Sciences,**  
**Gandhinagar-,382355 Gujarat, India.**



# CANCER/NEOPLASM

- Cancer can be defined as "A mass of tissues formed as a result of abnormal excessive, uncoordinated, autonomous, purposeless proliferation of the cell".
- Cancer is a disease characterized by abnormal and uncontrolled cell division attacking the surrounding tissue and organs, and also the distant body parts by circulating with blood and lymph.

- Neoplasm/tumor is an abnormal mass of tissue resulting either from uncontrolled division or from obstructed obstruction of cells.
- Neoplasm may be two types-
  1. Benign tumor: it is an non cancerous cellular growth which does not invade the nearby tissues or spread to other body parts.
  2. Malignant tumor: it is a cancerous, undefined and unpredictable cellular growth which invades the nearby tissues directly by the lymphatic system or circulatory system.

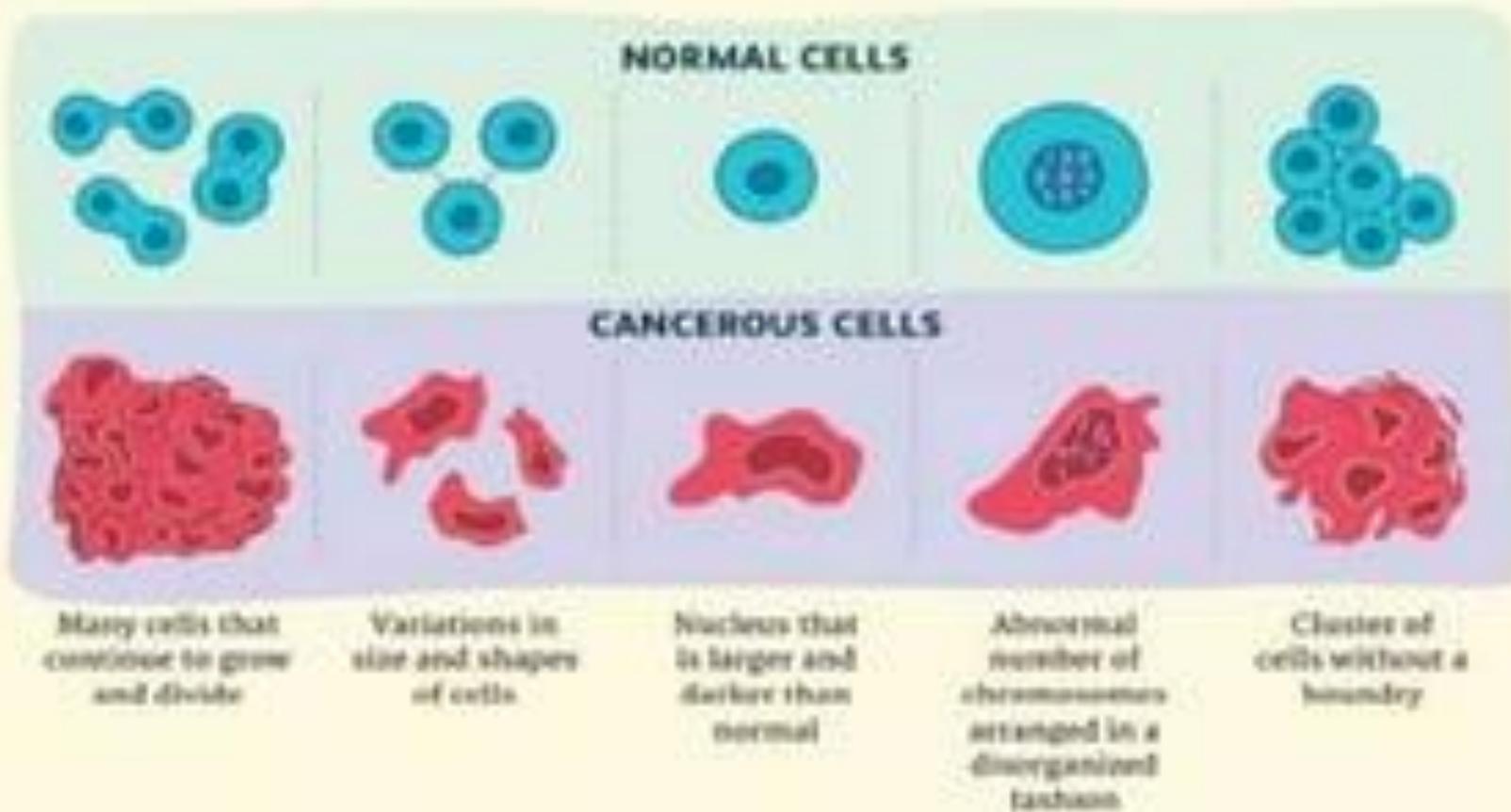


Fig: Normal cells & Cancerous cells

## Benign tumors

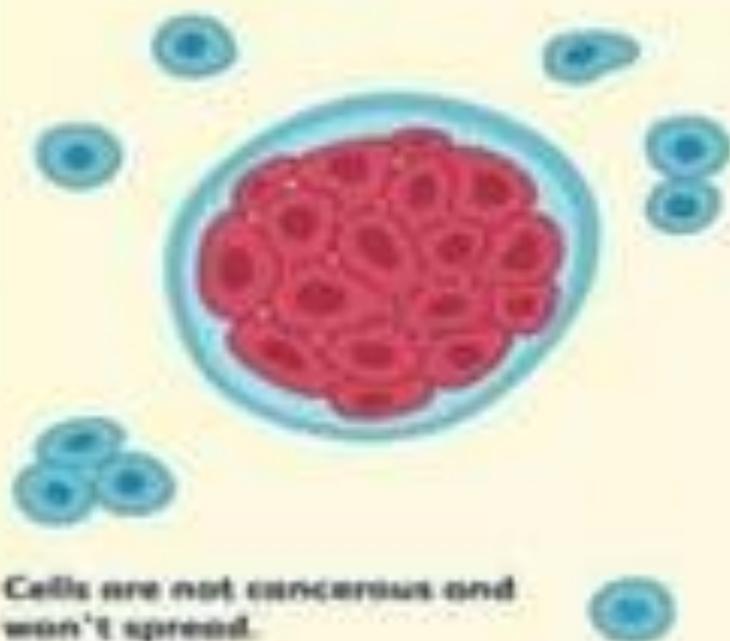
- It develops slowly in a localized manner. The abnormal cellular growth pushes the nearby normal tissues.
- It does not invade the nearby tissues and also does not spread to other body parts via blood and lymphatic channels.
- It can be surgically removed.

## Malignant tumors

- It comprises of an unclear mass of cells growing very rapidly.
- It lacks local growth, invades the surrounding tissues, and reaches the other body parts by vascular and lymphatic channels.
- It cannot be removed as it spreads widely throughout the body, thus leading to death.

## Comparison of benign & malignant tumors

### Benign Tumor



### Malignant Tumor



Fig: Benign Tumor & Malignant Tumor

- Neoplastic cells characterized with the help of following that distinguish them from normal cells-

- I. Uncontrolled proliferation: the proliferation of cancer cells are not regulated by regulatory processes of tissue growth.
- II. Loss of function
- III. Invasiveness: rapid spread of cancer cell to secondary site.
- IV. Metastasis: migration of primary tumors to another site through blood vessels or lymphatic result in formation of secondary tumor known as metastasis.

# Mechanism of carcinogenesis

- Cancer cell develop fro normal cell in a complex process consist following four phases of cell transformation-

## Phase I (Initiation):

Single or multiple exposure of carcinogenesis

Change in genetic material of normal cell

Alteration in DNA structure

II. **Phase II (Promotion)**: Ability of carcinogenesis to induce proliferation in initiated tissue & stimulate tumor formation.

III. **Phase III (Conversion)**: Normal initiated precancerous cell become cancerous cell. Alteration in genetic material take place.

IV. **Phase IV (Progression)**: Spread of tumors cell from a primary lesion to a distant site called metastasis. It has following three steps-

- a. **Attachments**: cancerous cell attaches to the extracellular matrix.
- b. **Degradation**: local degradation of extracellular matrix.
- c. **Locomotion**: cancerous cell loco mote to the secondary site through the locally degraded matrix.

# Classification of cancer

❖ **Carcinoma:** cancer arise from the surface, glandular or parenchymal epithelium.

Example- cancer of breast, prostate, lung.

❖ **Sarcoma:** cancer derived from connective tissue.

Example- fibrosarcoma (fibroblast malignancy), myosarcoma(muscle cell malignancy), etc.

❖ **Lymphoma or leukaemia:** it derived from heamotopoietic (blood forming) cells and develops from the precursors of WBCs. In leukaemia, cells multiply abnormally, diffuse within the bone marrow to multiply further and replace the normal blood forming cells. Thus neoplastic cells spill over into the circulation and large number of abnormal cells circulate in the peripheral blood.

## Etiology/Causes of cancer

- Tobacco
- Alcohol
- Genetic problems
- Excessive sunlight exposure
- Obesity
- Viruses
- Failure of immune system or defense mechanism

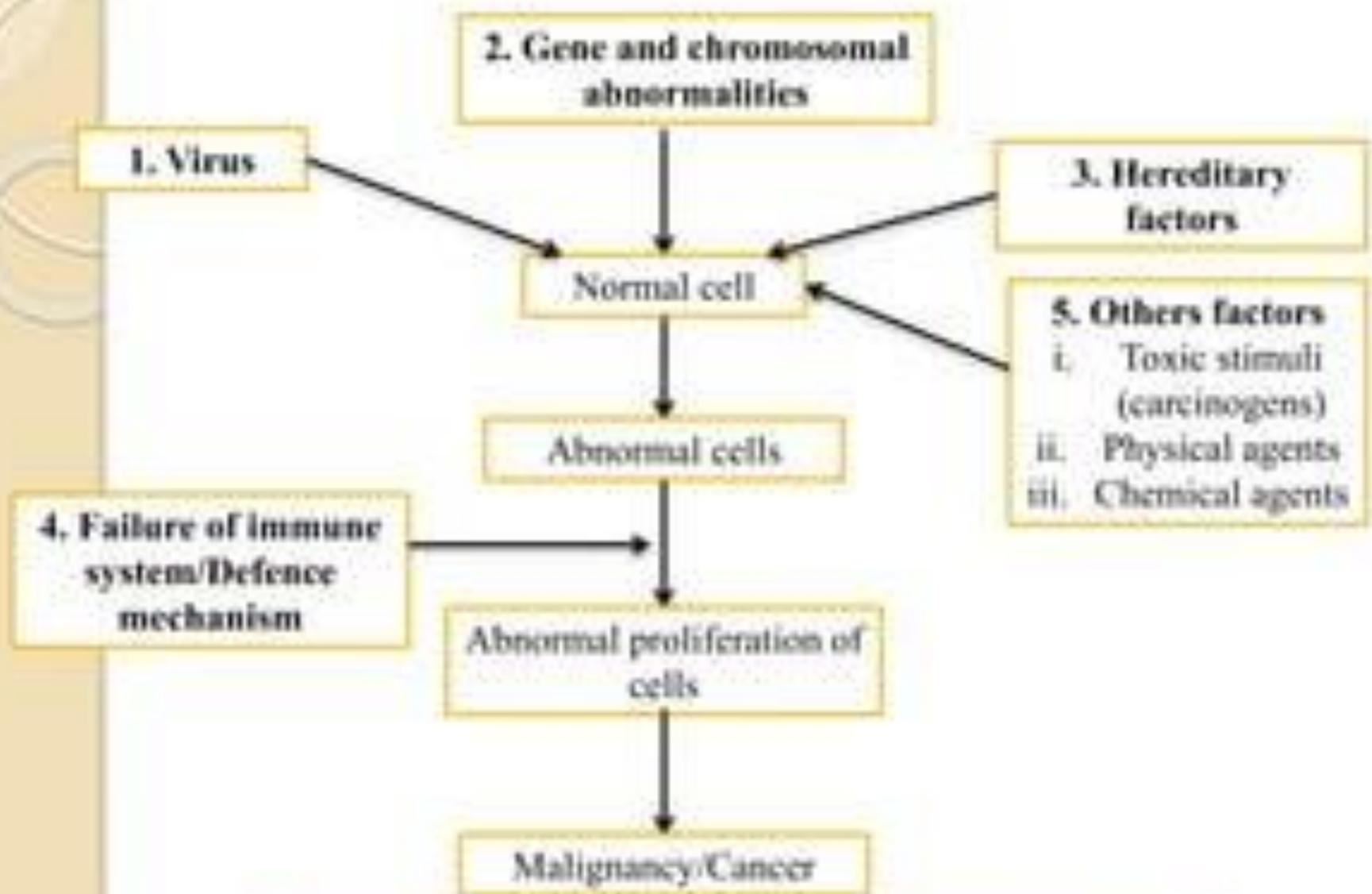


Fig: Etiological Factors Involved in Cancer

## Pathophysiology

Mutation inactivates tumor suppressor gene



Cells proliferations



Mutation inactivates DNA repair genes



Mutation of proto-oncogene creates an oncogene



Mutation inactivates several more tumor suppressor genes



**CANCER**

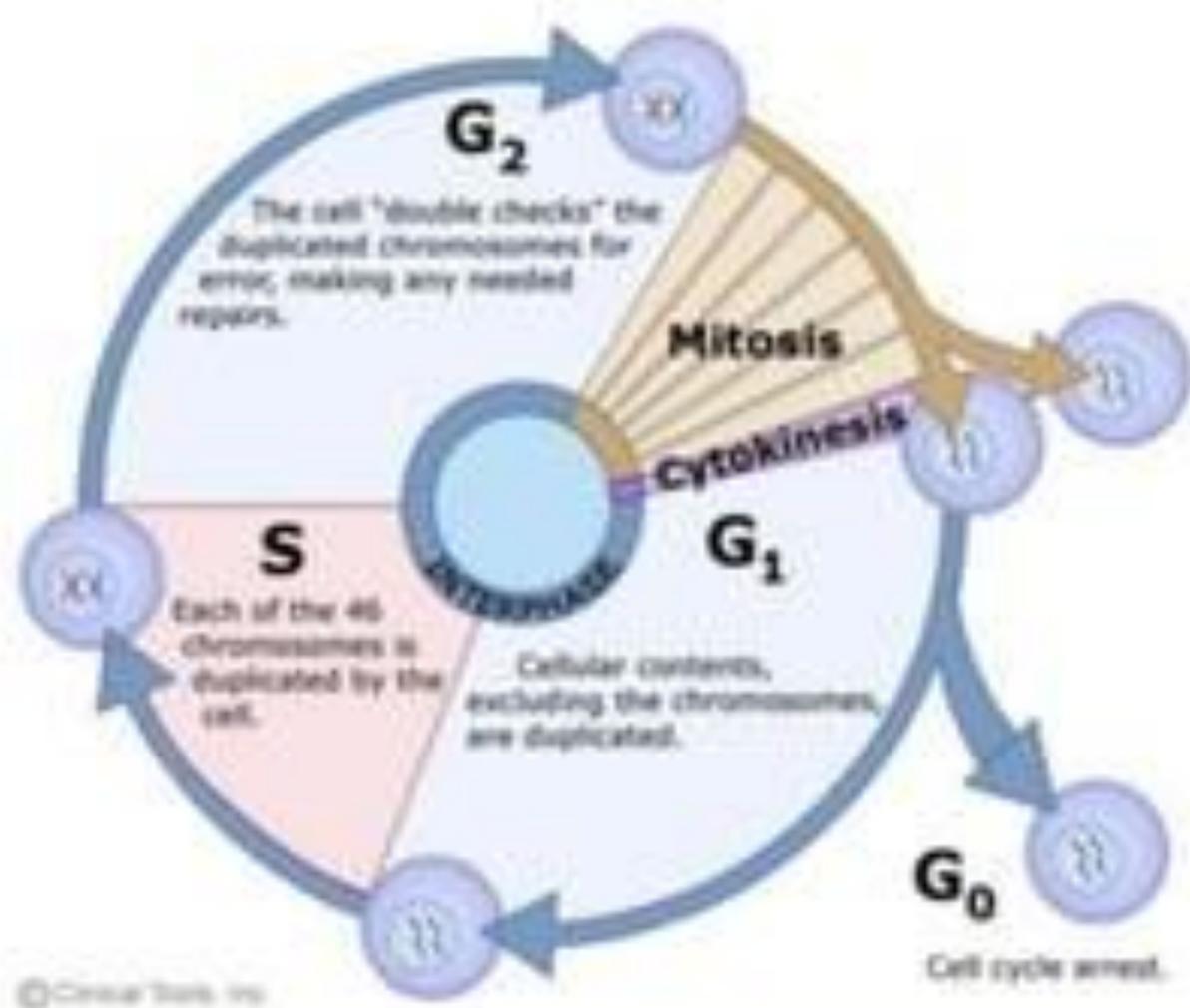


Fig: Growth Phase of Cancer Cell Division

- **G0 Phase:** This phase is also termed as the resting phase or G0 alpha phase. In this phase cell cycle arrest and halt to proliferation. Due to resting condition, this phase is resistant to various chemotherapeutic agents.
- **G-1 Phase:** This phase is also termed as the early protein synthesis phase. In this phase, cell synthesizes proteins, RNA and DNA molecules.
- **S Phase:** This phase is also termed as synthesis phase. In this phase, cells synthesizes a DNA protein with help of DNA polymerase, RNA polymerase II and topoisomerase I & II active enzyme.

- **G-2 Phase:** This phase also termed as premitosis phase. In this phase various cellular and structural components involved in mitosis for synthesis. At the end in this phase, the number of chromosomes is doubled and the cell become ready for active division.
- **M Phase:** This phase is also termed as mitosis phase(shortest phase of cell cycle). It is further divided into prophase, metaphase, anaphase and telophase. Two daughter cells are formed after this phase.
- ❖ Mutation results in loss of control of the cell cycle, differentiation and cell-to-cell adhesion and interaction.
- ❖ These changes cause morphological (appearance) changes in the cell or tissue.

## Signs & Symptoms

- Chills
- Loss of appetite
- Fatigue
- Fever
- Weight loss
- Anaemia
- Shortness of breath
- Abdominal pain
- Chest pain
- Cough
- Havinness

# Complications

- Local effects:
  - i. Compression
  - ii. Obstruction
  - iii. Infiltration
- Systemic effects:
  - i. Hormonal
  - ii. Nutrition
  - iii. Immunologic
  - iv. Idiopathic
- Treatment related effects:
  - i. Cytotoxic chemotherapy
  - ii. Bystander effects caused by death of tumor cells
  - iii. Toxic effects of radiation therapy

# Diagnosis

## 1. Screening:

Types of cancer	Screening method
Cancers of breast	Mammography & self examination
Cancers of cervix	Pap smear
Cancers of colon and rectum	Rectal examination, blood test, colonoscopy
Prostate cancer	Prostate specific antigen & transrectal ultrasonography

2. Tissue biopsy: procedure of removal of a tissue specimen for microscopic studies.



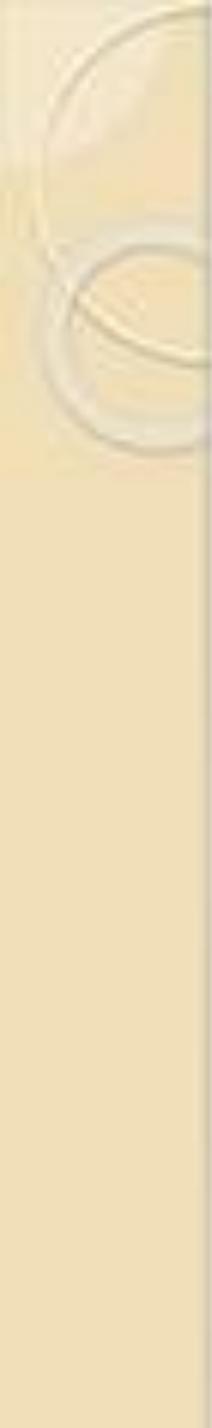
3. CT Scan & MRI

4. Laboratory methods: It involves cytological, histological and gene-profiling methods for diagnosing cancers.

5. Blood test for tumor markers

## Prevention & Treatment

- By avoiding risk factors like tobacco, over weight, alcohol & sexually transmitted disease.
- Dietary- emphasis on vegetables, fruits, whole grains and fishes.
- Surgery
- Radiation therapy
- Chemotherapy
- Medications like NSAID's, Vitamin D, Folic acid.
- Vaccinations- Hepatitis B vaccine, Human papillomavirus vaccine



**Thank You**