Principle of Surgical Oncology

Surgery Team
MED 433

Objectives :

Color Index: Slides & Raslan's () | Doctor's Notes | Extra Explanation | Additional

This work is based on doctor's Slides +Notes and Raslan's only (Does not include the book)

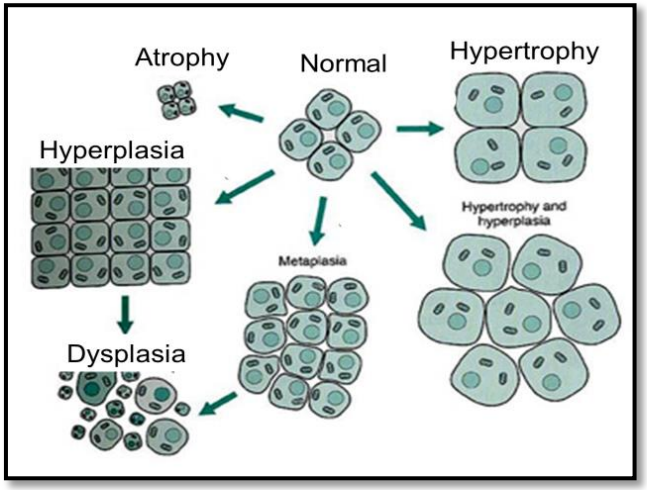
Mind Map

Principles of Surgical Oncology

- Tumor Differentiation and Grading
- **Staging and Spread of Malignant tumors**
- **Manifestation of Malignant tumors**
- **Investigation Of Malignant Tumor:**
- **Tumor Markers**
- **Hormones And Cancer**
- **Types of tumors**
  - Malignant
    - Carcinoma
    - Sarcoma
  - Benign
  - Teratoma
  - Hamartoma

Important concepts

1. **Hyperplasia**:→ increase in cells **Number.**
2. **Hypertrophy**→ increase in cell **size**.
3. **Atrophy**→: decrease in cell size



4. **Metaplasia and Dysplasia**→ change in the cell's **behavior.**

Metaplasia:
Replacement of one cell type by another.
(reversible by removing the stimulus)

Dysplasia:
abnormal maturation of the cells (irreversible)

5. **Teratoma and Hamartoma** More details in the next slide

Teratoma:
has haphazard arrangement of tissues and
the tissues are <u>not suppose</u> to be there
(hair is not suppose to be in the ovary for example)

. **Hamartoma**:
has haphazard arrangement of tissues but
the type of tissues can be normally be there.
Usually benign.

6.**Biopsy and Cytology**

Biopsy:
examination of block of **tissues.**

Cytology:
examination of **cells**

7.**Carcinoma in-situ:** is the **malignant** cancer that **did not invade** the <u>basement membrane</u> yet.

Teratoma and Hamartoma

Teratoma :

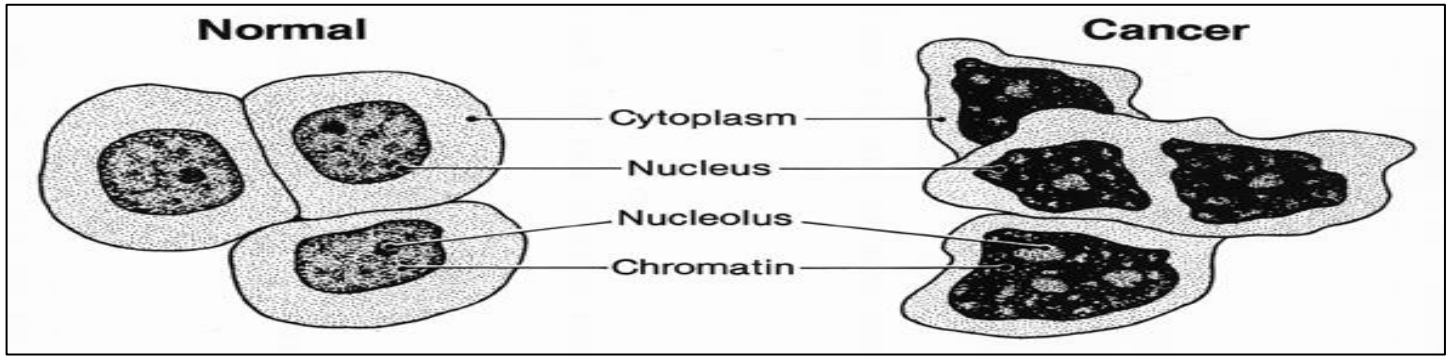
- **Type of germ cell tumor** that may contain several different types of tissue such as hair, muscle, and bone. Teratomas occur most often in the ovaries and testes.

- Arises from the embryonic "totipotential cells", which are capable of developing into any variety of cells.
- Commonly found in germ cell areas (testes and ovaries)
- Could be benign or malignant
- Has the potential to produce new tissues in the organ affected
- Ex: **Dermoid ovarian cyst**→ is one of the benign tumor of the ovaries which is a cystic teratoma that contains developmentally mature skin, complete with hair follicles, sweat glands, bone and cartilage, which are not normally found in the ovary.

Hamartoma :

- Benign tumor composed of an overgrowth of mature cells and tissues **normally present in the affected part.**
- Abnormal arrangement of normal tissue, **"haphazardly arranged tissue"** that resembles a neoplasm.
- Benign but capable of producing complications
- **Ex: Angiomyolipoma of the kidney**, composed of blood vessels, smooth muscle cells and fat (which normally found in kidney)

Comparison between Normal and Malignant Cells

	Normal Cell	Malignant Cell
Characteristics	It has controlled growth, contact phenomena, and whenever it gains unrepaired damage it will suicide "apoptosis"	Uncontrolled growth and loss of contact phenomena (Not very well-understood phenomena, that when cells get close to each other during healing, they connect and form junctions, and stop proliferating, otherwise they will continue multiplying "cancer")
Cytology	Large cytoplasm	Small cytoplasm **(because of the large nucleus)**
	Single and regular Nucleus	Multiple, irregular shape, dark stained Nuclei → (**lot of mitotic figures)**
	Single Nucleolus	Multiple and large Nucleoli
	Fine chromatin	**Coarse chromatin**
		

Comparison between Benign and Malignant tumors

feature	Benign	Malignant
Capsule	Encapsulated	Non encapsulated "Sometimes, there is a capsule but it's a "false capsule", meaning it's a fibrous capsule from the same tissue. " **so**→ Non encapsulated →local invasion→Metastasis
Invasion	No invasion	Usually invade
Metastasis	No metastasis	Metastasize
Treatment	Local excision for benign	Radical excision (**excision with surrounding lymph nodes**) +\- Chemotherapy or Radiotherapy or both.
Spread	Doesn't spread	▪ **local invasion**: within the organ itself or adjacent organ ▪ **Metastasis:** More details in slide(13) 1\ Lymphatic: Regional & distant lymph nodes. 2\ Haematogenous: mostly to liver, lung, bones. 3\ Transcoelomic: e.g peritoneal & pleural cavity. 4\ Implantation e.g. needle tracks, wounds.

Benign growth is controlled whereas malignant growth is not. That's why it: **can invade** the same organ (non-encapsulated), go to adjacent organs, or go to lymph or blood. **can metastasize** e.g. cancer in lung goes to brain, cancer of colon goes to lung, cancer of prostate goes to vertebral column.

Types of Malignant tumors

Has two main types:

1. Carcinoma:

Arises from epithelial tissue

Carcinomas include cancers of the: breast, lung, kidney, thyroid,colon, prostate, stomach and many others.

Ex: Adenocarcinoma of the stomach, transitional cell carcinoma of the bladder, squamous cell carcinoma of the skin, follicular carcinoma of the thyroid.

2. Sarcoma:

Arises from connective tissue (mesodermal tissue)

- **Sarcomas include cancers of the**: bone, muscle, fat, nerves, cartilage and fibrous tissue, such as ligaments and connective tissue.
- **Blood cancers**: Leukemia,lymphoma,Myeloma.

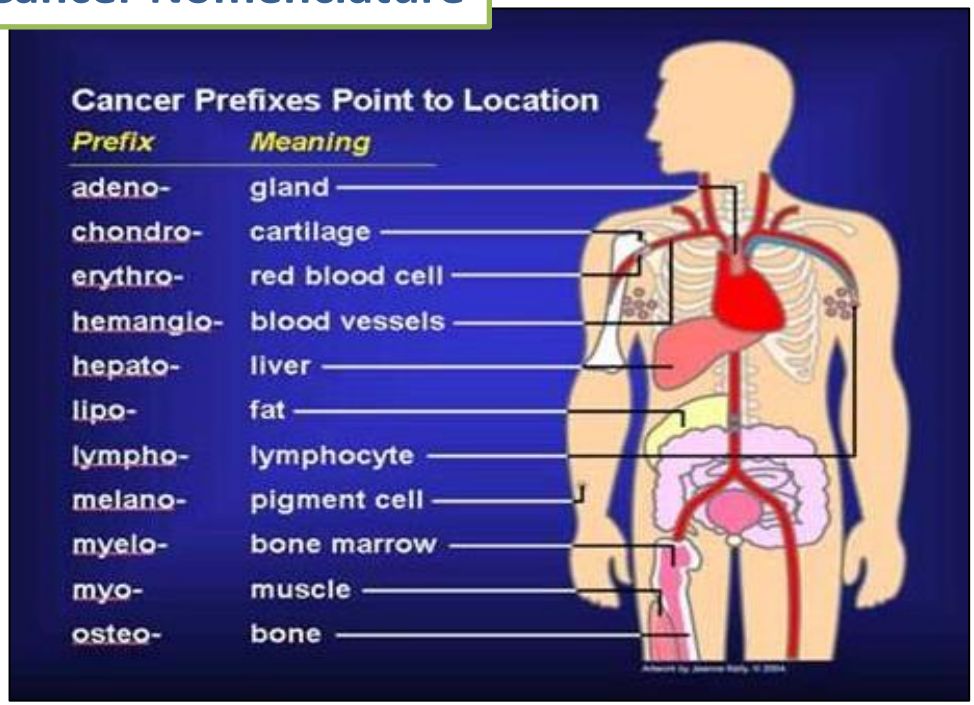
Sarcoma could be

Benign		Malignant
lipoma	→	liposarcoma
Fibroma	→	Fibrosarcoma
Myoma	→	myosarcoma

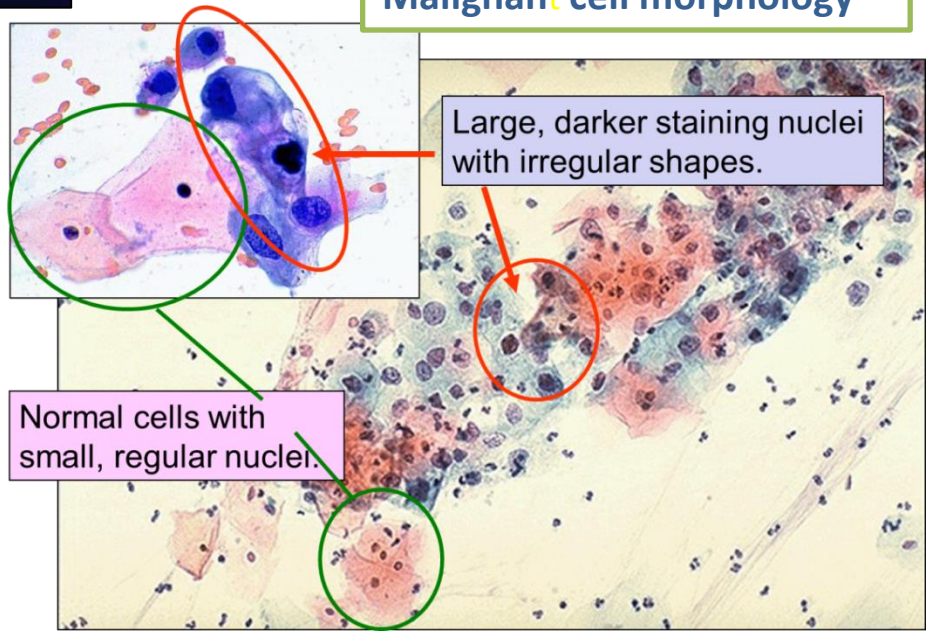
Rhabdomyosarcomas are tumors of the →skeletal muscles

Leiomyosarcomas are→ smooth muscle sarcomas.

Cancer Nomenclature



Malignant cell morphology



Tumor Differentiation and Grading

Differentiation

Grading

Both describe the histological features of the tumor.
(not the macroscopic features, invasion or metastasis)

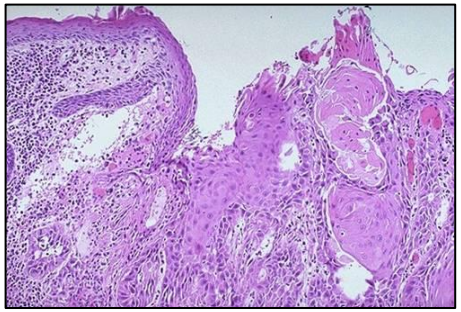
Describes the characteristics of cancer cells **in reference to their resemblance to the cell of origin**

Differentiation refers to how cancer cells look and function compared to normal cells

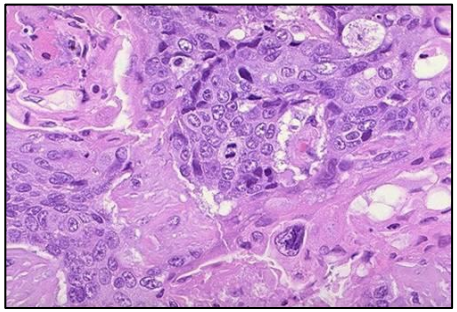
Describes the histologic characteristics of cancer cells
mainly talk about **cell layers**.
e.g. grade I, II, III.

Grading is a way of classifying cancer cells based on their appearance and behavior when viewed under a microscope)

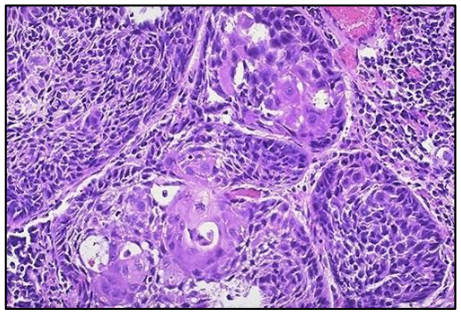
Degree of differentiation provides information about cancer aggressiveness and progression



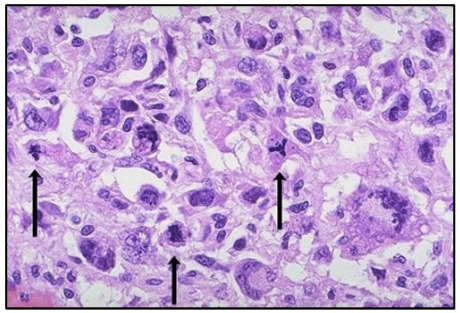
Well differentiated



Moderately differentiated



poorly differentiated



Anaplastic

More details in the next slide

Tumor Differentiation and Grading

1. Well differentiated
Cancer cells look and behave like the normal cells in the tissue (slow growing and less aggressive).

2. Moderately differentiated

3. poorly differentiated :

1) Indicates that the cancer is rapidly growing with no time for the cells to be differentiated.

1) Most of them are more susceptible to chemotherapy agents b\c they are weak due to the rapid development and growth.

4. Anaplastic
Cancer cells that divide rapidly and have little or no resemblance to normal cells.

1. if we found an enlarged lymph node but we did not know the origin, we send it to the lab. If it it's a welldifferentiated tumor, the pathologist will be able to identify the cell of origin.
2. However, in poorly differentiated or anaplastic tumors, the pathologist will not be able to identify the cell of origin, he will only be able to confirm the malignancy.

- The cell usually differentiates from being a "blast" in the beginning to it becoming a "cyte".
- The blast stage means it is still growing, and if we see a "cyte", it's closer in morphology to the mother cell.

Staging

Staging describes the primary tumor, its relation with

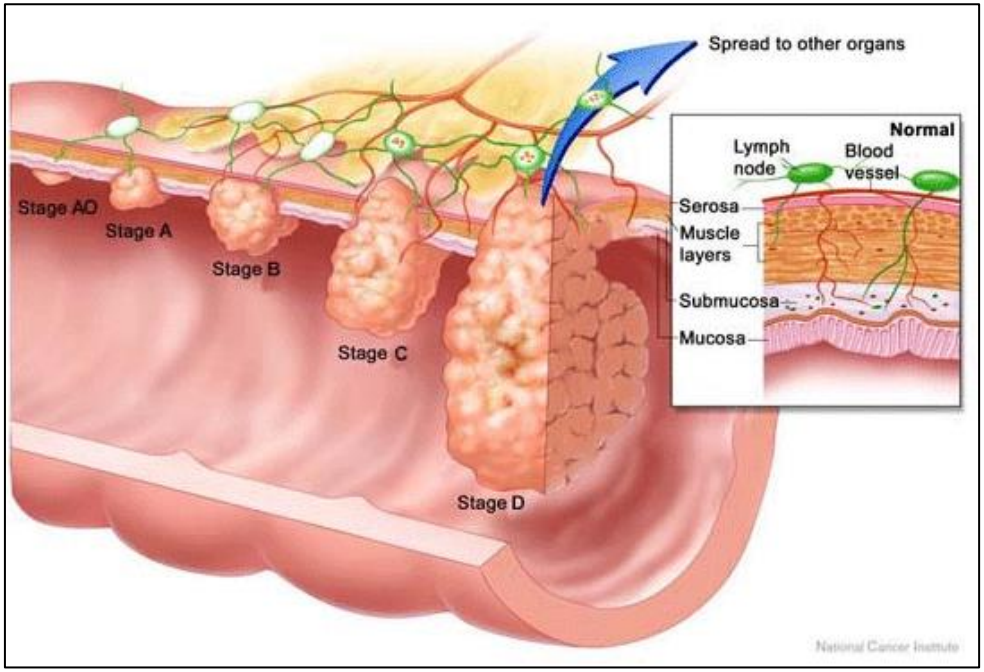
1- organ of origin
2- adjacent and distant organs
3- distant organs and lymph nodes

Spread of Malignant tumors

The difference between metastasis and direct invasion:

Direct invasion: tumor enlarges to invade the adjacent organ with continuity of primary tumor. (e.g. bladder cancer goes to colon or uterus).

Metastasis: tumor invades other organs with discontinuity of primary tumors.



Spread of Malignant tumors:

local invasion

- organ of origin
- Adjacent organs

Metastasis

- Lymphatic
- Haematogenous
- Transcoelomic
- Implantation

e.g. needle tracks, wounds. (Very rare)
Needle biopsy should be obtained for diagnosis

Regional & distant lymph nodes.
E.g. Colon cancer manifesting as a lump in the neck Lump in the neck > 1st sign of metastasis of cancer in the colon, stomach and testes

e.g. peritoneal & pleural cavity.
Dissemination of malignant tumors throughout the peritoneal (abdominal & pelvic) cavity.).

E.g." Krukenberg tumor", stomach cancer metastasis to the ovary, despite the lack of any anatomical relations between both (lymph nodes nor blood vessels nor direct

Common areas of metastasis: Liver, lung, bones.
Brain isn't a common target of metastasis because of the BBB that can block out the cancer cells. **However, small-cell lung cancer ,bronchogenic carcinoma and bladder tumor can easily go to the brain**.

Two Types of Staging:

1- Classical staging :

Stage I & II→ confined to the organ

Stage III → direct invasion

Stage IV → metastasis

2-TNM Classification:

T – Tumor (size)

N – Lymph node

M - Metastasis

There's no mention of lymph nodes or distant metastasis in the classical staging. That's why the TNM classification has been added.

Why Do We Stage Malignant Tumors?

To decide treatment:

Primary is different than secondary treatment

To plan the treatment

Surgery, radiotherapy, chemotherapy)

To asses the prognosis

TNM Classification (American Joint Commission on Cancer)				Dukes' Classification
Stages	T	N	M	Stages
Stage 0	Tis	N0	M0	
Stage I	T1	N0	M0	A
	T2	N0	M0	B1
Stage II	T3	N0	M0	B2
	T4	N0	M0	B2
Stage III	T1, T2	N1 or N2	M0	C1
	T3, T4	N1 or N2	M0	C2
Stage IV	Any T	Any N	M1	D

Whenever you deal with malignant tumor, always remember that there is primary tumor & there may be secondary.

Remember every organ has its own different staging
For example : Duke classification for colon cancer

Manifestation of Malignant tumors

1- Asymptomatic
2- Symptoms related to the primary
3- Symptoms related to the secondary
4-- Incidental finding
5- Weight loss

Bleeding per rectum → colon cancer
Hemoptysis → Lung cancer
Dysphagia → esophageal cancer
Hematuria (painless) → bladder tumor

Related to Secondary:
Low back pain → breast cancer
Hemoptysis → kidney cancer with no problem in urination
Minimal Fall → causes pathological fracture (bone metastasis)

Weight loss & Cachexia
Late manifestations of most malignant tumors (advanced stage)
except in →-GI and
-lung cancers
↓
(bronchogenic carcinoma)

*In the GIT, weight loss & cachexia depends on the level of tumor, at which the food is blocked so it's more evident and significant in the esophagus more than in colon (because it cause dysphagia, so the patient tend to eat less food)

1st presentation comes from the secondary and not from the primary
Presentation of malignant tumors:
Seizure > metastasis to brain
Colon cancer > can present as bleeding per rectum, abdominal distension, intestinal obstruction
PE = enlarged liver: nodular, rough, smooth, hard..(to know character of pain)

Investigation Of Malignant Tumor:

1-Investigate for the primary

For primary we have to define histological features
o In 99% of the cases, we have to know the tissue diagnosis in order to determine the tumor type

1. Depends on the site
2. Define the histology
3. Define the local extension

2-Investigate for the secondary

Look for metastasis usually → Liver
lung
bones

Both will define the diagnosis & stage

1.Accordingly, the treatment plan will be determined.

2.Treating Malignant tumors exposes the patient to major surgeries, dangerous chemotherapy or troublesome radiotherapy.

So make sure that it is malignant then define the type of this tumor (each malignancy has a specific way of treatment)

Cytology

Morphology of individual(cells.)

1- Exfoliative (urine, sputum,….)

the epithelial layer Multiplies and the superficial cells fall down
so try to collect & get benefit from it

2- Fluid aspiration

ascetic fluid, pleural fluid,cyst acidic fluid or plural effusion draw out and send to cytology

3-Fine needle aspiration (FNA) → cells only

taking cells from solid tumors
(FNA), very common nowadays: in solid tissue and draw out cells, then stain the cells on the slide and look under the microscope for any malignant cell

Biopsy

Histological (tissue) characteristics

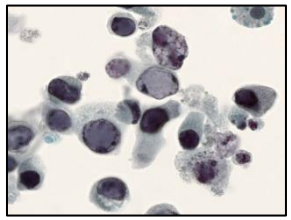
1-Fine-needle aspiration

2-Core biopsy

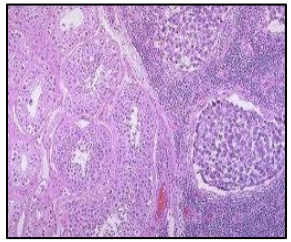
3-Incisional biopsy

(open, needle, forceps..) → part of the tumor

4-Excisional biopsy →whole tumor



cytology



Biopsy

More details in the next slide

Investigation Of Malignant Tumor:

Biopsy **(Examination of the tissue)**

Fine-needle aspiration

Core biopsy

E.g. Tru-cut: core of tissue removed for histological examination
Usually done if the lump is apparent and distinct and localized
Commonly done through endoscope

Incisional biopsy

Removes a small accessible piece of the lesion for histological examination (forceps, needle...)

Many ways of obtaining it

- **Like in ulcer**

you take a small sample by a knife then send it to histology

– **Needle**

E.g. if having breast cancer for example under x-ray, US or CT control

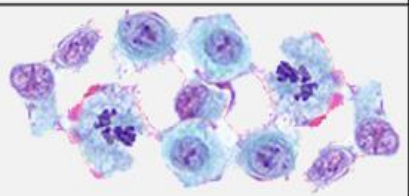
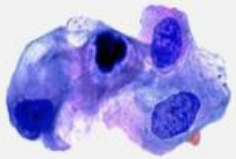
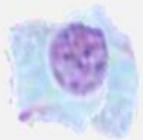
-Gastroscope or colonoscope

If we suspect a gastric ulcer to be malignant

Excisional biopsy

- Complete removal of a discrete lesion without a wide margin and without it being considered curative of the malignancy
- E.g. Remove breast lump for histology
- Sometimes, this cannot be done because the tumor is disseminated or cannot be removed alone

Principles of Cytology

Normal	Cancer	
		Large, variably shaped nuclei
		Many dividing cells; Disorganized arrangement
		Variation in size and shape
		Loss of normal features

The Difference Between Benign And Malignant Cells:

Malignant cells are characterized by deeply stained nuclei (**Hyperchromatism**), divided nuclei that are larger in size in comparison to the cytoplasm, and the shape of the cells is not identical (**polymorphism**, the cells in different stages of growth).

Tumor Markers

The concept is very important

Substances which if present in the blood or tissues may indicate malignancy.

1-Most markers are cells from normal cells or malignant cells (primitive)

- Most are non-specific

-Important in diagnosis (general findings + tumor markers)

-Important in follow up

E.g. patient has testicular tumor and high α –fetoprotein,, after removing the tumor, α –fetoprotein is decreased. If after 6 months, the α –fetoprotein goes back up, that indicates recurrence of the tumor.

-Important for screening (early detection)

- ✓ Males over 40 years old do PSA
- ✓ Mammography for carcinoma of the breast
- ✓ PAP smears for cervical carcinoma
- ✓ Others: CEA, α-fetoprotein, HCG

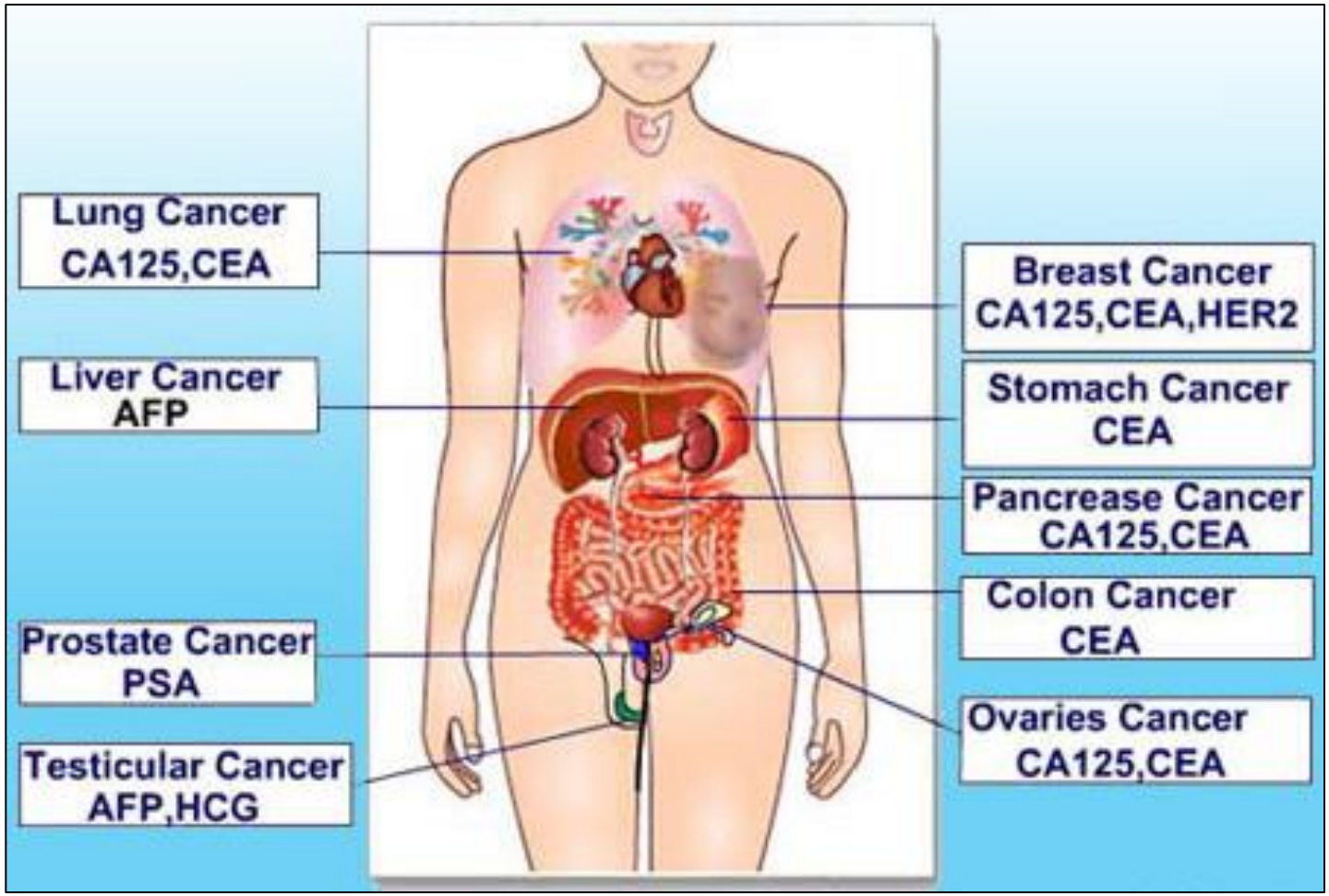
2-Sometimes pathologists use histochemical stains for specific tumor markers in tissue, and by this we can determine the type of tumor.

3-Patients with high PSA, biopsy showed no indication of malignanacy > false +ve

4-Patient has malignancy but PSA level was normal > false –ve

5- To detect relapses

Tumor Markers-examples



Hormones And Cancer

A) Hormones related to tumor growth:

-Usually sex hormones (testosterone, estrogen

-They may have a relation to tumor growth, so inhibition of the receptors of these hormones can be used in treatment →E.g.

1- In breast cancer, ask the histologist to find any estrogen receptors. That will affect the treatment plan and prognosis. (go to the next slide)

2- Growth of the prostate and the malignant cells are dependent on the testosterone so if we block the testosterone secretion by drugs, the tumor will stop growing

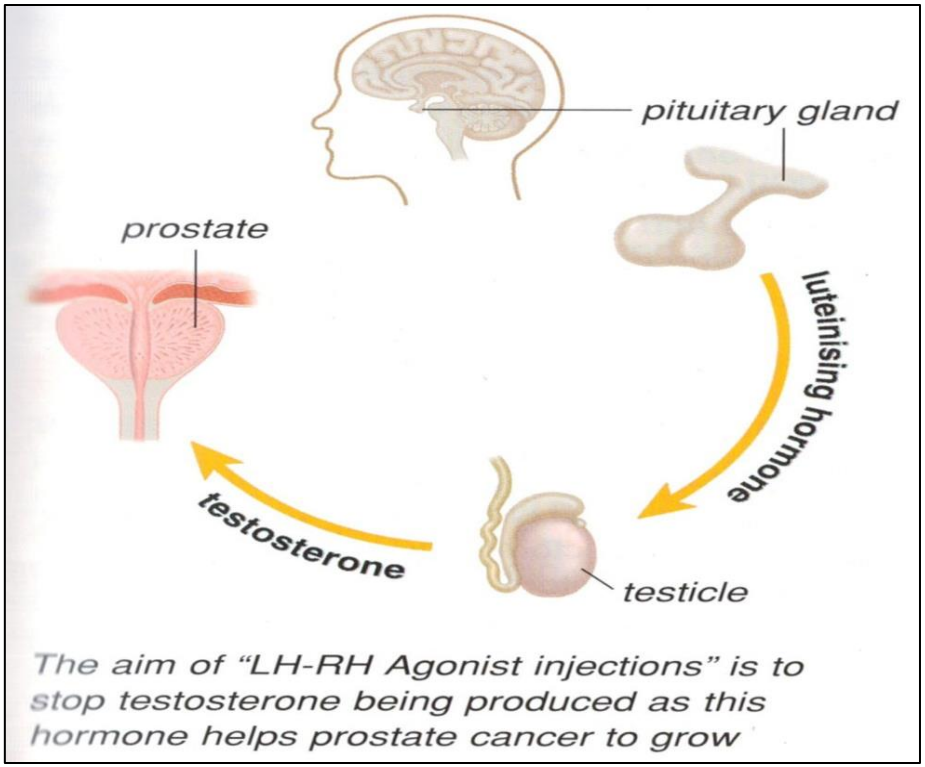
(go to the next slide)

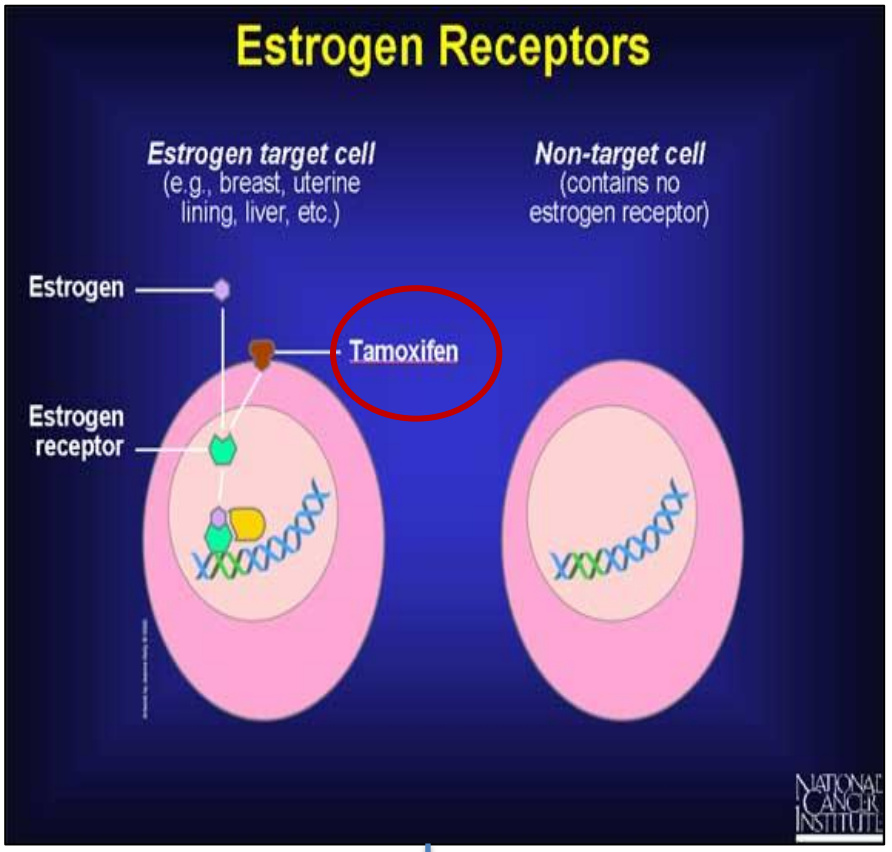
B) Hormones may be produced by tumors:

- Originally hormone producing organ e.g. adrenals (Cushing's…)
- Originally non hormone producing organ e.g. lung (bronchogenic carcinoma)

Hormones And Cancer

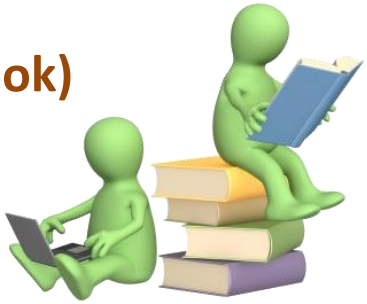
Testosterone and Prostate Cancer





When tissue is taken from a cancerous breast and get sent into the lab, we may find estrogen receptors which could be treated with anti-estrogen (Tamoxifen), thus decreasing the effect of estrogen on the breast. This way we're minimizing growth of the malignant cells

Review Questions (From Surgery Recall Book)



What tumor marker is associated with colon cancer ?

CEA

What tumor marker is associated with Hepatoma?

a-fetoprottein

What tumor marker is associated with Pancreatic carcinoma ?

CA 19-9

What is paraneoplastic syndrome ?

Syndrome of dysfunction not directly associated with tumor mass or mets (autoimmune or released substance)

What are the most common cancers in women?

1- Breast. 2- Lung. 3-Colorectal.

What are the most common cancers in men?

1-Prostate. 2-Lung. 3- Colorectal.

What is the most common cancer causing death in both men and women ?

Lung.

MCQs (From Raslan's)

1-A patient comes with an enlarged cervical lymph node, which of the following is unlikely to be the primary site?

a. Bronchus
b. Stomach
c. Colon
d. Mouth
e. Laryngopharynx

2-To detect hematogenous spread of a tumor, all the followings should be done EXCEPT:

A-Chest radiograph
B-Cystoscopy
C-Abdominal CT
D-Bone scan

Which of the following tumors has the least potential of malignant transformation?

A-Renal angiomyolipoma
B-Ovarian embryonic carcinoma
C-Osteosarcoma
D-Mesothelioma

Answers: 1;C , 2;B, 3;A

Thank You..

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