Principles Of Surgical Oncology

With all courtesy to our colleagues, Raslan and his team, a lot of our work is based on their Manual to Surgery Booklet.

Important

Mentioned by doctors but not in slides

Additional notes from Surgical Recall 6th edition or Raslan's booklet

Not mentioned by the doctor

431 SURGERY TEAM

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Lecture sections:

1. Types of tumors
2. Grading and staging
3. Presentation of malignant tumors
4. Investigations
5. Tumors markers
6. Hormones and cancer

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1. Types of Tumors

A. Benign:

- Encapsulated
- No invasion (controlled growth)
- No metastasis
- Can be removed locally

  In lipoma, we only have to resect it by simple excision, whereas in liposarcoma, we have to remove the skin and adjacent tissue as well.

These are the main characteristics of benign tumor.

B. 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 does invade (uncontrolled growth)
- Metastasis
- Loss of contact inhibition:

  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.
- Has two main types
  - Carcinoma
  - Arises from epithelial tissue
  - Ex: Adenocarcinoma of the stomach, transitional cell carcinoma of the bladder, squamous cell carcinoma of the skin, follicular carcinoma of the thyroid.
  - Sarcoma
  - Arises from connective tissue
  - Ex: lipoma(Benign), liposarcoma (Malignant), Fibroma(Benign) Fibrosarcoma (Malignant), Myoma (Benign),myosarcoma (Malignant), *Rhabdomyosarcomas* are tumors of the skeletal muscles, *Leiomyosarcomas* are smooth muscle sarcomas.

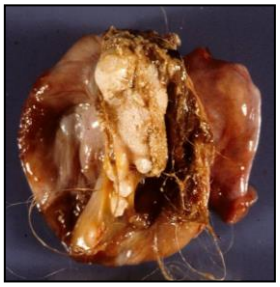
The difference between metastasis and direct invasion:
- Direct invasion: **tumor enlarges to invade the adjacent organ with continuity of primary tumor. (e.g. bladder cancer goes to colon or uterus).**
- Metastasis: **tumor invades other organs with discontinuity of primary tumors.**

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.

C. Teratoma

- 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, 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.**

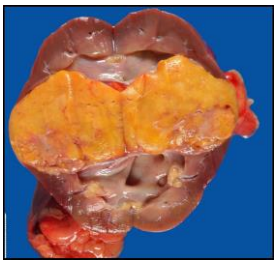
This teratoma was taken from an ovary, we can see skin, cartilage and teeth



D. Hamartoma

- Abnormal arrangement of normal tissue, "haphazardly arranged tissue" that resembles a neoplasm.
- Benign
- Capable of producing complications
- Ex: Angiomyolipoma of the kidney.

Angiomyolipoma of the kidney, composed of blood vessels, smooth muscle cells and fat. All of which are normally found in the kidneys.



2. Grading and Staging

A. Grading

- It describes the **histological characteristics** of cancer cells, mainly the cell layers (e.g. grade I, II, III…)
- Grade of Differentiation describes the characteristics of cancer cells in reference to their resemblance to the cell of origin:

- Well differentiated
- Moderately differentiated
- Poorly differentiated
  - Indicates that the cancer is rapidly growing with no time for the cells to be differentiated.
  - Most of them are more susceptible to chemotherapy agents b\c they're weak due to the rapid development and growth.

- Both grading and differentiation describe the **histological features** of the tumor and not the macroscopic features , invasion or metastasis.

Anaplastic

- E.g. if we found an enlarged lymph node but we did not know the origin, we send it to the lab. If it's a well-differentiated tumor, the pathologist will be able to identify the cell of origin.
- 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.

B. Staging

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

- **Local invasion**
  - The organ of origin
    - Bladder cancer can go to the uterus, small intestines, peritoneum, and rectum (local). Can also go to the liver, chest, brain
    - E.g. tumor in the stomach can go to the duodenum, tumor in kidney can go to posterior abdominal wall, bladder cancer goes to colon, uterus, lateral pelvic wall .
  - The adjacent organs
- **Metastasis**
  - The distant organs and lymph nodes:
    - In general, the organs that get metastasized the most are the liver, lung and bone(mostly long bones, vertebra and pelvis).
    - But the brain is rarely metastasized due to presence of BBB and can be metastasized from bronchogenic carcinoma.
    - Types of Spread:

1. 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.

2. Hematogenous

- 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.

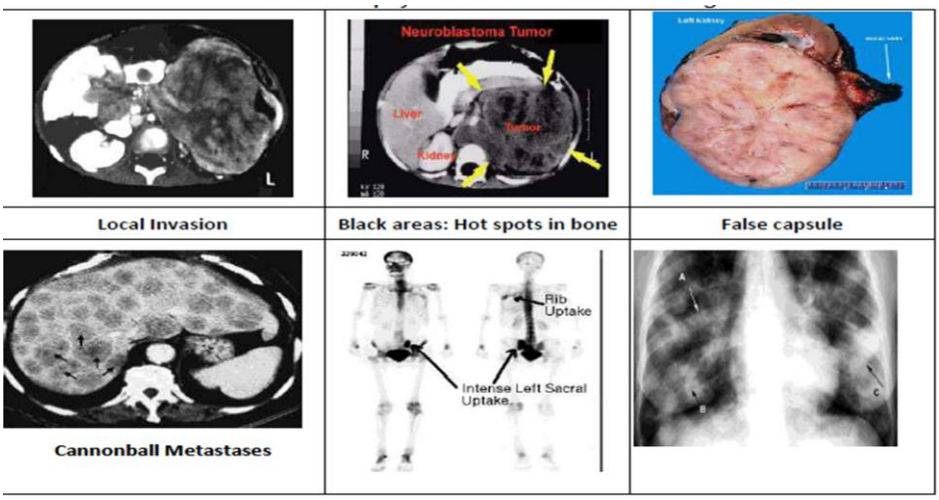
3. Transcoelomic

- 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).

4. Intraperitoneal seeding during surgical manipulation

- Implantation e.g. needle tracks, wounds…
- Very rare
- Needle biopsy should be obtained for diagnosis

Needle biopsy is done almost every day and this type of spread rarely happens.



Local invasion.

Distance mets.

- Types of Staging
  - Classical staging:
    - Stage I and II confined to the organ
    - III =direct invasion
    - IV= metastasis
  - TNM Classification is more specific: e.g. T1, No, Mo
    - T – Tumor : T1,2,3…., Tis, Ta, Tb…
    - N – Node : N0, 1, 2, 3 ….
    - M – Metastasis : M0,1,2,3…

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?

o 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)

o 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

o 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)

3. Presentation of malignant tumor

- Asymptomatic (incidental finding)
- Symptoms related to the primary tumor
  - o E.g. Bleeding per rectum or intestinal obstruction for colon cancer
  - o Dysphagia for esophageal cancer
  - o Hematuria for bladder tumor
  - o Hemoptysis for lung cancer
- Symptoms related to the secondary tumors
  - o E.g. 60 y/o female had sudden low back pain, after investigations, she was discovered to have breast cancer
  - o Hemoptysis- patient might have cancer in the kidney and the patient doesn't have any problem in urination (secondaries)
  - o Minimal fall > pathological fracture – discovered to have bone metastasis

- Weight loss & Cachexia
  - o Late manifestations of most malignant tumors (advanced stage) except in **GI and lung cancers** (bronchogenic carcinoma)
- 1st presentation comes from the secondary and not from the primary

  Presentation of malignant tumors:
  - o Seizure > metastasis to brain
  - o Colon cancer > can present as bleeding per rectum – abdominal distension – intestinal obstruction
  - o PE= enlarged liver: nodular, rough, smooth, hard.. (to know character of pain)

- Because it's related to food & digestion, weight loss will happen in early stage.
-In the GIT, weight loss & cachexia depends on the level of tumor, at which the food is blocked, Patients with upper GI tract tumor lose weight earlier than those who have tumor in lower GI tract.
So it's more evident in the esophagus (highest level), than in the stomach and the colon (lowest level)

4. Investigations

- Investigate for the primary tumor
  - o 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
    - Define the histology
    - Define the local extension
    - Depends on the site
- investigate for the secondaries:
  - o Look for metastasis
  - o Usually liver, lung and bones
- Both will define the diagnosis & stage
  - o Accordingly, the treatment plan will be determined
  - o 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)

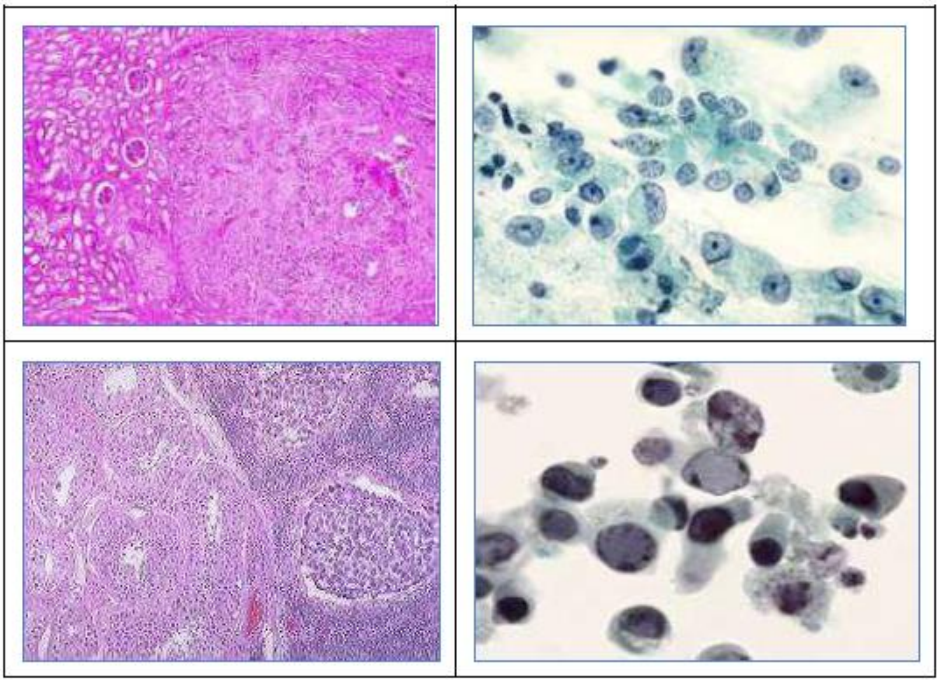
A. Cytology

- Morphology of individual **cells**
- Many ways of obtaining it
  1. **Exfoliative** (fluid): urine – sputum the epithelial layer Multiplies and the superficial cells fall down so try to collect & get benefit from it "without any effort from doctor "as in sputum or urine sample".
  2. **Fluid aspiration:** ascites, pleural fluid, cyst acidic fluid or plural effusion draw out and send to cytology
  3. **FNA:** taking cells from solid tumors, Fine needle aspiration (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 cells.

B. Biopsy

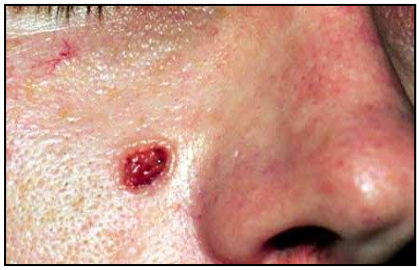
- histological **(tissue)** characteristics
- Examination of the tissue
  1. Fine-needle aspiration
  2. Core biopsy
     - E.g. Tru-cut: core of tissue removed for histological examination
     - Usually done if the lump is apparent and distinct and localized
     - Commonly done through endoscope

3. Incisional
   - 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
       - ✓ If we suspect a gastric ulcer to be malignant OR Colonoscope.
4. 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



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 is not identical (polymorphism, the cells in different stages of growth).



-This picture shows Basal cell carcinoma known as rodent ulcer

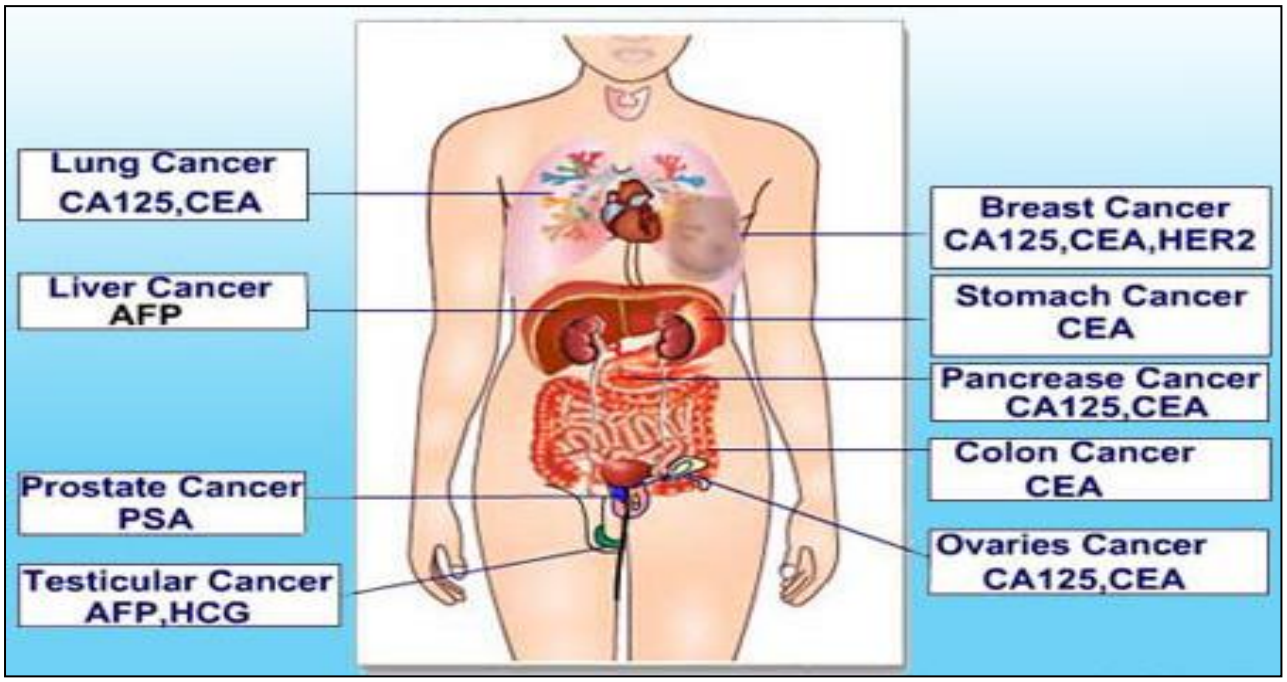
-It's local invasive and doesn't metastasize.

5. Tumor markers

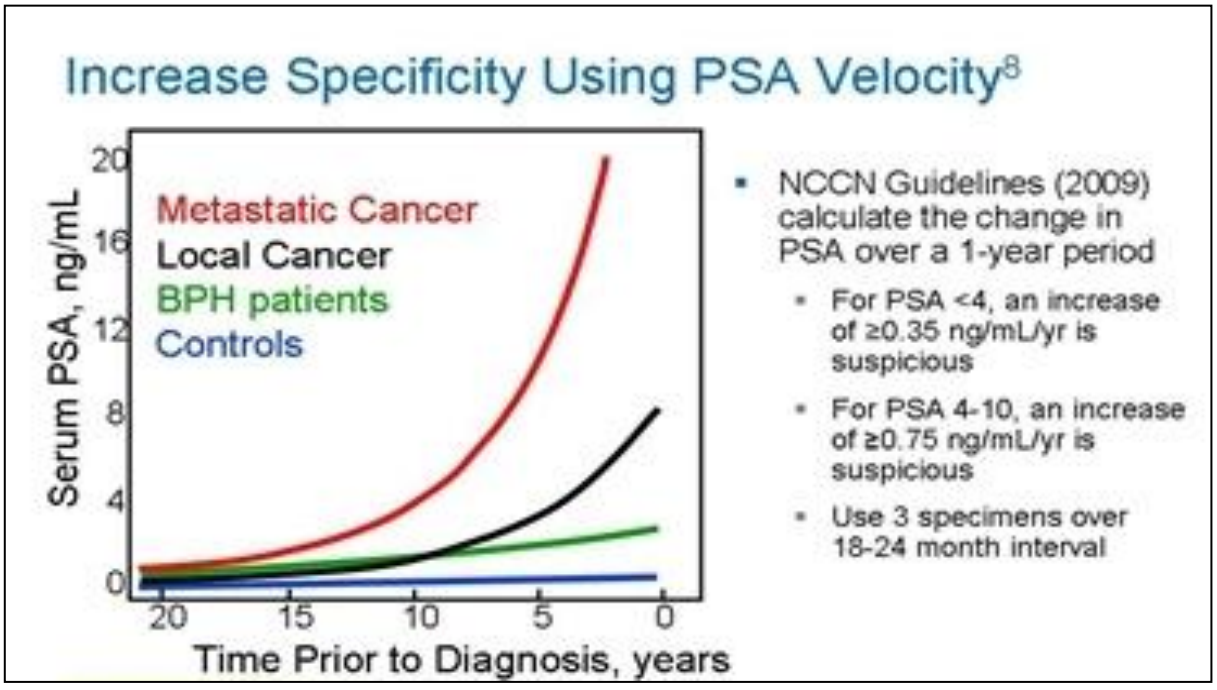
- Substances present in the blood or tissue fluid in a concentration related to the presence of a tumor
- Most markers are cells from normal cells or malignant cells (primitive)
  - Most are non-specific
    - E.g. Patients with high PSA, biopsy showed no indication of malignancy > **false +ve** (not specific)
    - Patient has malignancy but PSA level was normal > **false –ve**
  - Important in diagnosis (general findings + tumor markers>> Dx)
    - E.g. patient with testicular tumor "clinically" and was found to have a high level of the tumor marker>> the patient has teratoma not seminoma
  - 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
    - 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
- Sometimes pathologists use histochemical stains for specific tumor markers in tissue, and by this we can determine the type of tumor.
- To detect relapses

6. Hormones and 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 histologist 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 producing organ of the tumor, which is the testes, or blocking one of these pathways.
  - When 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:**
- Originally hormone producing organ e.g. adrenals (Cushing's…)
- Originally non hormone producing organ e.g. lung (cell carcinoma of lung or oat-cell carcinoma)



Not mentioned by the doctor but might be important



Velocity:

When PSA levels rise **quickly**, there should be **more suspicion** of malignancy.

MCQs

1- A patient with enlarged cervical lymph node, which of the following is unlikely to be the primary site:
A. Bronchus
B. Stomach
C. Colon
D. Mouth
E. Laryngopharnx.

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

3- which of the following tumors has the least potential of malignant transformation?
A. Renal angiomyolipoma
B. Ovarian embryonic carcinoma
C. Osteosarcoma
D. Mesothelioma

Key: 1 = C , 2 = B , 3 = A

Surgical recall questions

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 do the T, M, and N stand for in TMN staging?
T-Tumor size
M-Mets (distant)
N-Nodes

What tumor marker is associated with colon cancer?
CEA

What tumor marker is associated with hepatoma?
Alpha-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 cancer