Neoplasia

Neoplasia: literally means "new growth." A neoplasm often is referred to as a tumor, and the study of tumors is called oncology (from oncos, "tumor," and logos, "study of").

The division of neoplasms into benign and malignant categories is based on their potential clinical behavior.

Oncology: is the science that studies the tumors or neoplasm.

Neoplasia: is the process of the formation of new tissue and it is literally means "new growth" and the new growth is called neoplasm.

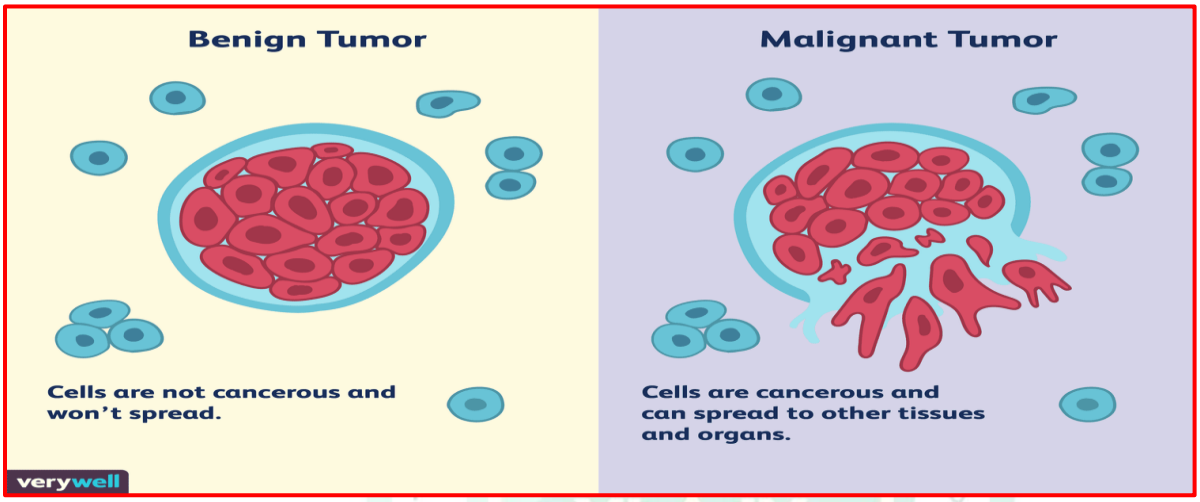
Neoplasm (tumor or tumour): is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissues, and persists in the same excessive manner cessation of the stimuli which evoked the change.

Classification of Tumors

The division of neoplasms into benign and malignant categories is based their potential clinical behavior.

Benign: the microscopic and gross characteristics of the lesion are considered to be relatively innocent.

Malignant: lesions can invade and destroy adjacent structures and spread to distant sites (metastasize) to cause death



Benign	Malignant
Tumors remain localized	**Can invade and destroy adjacent structures**
Tumors are amenable to local surgical removal	**Causes death - if not treated**
Patients generally survive	**Dangerous tumor**

Benign tumors are designated by attaching the suffix -oma to the cell type from which the tumor arises.

The nomenclature of mesenchymal tumors usually apply this rule:

• Benign tumor arising in fibrous tissue: Fibro + oma = Fibroma.

• Benign tumor arising in fatty tissue: Lipo + oma = lipoma.

• Benign tumor arising in cartilage: chondro + oma = chondroma.

• Benign tumor arising in skeletal muscle: Rhabdomyo + oma = rhabdomyoma.

• Benign tumor arising in smooth muscle: Leiomyo + oma = leiomyoma.

• Benign tumor arising in bone tissue: Oste + oma = Osteoma.

Exceptions!!

Some glaring inconsistencies may be noted. For example the terms: are used for malignant tumors.

• Melanoma (from the melanocytes of the skin).

• Mesothelioma (from the peritoneal cavity…mesothelium).

• Seminoma (from the testis).

• Lymphoma (from lymphoid tissue)

Carcinoma(cancer): Malignant neoplasms arising from epithelial cells.

Carcinomas include:

• Carcinomas that arise from glandular epithelial cells (with or without forming glands): adenocarcinomas.

• Carcinomas that arise from squamous cells (some producing keratin): squamous cell carcinomas.

• Carcinomas that show little or no differentiation: poorly differentiated or undifferentiated carcinoma.

All tumors (benign and malignant) have two basic components:

• Paranchymal tissue which represents the functional cells (i.e. made up of transformed or neoplastic cells.

• The supporting tissue or stroma which represent the connective tissue and blood vessels.

The state of neoplastic growth differs from hyperplasia in the following:

1. Neoplasia usually appears to arise spontaneously, but in those cases where the stimulus is known, it is not physiological.

2. The growth in hyperplasia is directly related to the degree of stimulation, while neoplasia, once it starts, proceeds irrespective of the stimulus.

3. Once the stimulus is removed, hyperplasia regresses. Neoplasia, on the other hand, proceeds unabated.

Molecular basis of cancer

Main classes of genes involved

1) Oncogenes

2) Tumor suppressor genes

3) Genes regulating apoptosis

4) DNA repair genes

Oncogenes

• First recognized in acute transforming retroviruses (v-onc)

• Most known oncogenes do not have viral counterparts

• Function as growth factors, receptors, signal transducers, transcription factors, and cell-cycle components

• Have similar functions as protooncogenes,but lack regulation/are constitutive.

RAS oncogene

• 15-20% of all human cancers have a RAS mutation

• Normally, RAS is activated by receptors to exchange GDP for GTP

• Activated RAS returns to ground state by its intrinsic GTPase activity

• GTPase activating proteins (GAPs) augment this process

• Mutant forms of RAS bind GAP but their GTPase activity is not augmented

Tumor suppressor genes

• Normally serve to inhibit cell proliferation

• First recognized in retinoblastoma, rare pediatric tumor of the eye

• RB tumor suppressor gene is a nuclear phosphoprotein that regulates cell cycle

– Active, hypophosphorylated state in non- dividing cells

– Inactive, hyperphosphorylated in G1/S transition

• Many cancers have mutations in the RB pathway (i.e. INK4a, Cyclin D, CDK4.

Salient features of neoplasia

• **Origin:** Neoplasms arise from cells that normally maintain a proliferative capacity. Genetic disorder: Cancer is due to permanent genetic changes in the cell, known as mutations. These mutations may occur in genes that regulate cell growth, apoptosis, or DNA repair.

• **Heritable:** The genetic alterations are passed down to the daughter tumor cells.

• **Monoclonal:** All the neoplastic cells within an individual tumor originate from a single cell or clone of cells that have undergone a genetic change. Thus, tumors are said to be monoclonal.

• **Carcinogenic stimulus:** The stimulus responsible for the uncontrolled cell proliferation may not be identified or is not known.

• **Autonomy:** In neoplasia, there is excessive and unregulated proliferation of cells that do not obey the normal regulatory control. The cell proliferation is independent of physiologic growth stimuli. But tumors are dependent on the host for their nutrition and blood supply.

Irreversible: Neoplasm is irreversible and persists even after the inciting stimulus is withdrawn or gone.

• **Differentiation:** It refers to the extent to which the tumor cells resemble the cell of origin.