432 Surgery Team

1 Principles of Surgical Oncology

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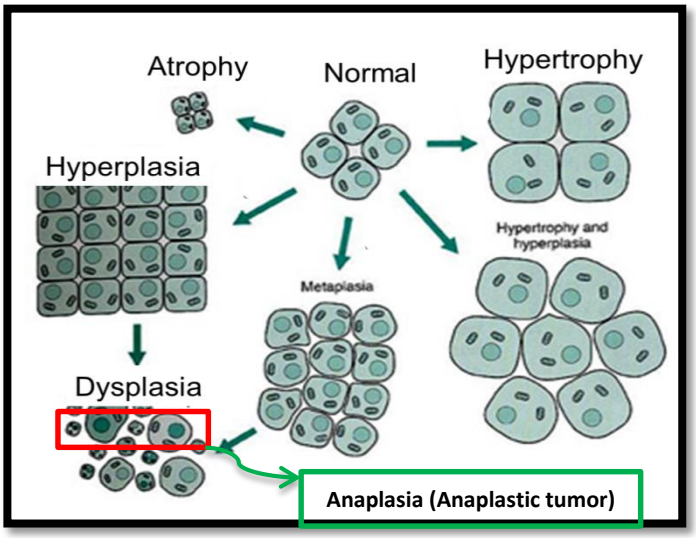
Objectives

Not given!

Pathological cell changes:



Atrophy: •cell decreases in **SIZE**.

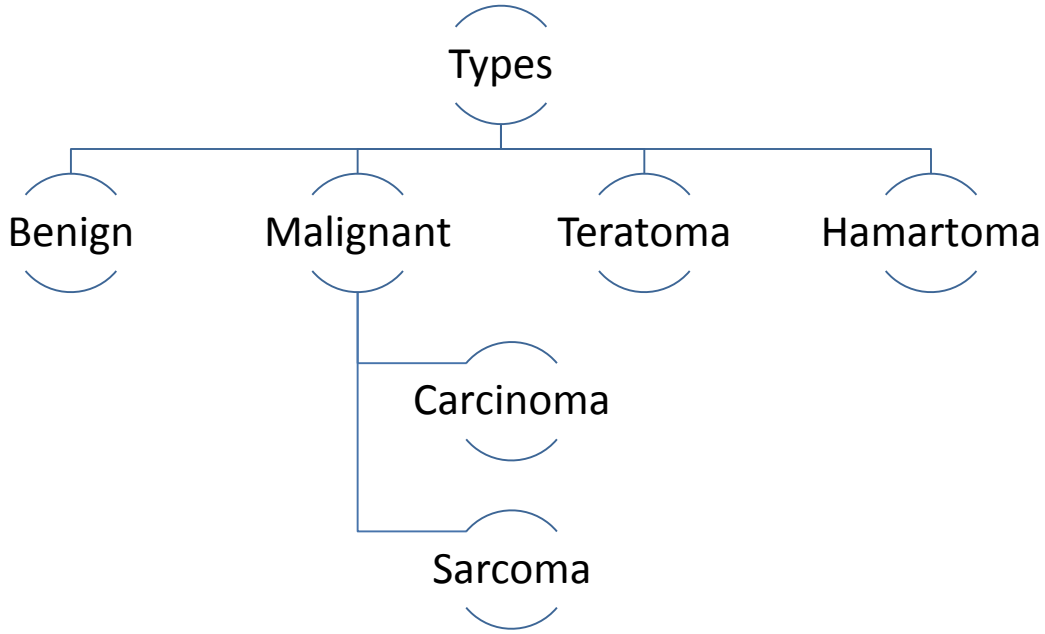
Hyper-trophy: •Increase of the **SIZE** of cell, **not number**.

Hyper-plasia: •Increase in the **NUMBER** of cells

Meta-plasia: •Replacement of one cell type by another.

Dysplasia: •Replacement of one cell type by **ANOTHER CELLS THAT HAVE THE POTENTIAL TO PROGRESS TO CANCER**

Types of Tumors:



Hamartoma vs Teratoma:

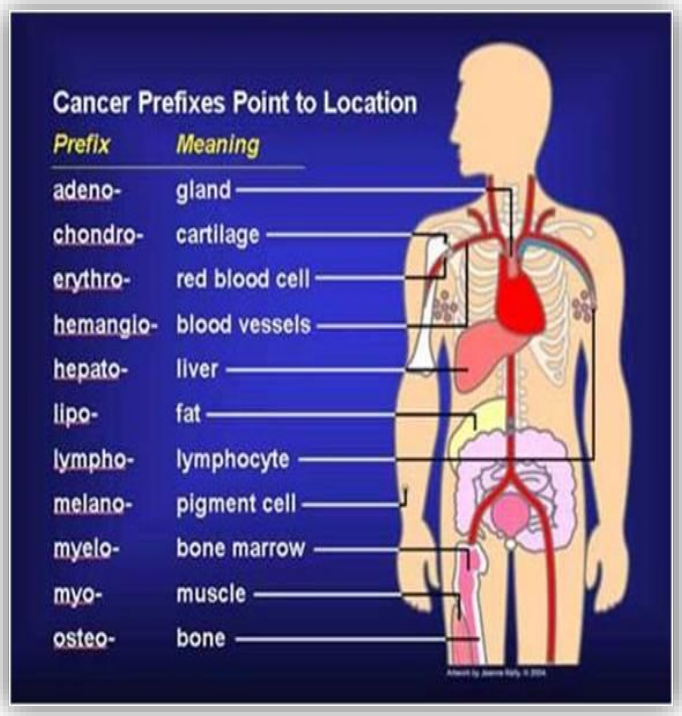
Teratoma:

- 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 "Totiopotential cells".
- Could be benign or malignant

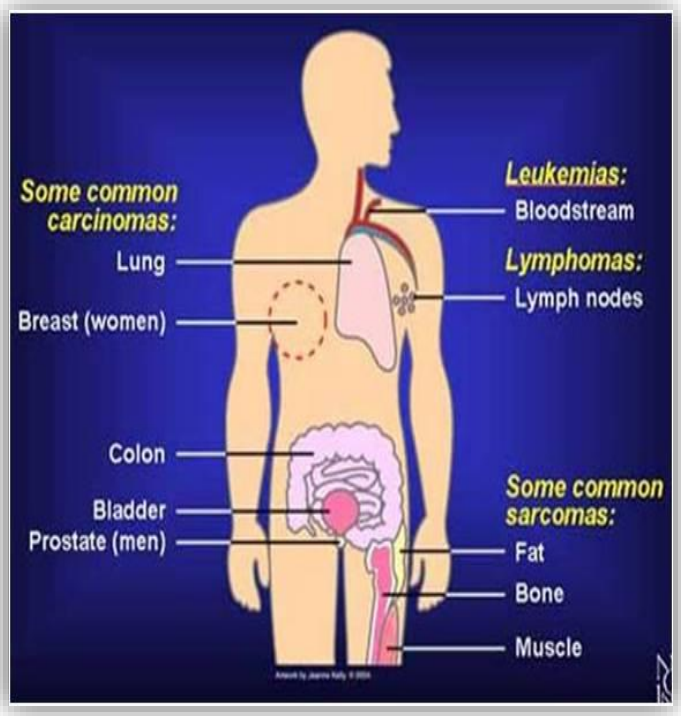
Hamartoma:

- 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.

Cancer Nomenclature



Types of Malignancies



Carcinoma :

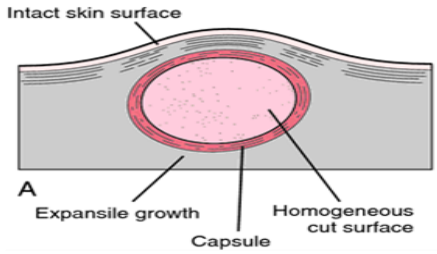
- Originates from the **epithelial** tissue
- Carcinomas include cancers of the: breast, lung, kidney, thyroid,colon, prostate, stomach and many others.

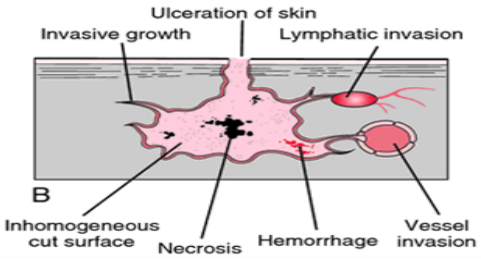
Sarcoma :

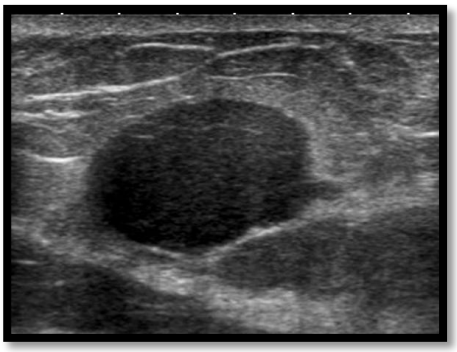
- Sarcomas develop from the **mesodermal** tissue.
- **Sarcomas include cancers of the:** bone, muscle, fat, nerves, cartilage and fibrous tissue, such as ligaments and connective tissue.
- **Blood cancers:**
- Leukemia,lymphoma,Myeloma.

Benign vs Malignant:

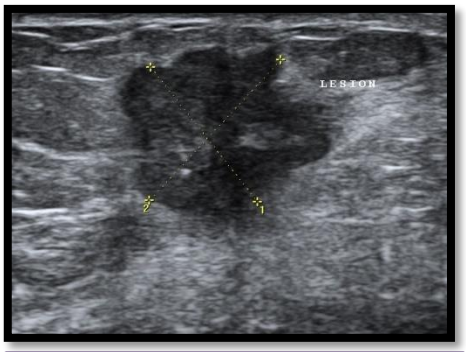
Benign	Malignant
- Encapsulated - No invasion - No metastasis	- Non encapsulated: Sometimes, there is a capsule but it's a "false capsule", meaning it's a fibrous capsule from the same tissue. - Usually invades - Metastasis



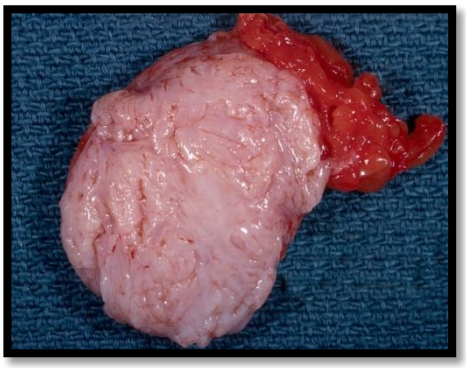


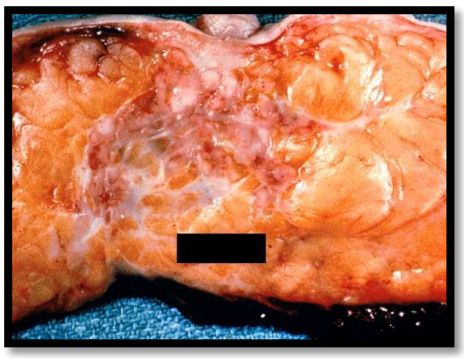


Benign (Encapsulated)



Malignant tumor in the breast + lymph nodes.



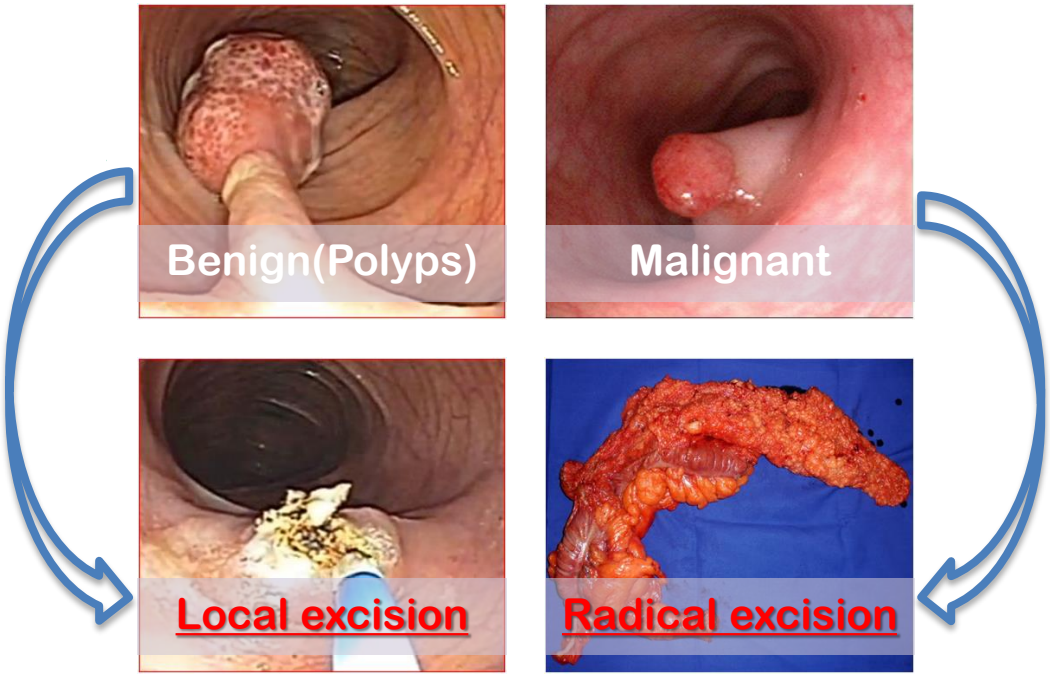


No boundaries

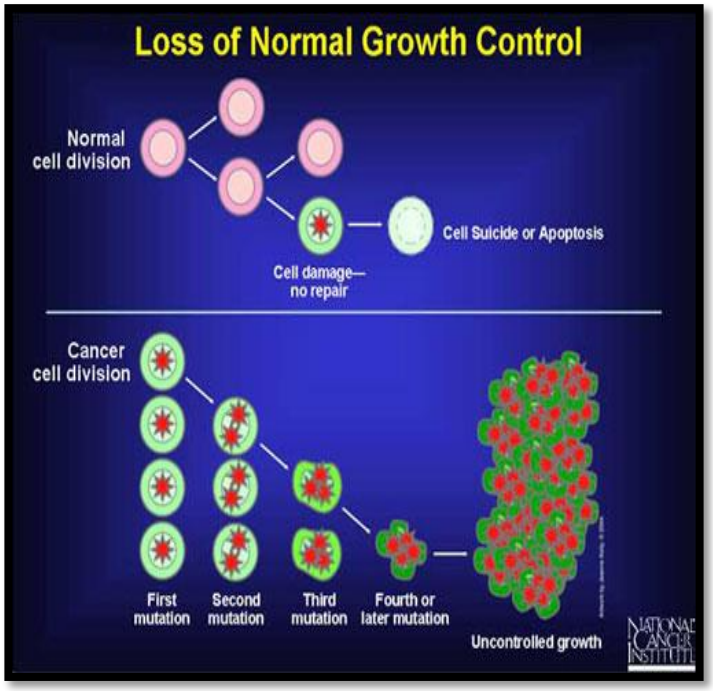
Note(s):

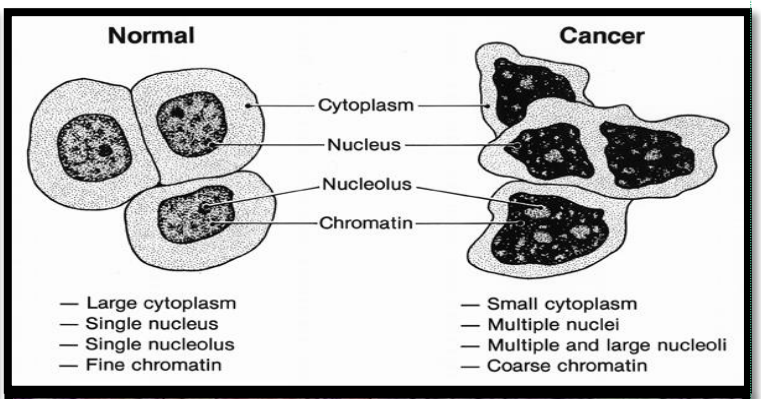
Benign growth is controlled whereas malignant growth is not. That's why it: - can invade the same organ (nonencapsulated), go to adjacent organs, or go to lymph or blood - can metastasize e.g. Cancer in lung goes to brain; cancer of colon goes to lung, cancer of prostate goes to vertebral column.

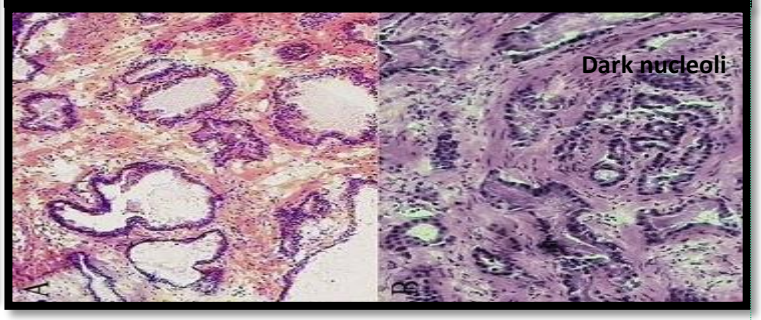
Treatment implications:



Normal cell & malignant cell:

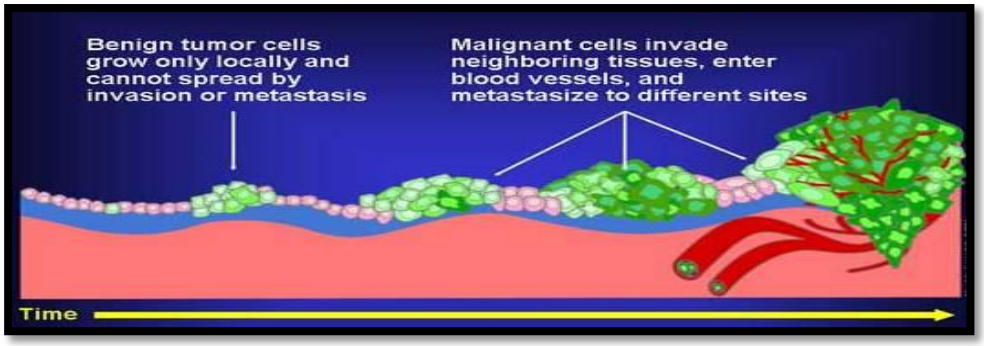


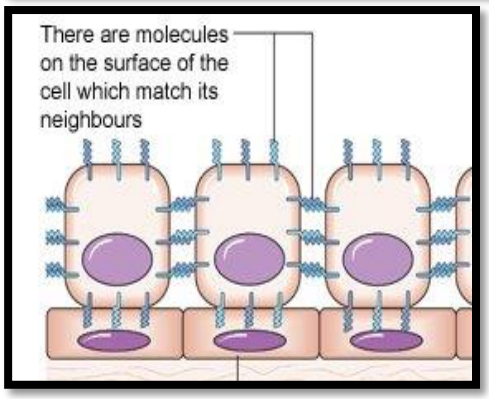


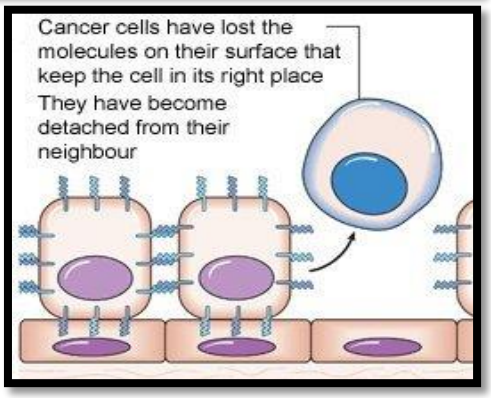


Cancer arises from a loss of normal growth control. In normal tissues, the rates of new cell growth and old cell death are kept in balance. In cancer, this balance is disrupted. This disruption can result from uncontrolled cell growth or loss of a cell's ability to go into apoptosis, which in turn will lead to abnormal shapes, numbers and non-uniformity of cells.

Characteristics of malignant cells:

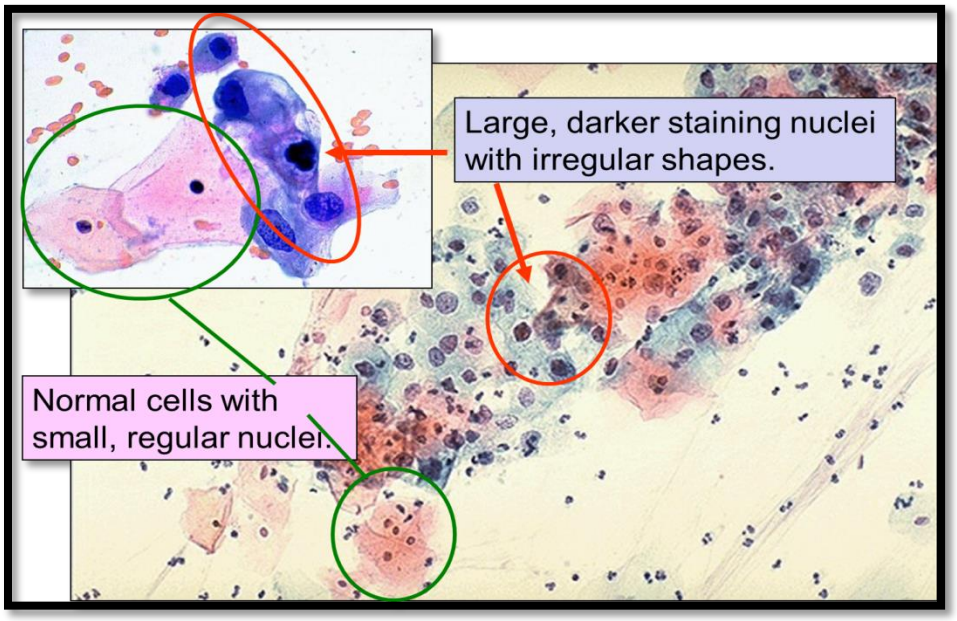






Normally, cells stop growing and reproducing once their plasma membrane comes into contact with another. Cancer cells lack this contact phenomenon. They continue to grow into other cells taking over and often destroying the other cells, creating a tumor

Malignant cell morphology:



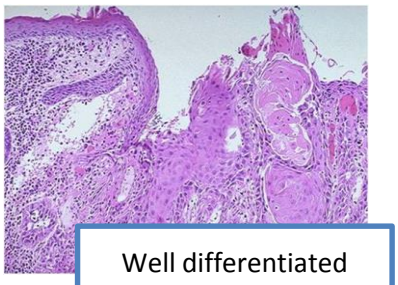
The difference between benign and malignant cells: Malignant cells are characterized by deeply stained nuclei (darker), divided nuclei that are larger in size in comparison to the cytoplasm, and the shape of the cells are not identical (polymorphism, the cells in different stages of growth).

Tumor Grading & Differentiation:

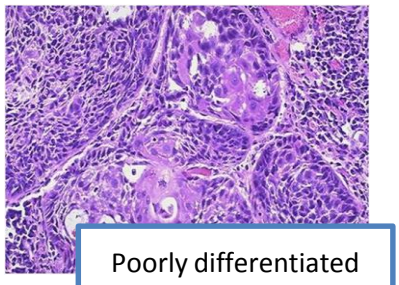
Grading: Describes the histological characteristics of cancer cells. It mainly talks about the layers of the cell. e.g. grade I, II, III. (Grading is a way of classifying cancer cells based on their appearance and behavior when viewed under a microscope).

Differentiation: 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

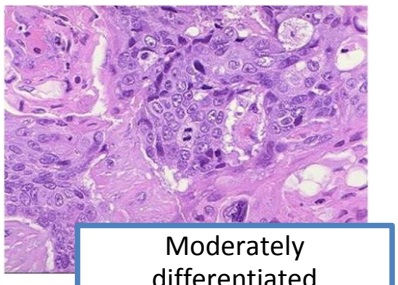
Well-differentiated	•Cancer cells look and behave like the normal cells in the tissue they started to grow in **(slow growing and less aggressive).**
Moderately differentiated	•Cancer cells look and behave somewhere between well-differentiated and undifferentiated cancer cells.
Poorly differentiated	•Cancer cells look and behave quite differently from normal cells in the tissue they started to grow in. They look immature/undeveloped **.(More aggressive and have a worse prognosis)**
Anaplastic.	•Cancer cells that divide rapidly and have little or no resemblance to normal cells.



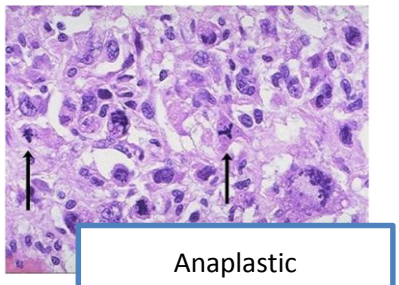
Well differentiated



Poorly differentiated



Moderately differentiated



Anaplastic

Note(s):

- 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.

***-Poorly differentiated** :*

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

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

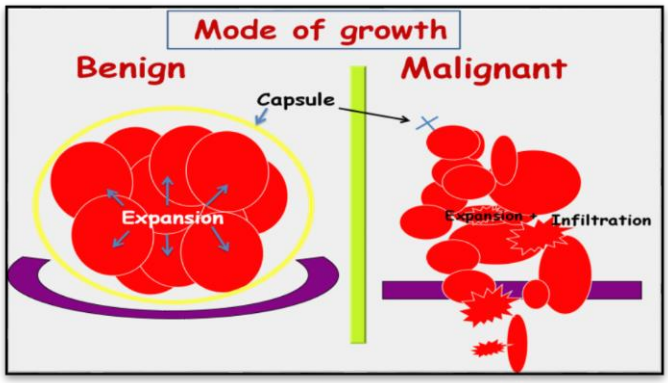
-Anaplastic E.g.:

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 well-differentiated 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.

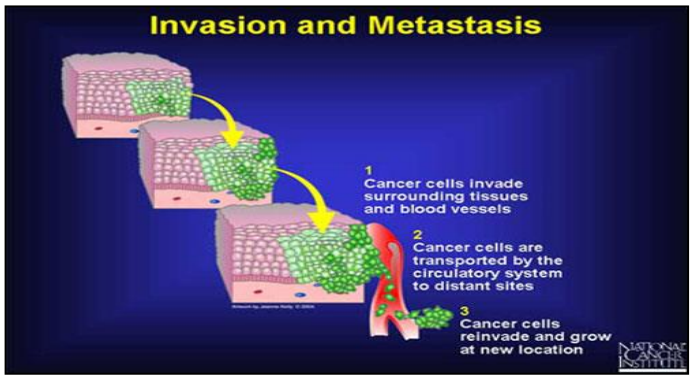
Both grading and differentiation describe the histological features of the tumor (not the macroscopic features, invasion or metastasis)

Local Effects of Tumors:



Compress adjacent structures

Why malignant cells are dangerous:



Invasion of basement membrane

Spread of Malignant tumours:

Local invasion:

Within the organ:

(Cancer of bladder → uterus and colon)

Adjacent organs:

(Lung cancer → skin and chest wall)

Metastasis:

- **Lymphatic:** 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.

- **Haematogenous:**

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 can metastasize to the brain. It spreads very quickly and also produces hormones like ACTH from the lung.

- **Transcoelomic** 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)**.

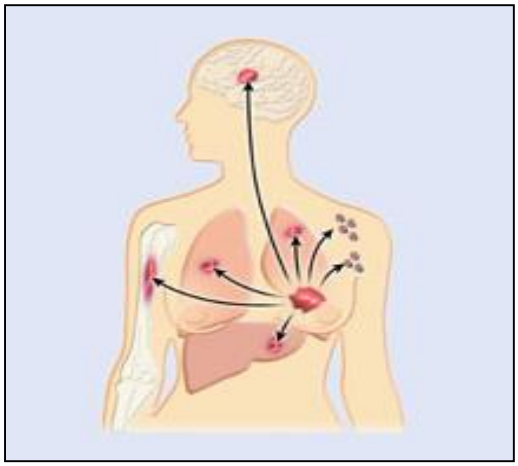
- Implantation e.g. needle tracks, wounds. **(Very rare)**

Note(s):

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. (Through blood)



STAGING OF MALIGNANT TUMORS:

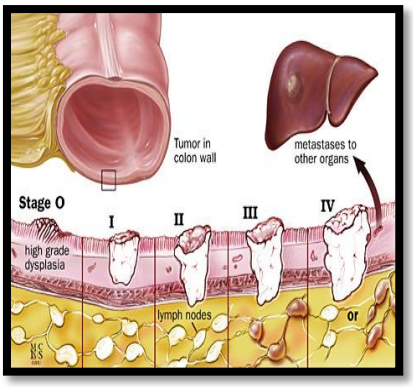
Staging describes the **primary tumor**, its relation with the **organ of origin**, adjacent **and distant organs.**

Types of Tumor Staging:

1. Classical staging:

- **Stage I and II confined to the organ.**
- **III =direct invasion.**
- **IV= metastasis.**

Lymph nodes aren't mentioned in the classical staging. That's one of the reasons to why the TNM classification has been created.



2.TNM Classification (more specific)

The TNM system is based on the size and/or extent (reach) of the *primary tumor* **(T)**, the *amount of spread to nearby lymph nodes* **(N)**, and the *presence of metastasis* **(M)** or secondary tumors formed by the spread of cancer cells to other parts of the body	***Primary Tumor (T)*** **TX**: Primary tumor cannot be evaluated **T0**: No evidence of primary tumor **Tis**: Carcinoma in situ (CIS; abnormal cells are present but have not spread to neighboring tissue; although not cancer, CIS may become cancer and is sometimes called preinvasive cancer) **T1, T2, T3, T4**: Size and/or extent of the primary tumor	***Regional Lymph Nodes (N)*** **NX**: Regional lymph nodes cannot be evaluated **N0**: No regional lymph node involvement **N1, N2, N3**: Degree of regional lymph node involvement (number and location of lymph nodes)	***Distant Metastasis (M)*** **MX**: Distant metastasis cannot be evaluated **M0**: No distant metastasis **M1**: Distant metastasis is present

For example, breast cancer classified as **T3 N2 M0** refers to a large tumor that has spread outside the breast to nearby lymph nodes but not to other parts of the body.
Prostate cancer **T2 N0 M0** means that the tumor is located only in the prostate and has not spread to the lymph nodes or any other part of the body.

(Source: http://www.cancer.gov/cancertopics/factsheet/detection/staging)

Why Do We Stage Malignant Tumors?

1. **To decide the treatment :**

Treatment for **primary tumors** is different from **secondary** ones and **localized** is different from **metastasis**. E.g. you can't tell the patient he has cancer in the kidney when you don't know if there's metastasis to the liver. This way you have exposed the patient to unnecessary treatment when operated on (because there is no benefit of the operation, since you didn't check for metastasis).

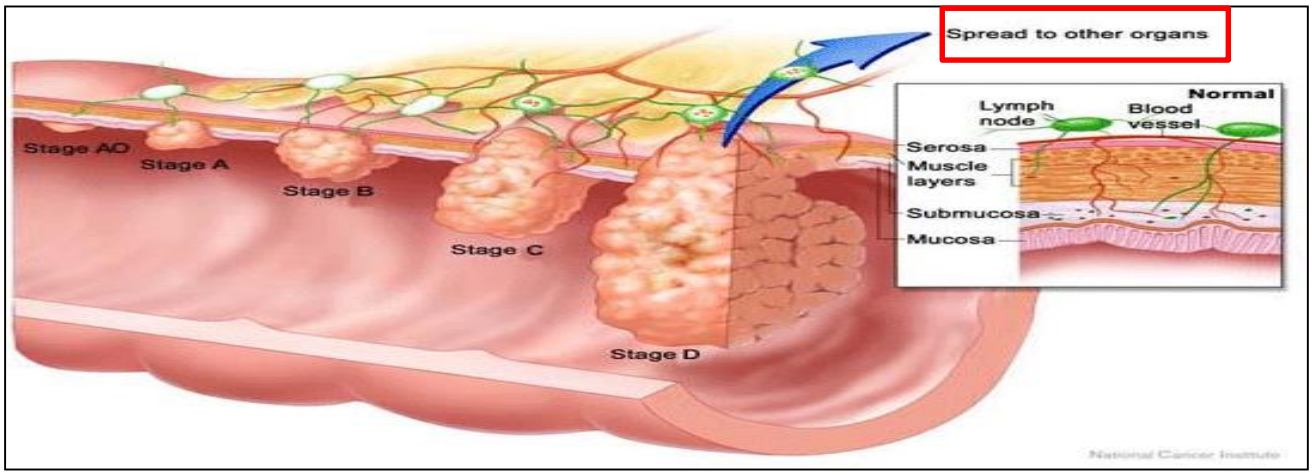
2. **To plan the treatment:**

- Multimodality treatment.
- Sometime they're referred to the tumor board to plan the treatment (surgery, radiotherapy, chemotherapy).
- Duration of treatment depends on the case.

3. **To assess the prognosis:**

- E.g. if we have a patient with a localized kidney tumor and another with a metastasized kidney tumor, the second patient has poorer prognosis in comparison
- "Our expectations, according to Statistics but not necessarily applied to the patient himself". So when we talk about certain tumors and its high percentage for bad prognosis, this is a statistical study for a population. But when we talk for a person, s/he has 50% of having bad or good prognosis.

Remember that every organ has its own different staging **(e.g. Duke Classification for colon cancer only)**



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

Presentation of Malignant Tumors:

- Asymptomatic (incidental finding)
- Symptoms related to the primary tumor:
  - E.g. Bleeding per rectum or intestinal obstruction for colon cancer.
  - Dysphagia for esophageal cancer.
  - Hematuria for bladder tumor.
  - Hemoptysis for lung cancer.
- Symptoms related to the secondaries:
  - E.g. 60 y/o female had sudden low back pain, after investigations, she was discovered to have breast cancer **(bone metastasis).**
  - Hemoptysis- patient might have cancer in the kidney and the patient doesn't have any problem in urination (secondaries).
  - Minimal fall → pathological fracture **(discovered to have bone metastases)**
- Weight loss and Cachexia are late manifestations of most malignant tumors (advanced stage) *except* GI and Lung cancer (bronchogenic carcinoma)

Note(s):

In the GIT, weight loss & cachexia depends on the level of tumor, at which the food is blocked. So it's more evident in the esophagus (highest level), than in the stomach and the colon (lowest level)

Investigation of Malignant Tumors:

1. Investigate for the primary tumor:

For primary we have to define **histological features**

In 99% of the cases, we have to know the tissue diagnosis in order to determine the tumor type

- Depends on the site.
- Define the histology.
- Define the local extension.

2. Investigate for the secondaries:

Look for metastasis.

Usually **liver**, **lung** and **bones.**

3. Both will define the diagnosis & stage.

Accordingly, the treatment plan will be determined

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).

BIOPSY (Examination of the tissue)			
Fine-needle aspiration	**Core biopsy:** 1. E.g. Tru-cut: core of tissue removed for histological examination 2. Usually done if the lump is apparent and distinct and localized 3. Commonly done through endoscope	**Incisional:** Removes a small accessible piece of the lesion for histological examination (forceps, needle...) Many ways of obtaining it: 1.Like in ulcer, you take a small sample by a knife then send it to histology 2. Needle E.g. if having breast cancer for example under x-ray, US or CT control 3. Gastroscope If we suspect a gastric ulcer to be malignant OR colonoscope	**Excisional:** 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.

CYTOLOGY(Morphology of individual cells)		
Exfoliative (fluid)	**Fluid aspiration** Ascites, pleural fluid, cyst acidic fluid or plural effusion drawn out and sent to cytology	**FNA** Taking cells from solid tumors, Fine needle aspiration (FNA), very common nowadays. Draw out cells from solid tissue then stain the cells on the slide and look under the microscope for any malignant cells

Tumor Markers:

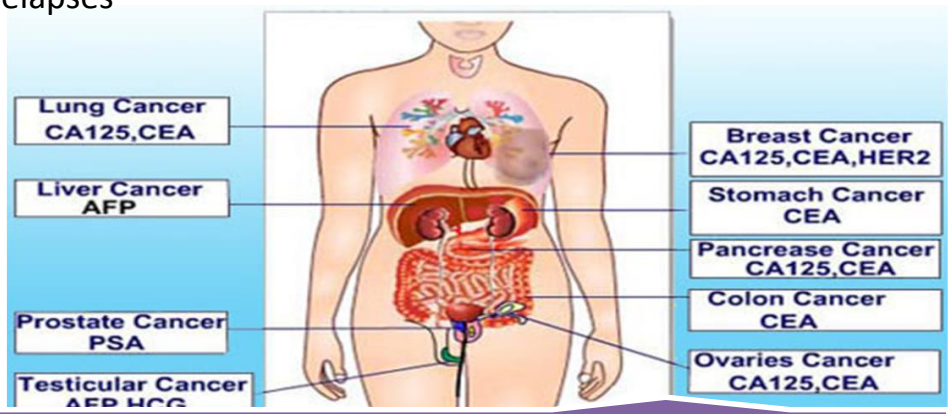
- Substances present in the blood or tissue fluid in a concentration related to the presence of a tumor.
- Most markers are cells from normal cells or malignant cells (primitive).
  - Most are non-specific.
- Important in *diagnosis* (general findings + tumor markers)

E.g. patient with testicular tumor "clinically" and was found to have a high level of teratoma's tumor marker → the patient has teratoma not seminoma.

- Important for *screening*.
  - *The early detection, incidence of disease*
  - *Males over 40 years old do PSA*
  - *Mammography for carcinoma of the breast*
  - *PAP smears for cervical carcinoma*
  - *Others: CEA, α-fetoprotein, HCG*
- 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.

- Sometimes pathologists use histochemical stains for specific tumor markers in tissue, and by this we can determine the type of tumor.
- Patients with high PSA, biopsy showed no indication of malignanacy > false +ve
- Patient has malignancy but PSA level was normal > false –ve
- To detect relapses



Tumor Markers-examples

Hormones & Cancer:

Hormones related to tumor growth:

- Usually sex hormones **(testosterone, estrogen)**
- They may have a relation to tumor growth
- Hormone receptors are involved The concept can be used in treatment

E.g. In breast cancer, ask the histologists to find any estrogen receptors. That will affect the treatment plan and prognosis. Also the prostate needs testosterone to live, so if we block the testosterone secretion by drugs, the tumor will stop growing.

Growth of the prostate and the malignant cells are dependent on the testosterone. So we control the malignancy by either removing the primary as producing organ of the tumor, which is the testes, or blocking one of these pathways.

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

Hormones may be produced by tumors:

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

SUMMARY

1. **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 ovary, testis
2. **Hamartoma:**benign tumor composed of an overgrowth of mature cells and tiss ues **normally present in the affected part.**
3. Benign :Encapsulated- No invasion- No metastasis
4. Malignant: Non encapsulated: Sometimes, there is a capsule but it's a "false capsule", meaning it's a fibrous capsule from the same tissue- Usually invade- Metastasis.
5. Benign growth is controlled whereas malignant growth is not. That's why it: - can invade the same organ(nonencapsulated), go to adjacent organs, or go to lymph or blood.
6. Cancer arises from a loss of normal growth control. In normal tissues, the rates of new cell growth and old cell death are kept in balance. In cancer, this balance is disrupted. This disruption can result from uncontrolled cell growth or loss of a cell's ability to apoptosis which in turn will lead to abnormal shapes, numbers and no uniformity of cells.
7. Staging describes the **primary tumor**, its relation with the **organ of origin**, adjacent **and distant organs: 1. Classical staging 2. TNM**
8. Grading is a way of classifying cancer cells based on their appearance and behavior when viewed under a microscope.
9. Differentiation refers to how cancer cells look and function compared to normal cells.

Surgical Recall

Chapter 33 Surgical Oncology

Define:

Surgical oncology	Surgical treatment of tumors
XRT	Radiation therapy
In situ	Not invading basement membrane
Benign	Nonmalignant tumor—does not invade or metastasize
Malignant	Tumors with anaplasia that invade and metastasize
Adjuvant RX	Treatment that aids or assists surgical treatment = Chemo or XRT
Neoadjuvant RX	Chemo, XRT, or both BEFORE surgical resection
Brachytherapy	XRT applied directly or very close to the target tissue (e.g., implantable adioactive seeds)
Metachronous tumors	Tumors occurring at different times
Synchronous tumors	Tumors occurring at the same time

What tumor marker is associated with colon cancer?	CEA
What tumor marker is associated with hepatoma?	α-Fetoprotein
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. Lung 2. Breast 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!

Questions

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

A-Bronchus

B-Stomach

C-Colon

D-Mouth

1- 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

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

A. Renal angiomyolipoma

B. Ovarian embryonic carcinoma

C. Osteosarcoma

D. Mesothelioma

Answers:

1st Questions: C

2nd Questions: B

3rd Question: A