Neoplasia

General Aim

At the end of lectures the students must understand the following;

-

- Definition.
--What are the basic components
-How the tumors are designated
-what is the basic classification of the tumors
- What are the differences between benign & malignant tumors.
-How can you define tumor Grade & tumor Stage
-Mechanisms of invasion & metastasis
-Molecular basis of cancer
-Kinetic of tumor cell growth- factors that affect the rate of tumor growth
- How do growing tumors develop a blood supply? (Tumor angiogenesis)
-Tumor immunity -Host defense against tumor
-How the tumor cells can escape the immune system.
-Causes of cancer –Carcinogenesis

Objectives of this lecture

At the end of the lecture, the student must be able to

- **Define Neoplasm**
- **Classify neoplasms**
- **Illustrate the major components of neoplasm**

Introduction

Neoplasia literally means "new growth"

A neoplasm is "**an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of normal tissues and persists in the same excessive manner after cessation of the stimuli which evoked the change.**"

It has been shown that the persistence of tumors, even after the inciting stimulus is gone, results from genetic alterations that are passed down to the progeny of the tumor cells. These genetic changes allow excessive and unregulated proliferation that becomes **autonomous** (independent of physiologic growth stimuli), thus the neoplasm is "A **disorder of cell growth triggered by a series of acquired mutations affecting a single cell and its clonal progeny**",

In common medical usage, a neoplasm is often referred to as a tumor. Tumor originally applied to the swelling caused by inflammation, but the non-neoplastic usage of tumor has almost vanished; thus, the term is now equated with neoplasm. The division of neoplasms into benign and malignant categories is based on a judgment of a tumor's potential clinical

behavior

A tumor is said to be **benign** when its microscopic and gross characteristics are considered relatively innocent, implying that it will remain localized, it cannot spread to other sites, and it is generally amenable to local surgical removal. It should be noted, however, that benign tumors can produce more than localized lumps, and sometimes they are responsible for serious disease.

Malignant tumors are collectively referred to as cancers, derived from the Latin word for crab. Malignant, as applied to a neoplasm, implies that the lesion can invade and destroy adjacent structures and spread to distant sites (metastasize) to cause death. Not all cancers pursue so deadly a course. All tumors, benign and malignant, have two basic components:

(1) **clonal neoplastic cells that constitute their parenchyma** and

(2) **reactive stroma made up of connective tissue, blood vessels, and variable numbers of macrophages and lymphocytes**. Although the neoplastic cells largely determine a tumor's behavior and pathologic consequences, their growth and evolution is critically dependent on their stroma

Neoplasms enjoy a degree of autonomy and tend to increase in size regardless of their local environment, however, neoplasms depend on the host for their nutrition and blood supply. Neoplasms derived from hormone responsive tissues often also require endocrine support, and such dependencies sometimes can be exploited therapeutically.

Nomenclature

Benign Tumors

Benign tumors are designated by **attaching the suffix -oma** to the cell of origin. Tumors of **mesenchyma**l cells generally follow this rule. For example, a benign tumor arising in fibrous tissue is called a fibroma whereas a benign cartilaginous tumor is a chondroma.

In contrast, the nomenclature of **benign epithelial tumors** is more complex. These are variously classified, some based on their **cells of origin**, others on **microscopic pattern**, and still others on their **macroscopic architecture.**

Adenoma is applied to a benign epithelial neoplasm derived from **glands**, although they may or may not form glandular structures. Benign epithelial neoplasms producing microscopically or macroscopically visible **finger- like or warty projections** from epithelial surfaces are

referred to as **papillomas**. Those that form **large cystic masses** are referred to as **cystadenomas**.

Malignant Tumors

The nomenclature of malignant tumors essentially follows the same schema used for benign neoplasms, with certain additions. Malignant tumors are of two types

1. **Sarcoma**: malignant tumor arising in **mesenchymal** tissue (e.g., fibrosarcoma, chondrosarcoma, leiomyosarcoma, and rhabdomyosarcoma).
2. **Carcinoma:** malignant neoplasm of **epithelial** cell origin. Squamous cell carcinoma would denote a cancer in which the tumor cells resemble stratified squamous epithelium, and adenocarcinoma denotes a lesion in which the neoplastic epithelial cells grow in glandular patterns.

   Sometimes the tissue or organ of origin can be identified, as in the designation of renal cell adenocarcinoma or bronchogenic squamous cell carcinoma. Not infrequently, however, a cancer is composed of undifferentiated cells of unknown tissue origin, and must be designated merely as an undifferentiated malignant tumor.

Mixed tumors develop when a single neoplastic clone undergo divergent differentiation e.g mixed tumor of salivary gland (pleomorphic adenoma) which contains epithelial components scattered

within a myxoid stroma that sometimes contains islands of cartilage or bone. All these elements arise from a single clone capable of giving rise to epithelial and myoepithelial cells

Teratoma is a special type of tumor that contains recognizable mature or immature cells or tissues derived from more than one germ cell layer, and sometimes all three.

Teratomas originate from totipotential cells such as those normally present in the ovary and testis which have the capacity to differentiate into any of the cell types found in the adult body and may give rise to neoplasms that mimic, in a helter-skelter fashion, bits of bone, epithelium, muscle, fat, nerve, and other tissue e.g ovarian cystic teratoma (dermoid cyst),

Exceptions:

For generations, benign designations have been used for certain malignant neoplasms. Examples

- Lymphomas: tumor of lymphoid tissue, all malignant.
- Melanoma: malignant tumor of melanocytes.
- Seminoma dysgerminoma: tumor of primitive germ cells
- Glioma: Majority are malignant.
- Nephroblastoma, retinoblastoma medulloblastoma: tumors of primitive embryonic cells, all malignant.

Hamartoma is a mass of disorganized tissue indigenous to the particular site, such as the lung or the liver. While traditionally considered developmental malformations, many hamartomas have clonal chromosomal aberrations that are acquired through somatic mutations and on this basis are now considered to be neoplastic.

Choristoma is a congenital anomaly consisting of non-neoplastic ectopic nodular nest of tissue (i.e. excess of normal tissue in abnormal location)
e.g. ectopic pancreatic tissue in in the submucosa of the stomach, duodenum, or small intestine. The designation -oma, is undeserved, as they are usually of trivial significance

Table 1 : Summary of tumor nomenclature

Tissue Type	Benign	Malignant
Epithelial	"-oma"	" - carcinoma"
Glandular	Adenoma (eg. Tubular adenoma of colon)	Adenocarcinoma (eg. Colon adenocarcinoma)
Squamous	Squamous papilloma	Squamous cell carcinoma
Mesenchymal	"-oma"	"- sarcoma"
Bone (osteo-)	Osteoma	Osteosarcoma
Blood vessels Lymph vessels	Haemangioma; Lymphangioma	Angiosarcoma Lymphangiosarcoma
Smooth muscle	Leiomyoma	Leiomyosarcoma
Skeletal muscle	Rhabdomyoma	Rhabdomyosarcoma
Cartilage	Chondroma	Chondrosarcoma
Fat	Lipoma	Liposarcoma