430 Surgery Team

Principles of Surgical Oncology

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Green: Team's Notes
Blue: Further Explanations
Red: Important notes

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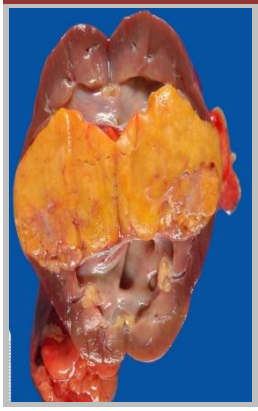
Definition of Tumors

The term "tumor" is commonly used as a synonym for a neoplasm[1] (a solid or fluid-filled [cystic] lesion that may or may not be formed by an abnormal growth of *neoplastic* cells) that appears enlarged in size. *Tumor* is not synonymous with cancer. While cancer is by definition malignant, a tumor can be benign, pre-malignant, or malignant, or can represent a lesion without any cancerous potential whatsoever.

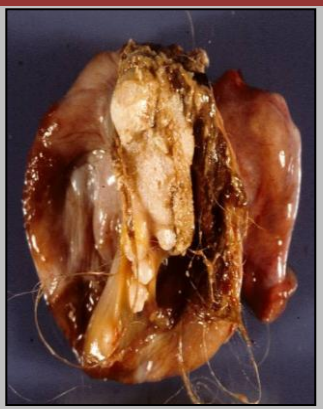
Types of Tumors

1. Benign
2. Malignant: The main two components of malignant tumors (Mainly differ in origin):
   - Carcinoma (Epithelial origin)
   - Sarcoma (Connective tissue origin, e.g. angiomyo-sarcoma, osteosarcoma, leiomyosarcoma, fibrosarcoma, liposarcoma)
3. Teratoma: is an encapsulated tumor with tissue or organ components resembling normal derivatives of all three germ layers. Dermoid tumor arise as dermoid cyst, in the ovaries and testis its component includes hair, bone, teeth, skin and sometimes nerves and these components should not arise in the testis or ovaries because it is not in its original places.
4. Hemartoma: is a disorganization of tissues which is originally present in that organ e.g. angiomyolipoma

Hamartoma Vs. Teratoma



Hamartoma: the tissues are in their original place but disorganized. Usually not malignant it may be big in size.



Teratoma: the tissues are not in their original place. They can become benign and malignant and when they are malignant it becomes very malignant because of its different origin

- Important differences between Benign and Malignant tumors from pathological and surgical point of view:

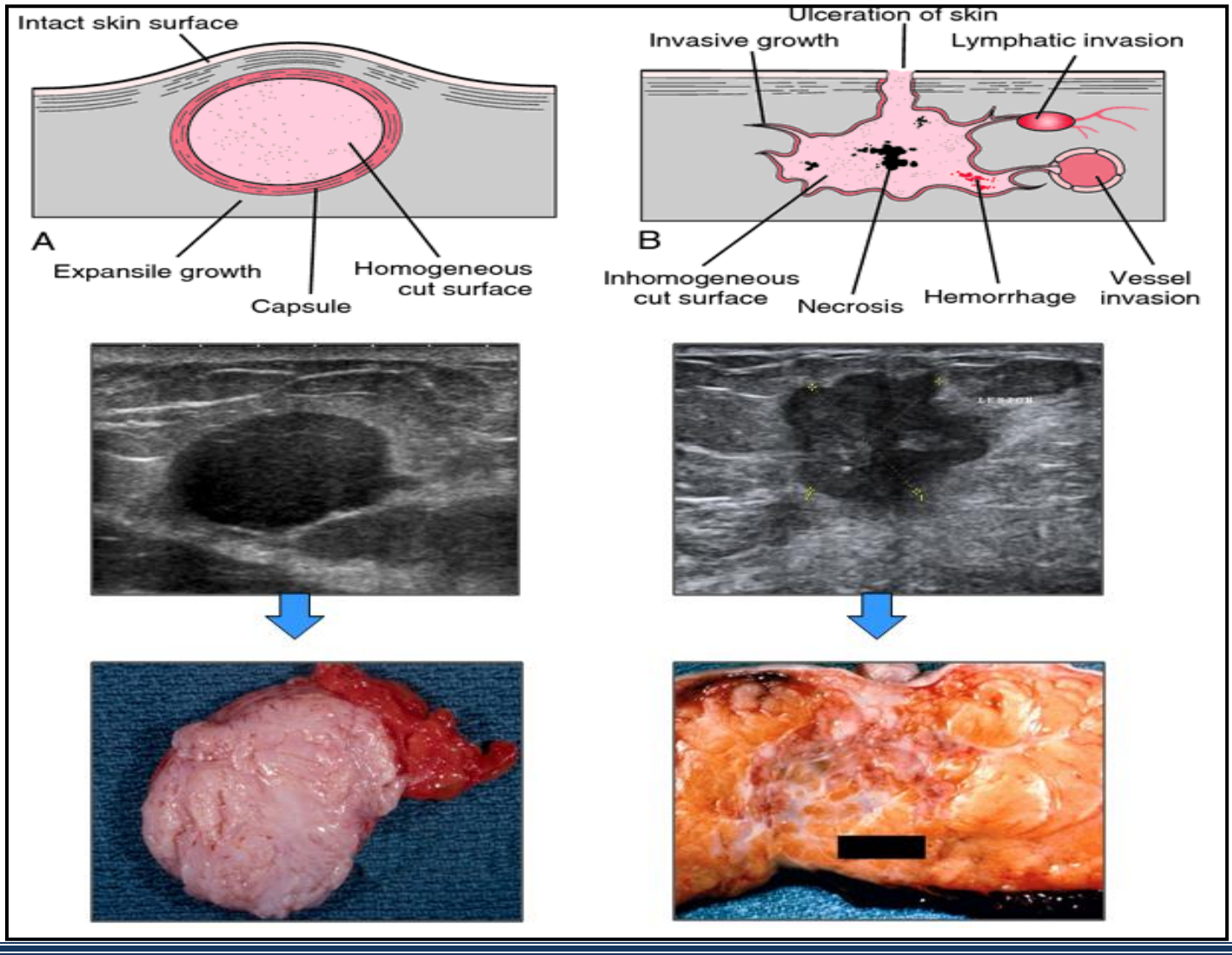
The differences between the benign and the malignant tumors arise from the differences between the cells (the behavior of the cells) once the normal system is destroyed (In which it's unknown in most of the cases) the cells become uncontrollable(Loss of normal growth control).
Normally in all the epithelial organs the superficial layer is discarded and is replaced continuously on a regular basis, but with cancer cells there is no system that's why the

growth is uncontrollable (this means that it can be non-encapsulated and can invade the tissues, the blood vessels, the lymphatic).

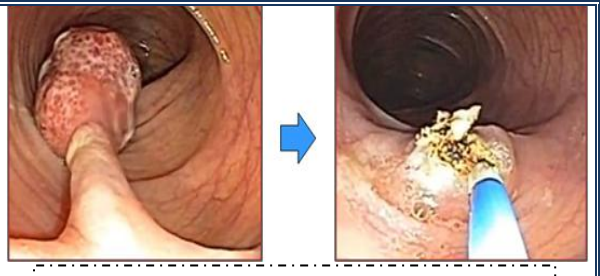
- Benign tumors:
  - Encapsulated (good line of demarcation e.g. lipoma the whole capsule can be removed)
  - No invasion (can be big in size and causes compression but no invasion)
  - No metastasis
- Malignant tumors:
  - Non encapsulated (pseudocapsule; it compresses the normal organ tissue and some reaction to that, because the malignant tumor is an abnormal event that's why the body is trying to overcome this and tries to form a capsule but it's not a capsule, this means there's no line of demarcation [no difference between the malignant tissue and the normal tissue] that's why in surgery they don't only remove the tumor itself but they remove parts of the organ or the whole organ along with the tumor {radical excision}).
  - Usually invasive
  - Metastasis

Tumor Invasion

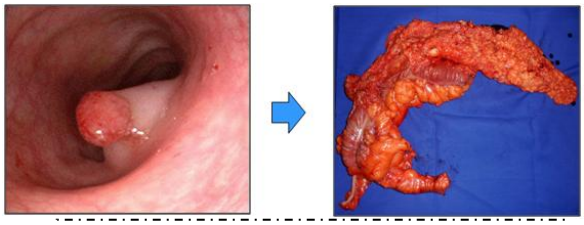
Invasion means that the tumor invades locally and in continuation with the primary tumor e.g. a tumor in the bladder invades the uterus, but metastasis is discontinuous with the primary tumor e.g. lymph nodes, vasculature, liver.



❖ Treatment implications:
- Benign tumors: Local excision
- Malignant tumors: Radical excision



Local excision of Benign tumor



Radical excision of Malignant tumor

Tumor Grading and Differentiation

- Tumor Grading: Describes the <u>histological characteristics</u> of cancer cells. It is mainly concerned with cell layers (e.g. Grade I, II, III)
- Tumor Differentiation: Describes the characteristics of cancer cells in reference to their resemblance to the cell of origin. (the differences between the malignant cell and cell of origin). For example;
  - Well differentiated (Resembles the original cells).
  - Moderately differentiated
  - Poorly differentiated
  - Anaplastic (No resemblance).

∗Both tumor grading and differentiation describe **the histological features** of the tumor, but not the macroscopic features, such as invasion or metastasis

Tumor Grading

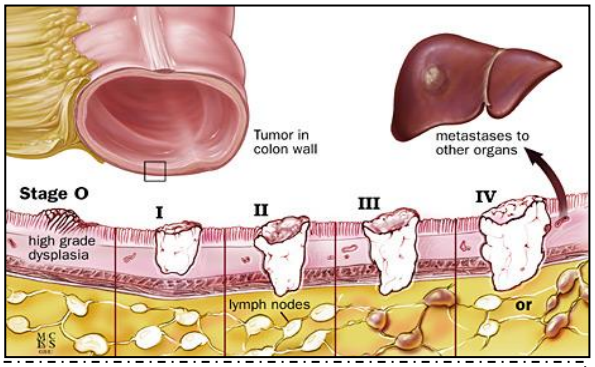
Grading depends on the organ and on the cellular layer s. E.g. grade1 in the colon is different from grade1 in the bladder

Tumor Staging

Describes the primary tumor, the relation of the primary tumor with the organ of origin, with the adjacent organs and with the distant organs

<u>Types of Tumor Staging</u>

- Classical staging: e.g. stage I, II, III, IV
- TNM Classification: (international classification) e.g. T1, No, Mo
  - T – Tumor: T1, 2, 3, Tis, Ta, Tb (primary tumor only)
  - N – Node: N0, 1, 2, 3
  - M – Metastasis: M0, 1, 2, 3

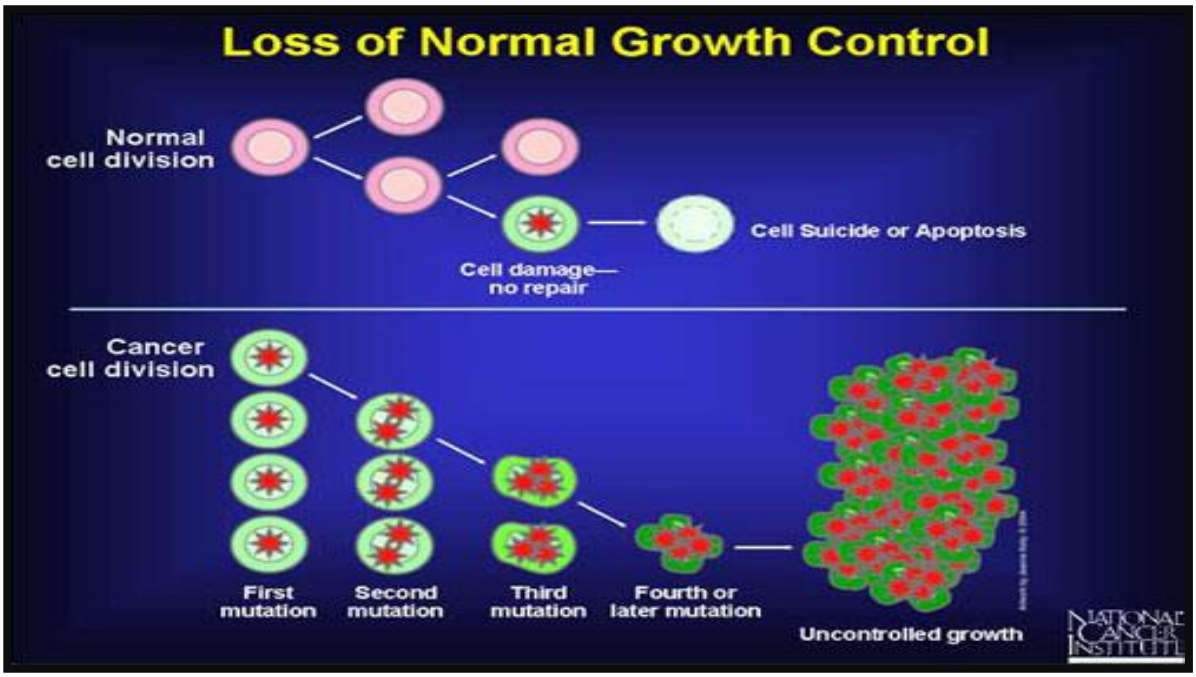


-Stage I: in the epithelial.
-Stage III: has gone deep in the organ's wall.
-Stage IV: there's distant metastasis.

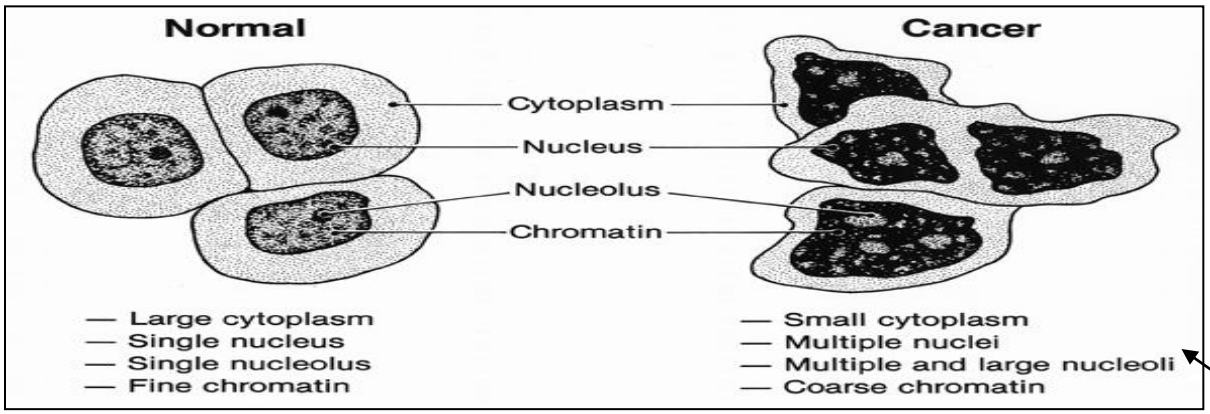
TNM Classification (American Joint Commission on Cancer)				Dukes' Classification
Stages	T	N	M	Stages
Stage 0	Tis	N0	M0	
Stage I	T1	N0	M0	A
	T2	N0	M0	B1
Stage II	T3	N0	M0	B2
	T4	N0	M0	B2
Stage III	T1, T2	N1 or N2	M0	C1
	T3, T4	N1 or N2	M0	C2
Stage IV	Any T	Any N	M1	D

Malignancy

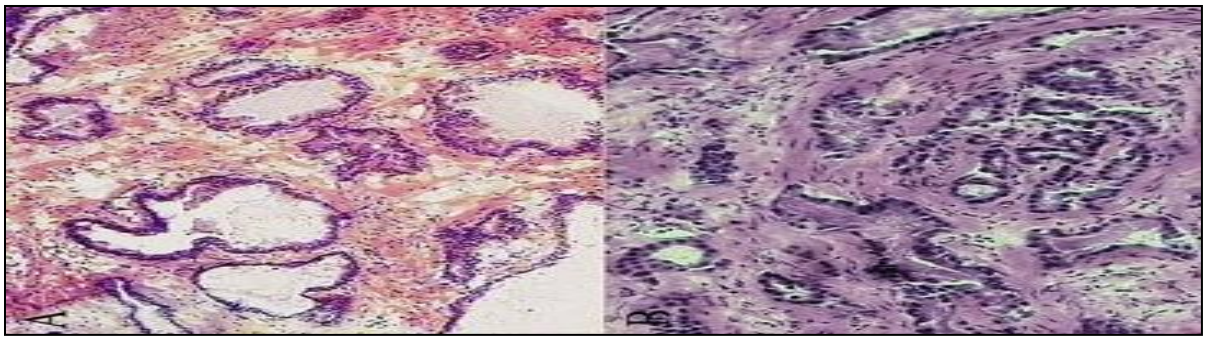
- Normal Vs. Malignant cells



Under the microscope, a cancer cell will appear with a small cytoplasm because the space is taken by the uncontrolled dividing nuclei. These are the basis of diagnosing the malignant cells under the microscope.



Mopholog -ical changes

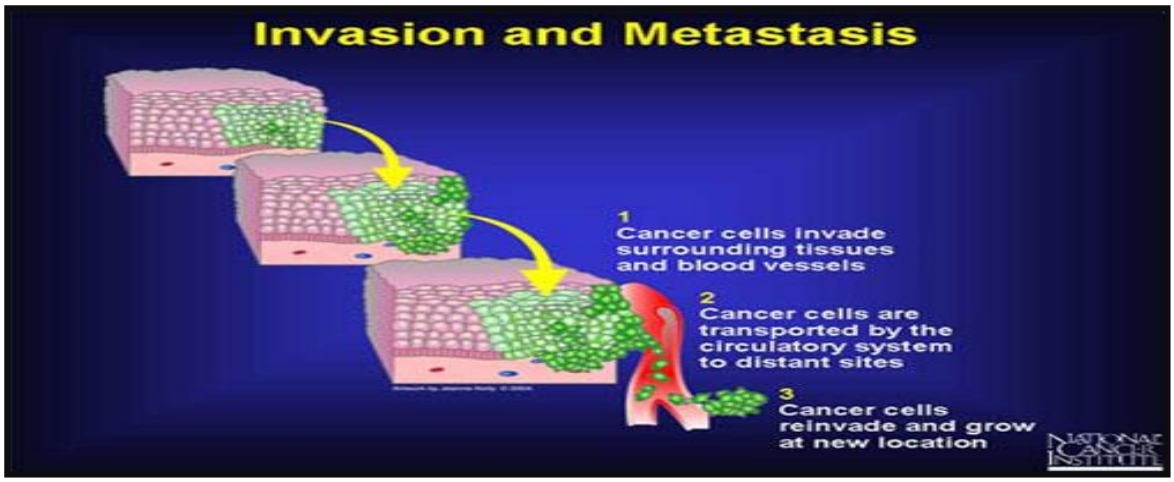


- Characteristics of malignant cells:
  - **Uncontrolled growth** and **loss of contact phenomena** are the main characteristics of malignant cells.
  - The body deals with the malignant cells as foreign bodies >> many lymphocytes surround it >> uncontrolled growth.
- Why are malignant cells dangerous?

  Malignant cells are considered dangerous due to invasion and metastasis

Contact Phenomena

Contact phenomena is explained by which cells are normally contacted together through a system in which there is no overlapping of cells

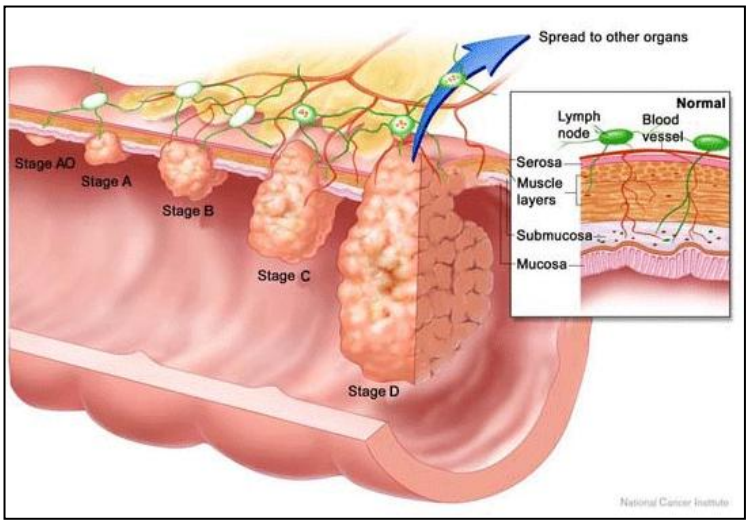


- Spread of malignant tumor:

  The three main roots of malignant tumor spreading:
  - Direct (local)
  - Blood vessels
  - Lymphatic system

  These roots of spreading differ from one organ to another and from a tumor to a different type of tumor even in the same organ

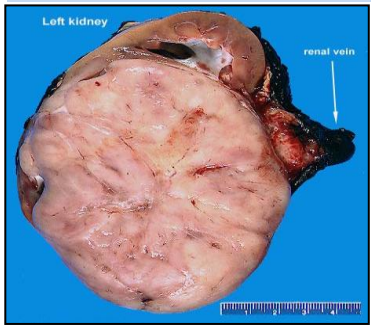
  For example:



  Thyroid cancer: (same organ with different behaviors)
  - Papillary>young age>lymphatic
  - Follicular>middle age>blood
  - Anaplastic>locally and blood and lymphatic (same organ same tumor with different behaviors)

  Testicular cancer: (same organ with different behaviors)
  - Seminoma> lymphatic
  - Teratoma> blood

Local invasion (Kidney)



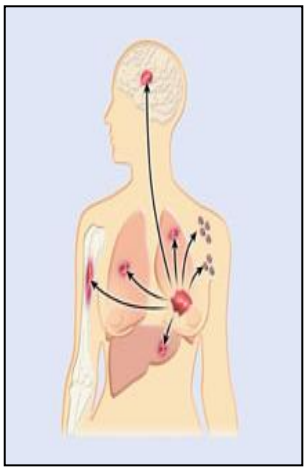
∗Local invasion:

- Within the organ
- Adjacent organs

  -Local invasion > can invade the whole organ or can exceed to an adjacent organ.

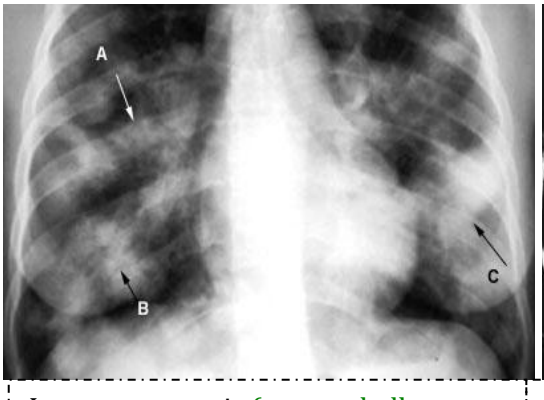
  E.g. a bladder tumor can involve the whole wall of the bladder (depending on its stage) or it can invade the uterus, rectum or peritoneum. Distant metastasis will go to the lungs, lymph nodes or liver through blood

∗Metastasis:

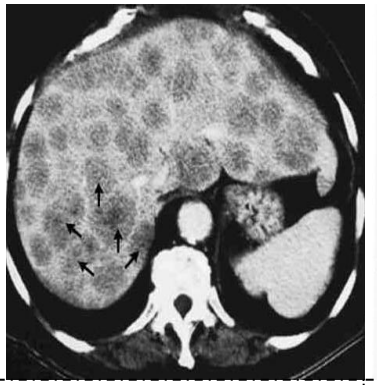


- Lymphatic: Regional & distant lymph nodes (It depends on the organ)
- Haematogenous e.g. liver, lung, bones Most tumors metastasis to three main organs (liver, lungs and bones)
- Transcoelomic e.g. peritoneal & pleural cavity

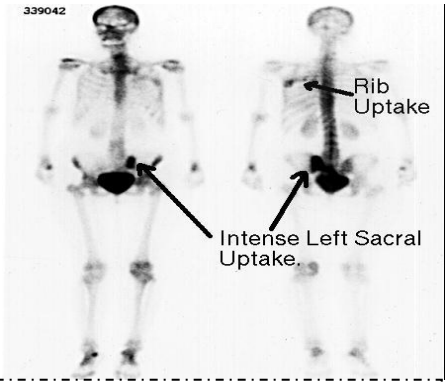
  Coelomic means a cavity, for example if a surgeon is removing the colon because of colon cancer the surgeon will look into the surface of the intestine and the peritoneal cavity and the omentum for seedlings (the tumor cells invade the organ's wall and swims in the peritoneum and grows there) so it's no more considered locally and surgery won't be beneficial and it cannot be discovered in the investigations (CT and US) that are done before the surgery
- Implantations e.g. needle tracks, wounds. If a person pricks a malignant tumor with a needle, theoretically these malignant cells can fallow the root of the needle and implant them self into a different place. Incidence of this root is very negligible.



Lungs metastasis (cannon ball metastasis)



Liver metastasis (usually comes from the gastrointestinal tumors)



Bone metastasis

Note

Brain is not a common place for metastasis because it is protected by the BBB but bronchogenic carcinoma can yet cause brain metastasis.

- Malignant tumors staging:

  It is important to stage malignant tumors for many reasons including:

  1- To decide the treatment. (If a surgery or a chemo/radio therapy is better at this stage).
  2- To plan the treatment. (When to give chemotherapy or radiotherapy or when to do the surgery).
  3- To assess the prognosis.

  ∗Note: Whenever you deal with a malignant tumor, always remember that there is a primary tumor & there may be secondary tumors.

  Examples:

  - A patient has a kidney tumor may have hemoptysis (lung cancer).
  - A patient has a pancreatic tumor may have paralysis (brain tumor).
  - A patient has an ovarian tumor may have jaundice (liver cancer).

- Presentation of Malignant Tumors: (depends mostly on the organ the tumor is affecting)

  The presentation varies widely amongst from tumor to tumor and sometimes from person to person, it might be:

  - Asymptomatic.
  - Symptoms related to the primary tumor. E.g. Hematuria, nipple discharge.
  - Symptoms related to the secondary tumors. E.g. Hemoptysis, fracture.
  - Incidental finding. E.g. Upper abdominal pain because of gall stones they do an US and they find a renal tumor with no symptoms related to the renal tumor.

  ∗Note: Weight loss and Cachaxia are late manifestations of most malignant tumors except GI and Lung

- Investigation of Malignant Tumors:

  ∗ Aims when investigating for the primary tumor
  -Depends on the site
  -Define the histology
  -Define the local extension

  ∗ Aims when investigating for the secondary tumors
  -Look for metastasis
  -Usually liver, lung and bones are the most common sites for metastasis

  Both will define the diagnosis and stage

  - Investigations:

    A- **Histology**: The histology is defined through biopsy and cytology.

    Obtaining material for histology:

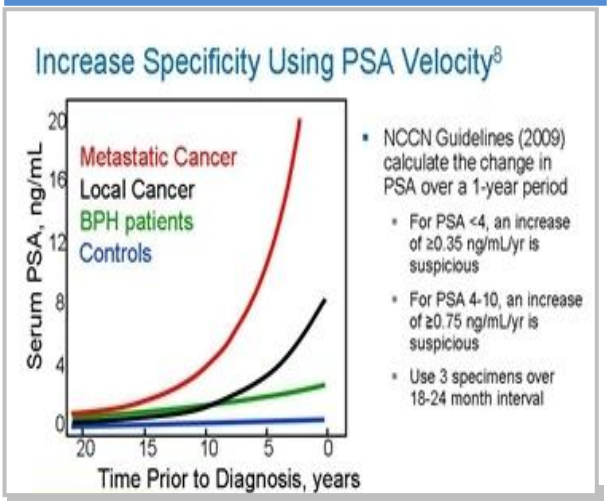
    1- Cytology (Morphology of individual cells):
    - Exfoliative (urine, sputum, etc)
    - Fluid aspiration (ascetic fluid, pleural fluid)
    - Fine needle aspiration

    2- Biopsy: Histological (tissue) characteristics:
    - Incisional biopsy (open, needle, forceps, etc)
    - Excisional biopsy

B- **Tumor Markers**: Substances which if present in the blood or tissues may indicate malignancy

- The concept is very important
- There are many tumor markers, most are non-specific (They might suggest cancer when there isn't really cancer (false +ve))
- Important in diagnosis (it can sometimes helps in identifying the tumor's type after staining for markers and the organ in which the tumor is affected by obtaining tumor markers from tissues as well as blood and body fluids)
- Important for screening
- Important for follow up (tumor markers are measured at time of diagnosis and then they are continued to be measured throughout the treatment and after it, if decrease in their levels occur this might indicate that the patient is responding well to the treatment, and if it decreases but then starts rising again, this is an indication of recurrence)

Prostate Specific antigen



The pattern in which the PSA level is rising differs from whether it is a local, invasive or metastatic tumor
Note: Increase in PSA indicates increase in the tumor spreading

Hormones and cancer

- Hormones related to tumor growth
  - Usually sex hormones (testosterone and estrogen)
  - They may have a relation to the tumor's growth
  - Identify the presence of hormone receptors in a tumor (This is important and might be used in treating the tumor, for example, if a breast tumor has estrogen recptors part of the treatment id depriving the patient of estrogen supplements)
- Hormones may be produced by tumors (this is of 2 origins):
  - Originally hormone producing organs (e.g. adrenals)
  - Originally non-hormone producing organs (e.g. lungs)

References

1. O. James Garden, Andrew W. Bradbury, John L.R. Forsythe and Rowan W. Parks – Principles and Practice of Surgery, 5th edition- Churchill Livingstone
2. Salah AlFaqeeh, M.D. – Principles of Surgical Oncology, 2012