

Tumors

Definitions:

- **Oncology**, scientific study of tumors, including their causes, effects, behavior, prognosis, diagnosis & treatment.
- **Tumor = Neoplasm**: (neo new + plasm flesh): an abnormal mass of tissue form by excessive uncontrolled cell proliferation.
- **Malignant**: any tumor that **invade** (adjacent tissues) & **spread** to distant tissues.
- **Benign**: tumor that neither invade nor spread to other tissues.
- **Cancer**, malignant tumor
- **Differentiation**: degree of resemblance of tumor cells to tissue of origin.
- **Tissue of origin** tissue from which he tumor arises.
- **Dysplasia**: partial loss of differentiation characterized by disordered size, shape (pleomorphism), maturation, & spatial arrangement of cells, increase nucleo-cytoplasmic ratio (N/C ratio normally 1:4-6, becomes 1:2 in dysplastic & malignant cells), nuclear hyperchromia. dysplasia may or may not progress to malignancy.
- **Anaplasia**: complete loss of differentiation.
- **Carcinoma**: malignant tumor of epithelial cells
- **Carcinoma-in-situ**: severe dysplasia without invasion of basement membrane.
- **Sarcoma**: malignant tumor of mesenchymal tissue,
- **Carcinogen**: an agent or substance that causes cancer.
- **Carcinogenesis**: process of development of cancer.
- **Grading**: an attempt to assign rough numerical value (grade) to the degree of differentiation of a tumor.
- **Staging**: a system that delineate the extent of tumor size & spread in the body.
- **Metastasis**: deposition of malignant cells into distant non-contagious tissue.
- **Hamartoma**: mass formed by normal tissue components of an organ (i.e., normal tissue in wrong proportion).
- **Choriostoma = heterotopia = heterotopic tissue = ectopic tissue**: Normal tissue in wrong place (e.g., pancreatic tissue in the wall of the stomach)

Classification of tumors

1- Epithelial tumors:

Benign Epithelial tumors :

Adenoma - glandular epithelium tumor often producing a secretion e.g. (mucin) which may be intraepithelial or intraluminal

Papilloma – epithelial tumor forming finger like projections from epithelial surface with a connective tissue core

Polyp – a tumor projecting from the mucosal surface of a hollow organ

Malignant epithelial tumor : Carcinoma

Squamous cell carcinoma e.g. skin, mouth, cervix, bronchus....etc

Adenocarcinoma from glandular origin, e.g. G.I.T., endometrium, breast, kidney, thyroid.....etc

2- connective tissue cell origin :

Benign :

Named by tissue of origin with attached

suffix – oma

e.g. **fibroma** , **lipoma** , **chondroma** ...etc

Not all endings (– oma) are benign tumors e.g. : **granuloma** , **lymphoma** , **hamartoma** , **choristoma** ...etc

Malignant connective tissue tumors:

SARCOMA :

Prefix (origin)+ suffix (sarcoma) e.g.

Osteosarcoma , **liposarcoma** , **angiosarcoma**

leiomyosarcoma , **rhabdomyosarcoma** ...

Some tumors are MIXED !!!

Mixed Tumors :

Tumors derived from a single germ cell layer that differentiates into more than one cell type.

e.g. mixed tumor of salivary gland,

Fibroadenoma of breast

OR :

Teratomas – made of a variety of parenchymal cell types that derive from more than one germ cell layer formed by totipotent cells that are able to form ectoderm, endoderm & mesoderm

TERATOMA :

May be benign or malignant depending on structure, site, age, sex

Contain skin ,sebaceous & mucus glands,hair,cartilage, bone, respiratory epithelium, glial tissue etc.

Usual location is ovary or testes

Some tumors have names that do not conform with general rules :

Melanomas arise from nevus cells

Seminomas arise from testicular germ cells

Lymphomas arise from lymph nodes

Some tumors are named **eponymously** e.g. Hodgkins disease, Wilm's tumor....etc

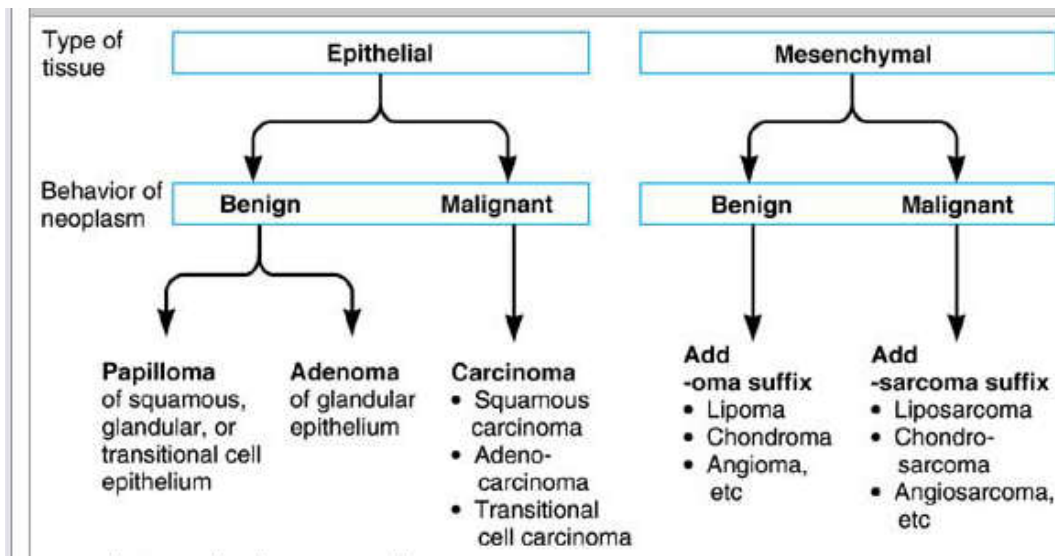
Hamartoma :

Tumor like malformation in which there

is abnormal mixing of normal components of the organ ,either in the form of change in quantity or arrangement of tissue elements.

e.g. Lung Hamartoma.

Choristoma : Different types of tissue, pancreatic tissue in the wall of stomach



How do benign & malignant tumors differ?

- 1- Differentiation & anaplasia
- 2- Rate of growth
- 3- Presence of capsule
- 4- Local invasion
- 5- Distant metastases

1-Differentiation

This indicates the degree of resemblance of the tumor cell to its cell of origin, functionally & morphologically.

e.g – Cells of a lipoma may look exactly like normal fat cells.

When a tumor cell loses its differentiation it gradually gains features of **DYSPLASIA**

It is a process of gradual loss of differentiation

It is an abnormal growth which may/or may not precede malignancy

Complete loss of differentiation □ **ANAPLASIA**

Cytological Features of Dysplasia

Increased nuclear size , ↑ N/C ratio

Variation in nuclear & cell size : **PLEOMORPHISM**

Loss of differentiating features

Increased nuclear DNA content

HYPERCHROMATISM

Nucleoli :Prominent, sometimes multiple

Mitotic figures : Increased

Abnormal mitoses : may be present

Loss of polarity : in an epithelial surface

2- Rate of growth

Rate of growth usually correlates with level of differentiation

May be rapid in some benign tumors

Some tumors may shrink in size

Some malignant tumors may outgrow their blood supply

3- Local invasion & Encapsulation

Benign tumors frequently have a capsule

Malignant tumors progressively invade & destroy surrounding tissue e.g. Breast cancer infiltrating skin

*Second most important feature distinguishing malignant tumors

4- Metastasis :

Spread of malignant tumors to distant sites not contiguous with the main tumor

Most important in diagnosing malignancy

All tumors can potentially metastasize except **BASAL CELL CARCINOMA**

Metastasis is often proportionate to the size and differentiation of the primary tumor

Routes of metastases :

1- Lymphatics (More characteristic in **Carcinoma** Spread follows the anatomical route of drainage)

2- Blood vessels:

- Usually venous first following anatomical drainage : Lung & Liver
- More characteristic of **Sarcoma** ,but may in occur in later stages of carcinoma
- Certain carcinomas invade veins early
- **RENAL Carcinoma** → renal vein → IVC
- **Hepatocellular Carcinoma** →Portal & Hepatic v.

3- Seeding within body cavities/ Transcoelomic Spread Within peritoneal or pleural cavity e.g.: Ca stomach to ovary

Summary : Differences between benign & malignant neoplasms

■ BENIGN vs MALIGNANT

- ☐ Well-differentiated
- ☐ Low mitotic index
- ☐ Slow Growth
- ☐ With capsule
- ☐ No invasion
- ☐ No metastases

- ☐ Anaplastic
- ☐ High mitotic index
- ☐ Rapid growth
- ☐ Infiltrative growth without capsule
- ☐ Invasion
- ☐ Metastases

EPIDEMIOLOGY of CANCER

- Geographic location :

- Gastric CA -- High in Japan
- Skin CA----- High in New Zealand
- Hepatocellular CA --- High in Africa,China
- Breast CA ---- High in USA
- Prostatic CA ---- High in USA
- Colorectal CA ----High in USA
- Nasopharyngeal CA--- Far East
- Burkitt Lymphoma ----- Africa

2- Environment :

Diet

Occupation

Sunlight

Personal habits

3- Age :

In general , cancer incidence \approx AGE

However , certain cancers occur more in children

Acute Leukemia

Some Lymphoma

Some CNS Tumors

Bone & soft tissue Sarcomas

4- Heredity :

Inherited Cancer Syndromes :

Presence of defined genetic abnormality,

e.g.

APC gene : Familial Adenomatous Polyposis Coli

Grade of tumor: Based on level of differentiation :

This indicates the degree of resemblance of tumor cells to cell of origin and is **always based on microscopic criteria.**

Grade I : Well differentiated tumor

Grade II : Moderately differentiated tumor

Grade III : Poorly differentiated tumor

Grade IV : Anaplastic tumor

STAGE of Tumor :

This indicates the extent of spread of the tumor.

Clinical ,investigative procedures and pathological appearance of tumor have to be used to assess it.

It depends on :

- * Size of tumor
- * Regional lymph node involvement
- * Metastases to distant organs

CANCER DIAGNOSIS

History & clinical examination

Radiographic techniques

- i- X ray
- ii- CT scan
- iii- MRI
- iv- Ultrasound
- v- Laboratory tests : general & specialized- cytology, histopathology, tumor markers