<u>Lec.</u>4

Neoplasia and Cancer

Neoplasm An abnormal tissue that grows by cellular proliferation more rapidly than normal and continues to grow after the stimuli that initiated the new growth cease.

Neoplasms show partial or complete lack of structural organization and functional coordination with the normaltissue, and usually form a distinct mass of tissue that may be either benign (benign tumor) or malignant (cancer)

- There are three types of neoplasm
- A benign neoplasm is a tumor that does not metastasize or spread to other cells, tissues or organs. Of the three types, this is the safest because it is non-progressive and does not invade other parts of the body.

The reason that this type of neoplasm does not spread is that it is surrounded by a layer of cells, or a fibrous sheath, that contain the abnormal cells. Health problems related to benign neoplasm include compression of neighboring organs and blood

• A pre-malignant neoplasm is also referred to as carcinoma in situ. Like a benign neoplasm, a pre-malignant neoplasm does not spread to other organs and tissues that surround it. The cells that make up this neoplasm usually grow within the organ where the initial abnormal growth began, and lead to lesions on the surface or lining of the organ itself, such as those seen with skin cancer.

In some cases, these types of neoplasm do form tumors, depending on the organ in which they are found, such as within the breast.

• A malignant neoplasm is basically cancer. Of the various types of neoplasm, this is the most severe as it can invade surrounding organs and tissues and also spread to other parts of the body through metastasis.

During this process, cells break off of the neoplasm and travel through the blood vessels to other parts of the body. When the cancerous cell reaches the new tissue or organ, it continues to replicate and creates a new neoplasm at that site. Early detection and treatment are the keys to successfully beating a malignant neoplasm.

Causes of Neoplasms

Some of the possible common medical causes of Neoplasms may include:

- Genetic •
- Lymphoid neoplasm
- Idiopathic
- UV rays
- X rays
- Diet rich in red meat
- Smoking and Alcohol

Cancer

Cancer also known as a malignant tumor, are a large family of diseases that involve abnormal cell growth with the potential to invade or spread to other parts of the body.

Cancer can spread from its original site by local spread, lymphatic spread to regional lymph nodes or by blood to distant sites, known as metastasis



Genetics

Cancer is fundamentally a disease of tissue growth regulation failure. In order for a normal cell to transform into a cancer cell, the genes that regulate cell growth and differentiation must be altered.

The affected genes are divided into two broad categories,

Oncogenes are genes that promote cell growth and reproduction. **Tumor suppressor genes** are genes that inhibit cell division and survival. Malignant transformation can occur through the formation of novel oncogenes, the inappropriate over-expression of normal oncogenes, or by the under-expression or disabling of tumor suppressor genes. Typically, changes in *many* genes are required to transform a normal cell into a cancer cell



An oncogene is a gene that has the potential to cause cancer. In tumor cells, they are often mutated or expressed at high levels.

Most of the normal cells undergo a programmed form of rapid cell death (apoptosis). Activated oncogenes can cause those cells designated for apoptosis to survive and proliferate instead. Most oncogenes require an additional step, such as

mutations in another gene, or environmental factors, such as viral infection, to cause cancer. Many cancer drugs target the proteins encoded by oncogenes

Classification

Cancers are classified by the type of cell that the tumor cells resemble, These types include:

- Carcinoma: Cancers derived from epithelial cells. This group includes many of the most common cancers, particularly in the aged, and include nearly all those developing in the breast, prostate, lung, pancreas, and colon.
- Sarcoma: Cancers arising from connective tissue (i.e. bone, cartilage, fat, nerve), each of which develops from cells originating in mesenchymal cells outside the bone marrow.
- Lymphoma and leukemia: These two classes of cancer arise from hematopoietic (blood-forming) cells that leave the marrow and tend to mature in the lymph nodes and blood, respectively. Leukemia is the most common type of cancer in children accounting for about 30%.
- Germ cell tumor: Cancers derived from pluripotent cells, most often presenting in the testicle or the ovary.
- Blastoma: Cancers derived from immature "precursor" cells or embryonic tissue. Blastomas are more common in children than in older adults.

Signs of cancer for men and women

- An unusual lump or swelling anywhere on your body
- A change in the size, shape or colour of a mole
- A sore that won't heal after several weeks
- A mouth or tongue ulcer that lasts longer than three weeks
- Persistent difficulty swallowing or indigestion

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- Problems passing urine
- Blood in your urine
- Blood in your bowel motions
- Breathlessness
- Coughing up blood

• Signs of cancer for women

- An unusual breast change
- Bleeding from the vagina after the menopause or between periods
- Persistent bloating

Common Diagnostic Methods include

• 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.

• Sentinel node biopsy

This is a procedure where the closest and most important nodes near the cancer are surgically excised and examined. Since sentinel nodes are the first location that cancer is likely to spread, only these lymph nodes that likely contain cancer cells.

• 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.

• Imaging studies

There are several imaging techniques. These include X rays, CT scans, MRI scans of various parts of the body.

X-rays are the most common imaging techniques This is used for detection of stomach and small intestinal growths and cancers.

Mammogram is an X-ray of the breasts used to screen for and/or detect breast lumps and growths.

• **Treatment** (cancer treatment include)

- Anti-cancer vaccine based on exposing some cancer cells extracted from a tumour to UV rays for 24 hrs then injecting them back into the organism, this approach has already been successful on rats.
- Chemotherapy
- Gene therapy
- Photodynamic therapy
- Radiation therapy
- Targeted therapy

carcinogen

A carcinogen is any substance, radionuclide, or radiation that is an agent directly involved in causing cancer. This may be due to the ability to damage the genome or to the disruption of cellular metabolic processes. Several radioactive substances are considered carcinogens

Carcinogens can be classified as genotoxic or nongenotoxic . Genotoxins cause irreversible genetic damage or mutations by binding to DNA. Genotoxins include chemical agents like N-nitroso- N- methyl urea (NMU) or non-chemical agents such as ultraviolet light and ionizing radiation. Certain viruses can also act as carcinogens by interacting with DNA. Nongenotoxins do not directly affect DNA but act in other ways to promote growth. These include hormones and some organic compounds

• There are many natural carcinogens

Aflatoxin B_1 , which is produced by the fungus *Aspergillus flavus* growing on stored grains, nuts and peanut butter, is an example of a potent, naturally occurring microbial carcinogen

Certain viruses such as hepatitis B and human papilloma virus have been found to cause cancer in humans.

Co-carcinogens are chemicals that do not necessarily cause cancer on their own, but promote the activity of other carcinogens in causing cancer. like cigarette-smoking, alcohol-drinking or even areca nut tobacco-chewing, which is an Asian tradition, because those activities promote the cytopathic effect (CPE)

Radiation depends of the type of radiation the emitted radiation (alpha, beta, gamma, or neutron and the radioactive strength), type of exposure, and penetration. For example, alpha radiation has low penetration and is not a hazard outside the body, but emitters are carcinogenic when inhaled or ingested

Cooking food at high temperatures, for example grilling or barbecuing meats, can lead to the formation of minute quantities of many potent carcinogens that are comparable to those found in cigarette smoke (i.e., benzo[a]pyrene).

Charring of food resembles coking and tobacco pyrolysis, and produces similar carcinogens. There are several carcinogenic pyrolysis products, such as polynuclear aromatic hydrocarbons, which are converted by human enzymes into epoxides, which attach permanently to DNA