



# Cancer

Section 10 – Dr. Gary Mumaugh



# Cancer Introduction



- Cancer is actually more than 100 diseases
- They all result from a DNA dysfunction with cell growth and reproduction
  - These occur because of mutations for several reasons
  - Our immune system destroys these mutated cells daily
  - Cancer can only start and grow with a weakened immune system
- Because of the non-mature immune system in children, certain cancers are common
- The weakened immune system of the elderly leads to an increase of cancer
- Cancer is the #1 killer in the USA



# Definitions



- Benign tumor – self contained
  - Pushing normal tissues out of the way as they grow
- Malignant tumor – invades local tissue
  - Can spread by local extension, in organs, or via the blood or lymphatics
- Localized cancer
  - Growth only in tissues they are derived from
- Metastatic cancer
  - Spread to distant sites
- Carcinogens

Toxic substances that stimulate the cell mutations



# Incidence

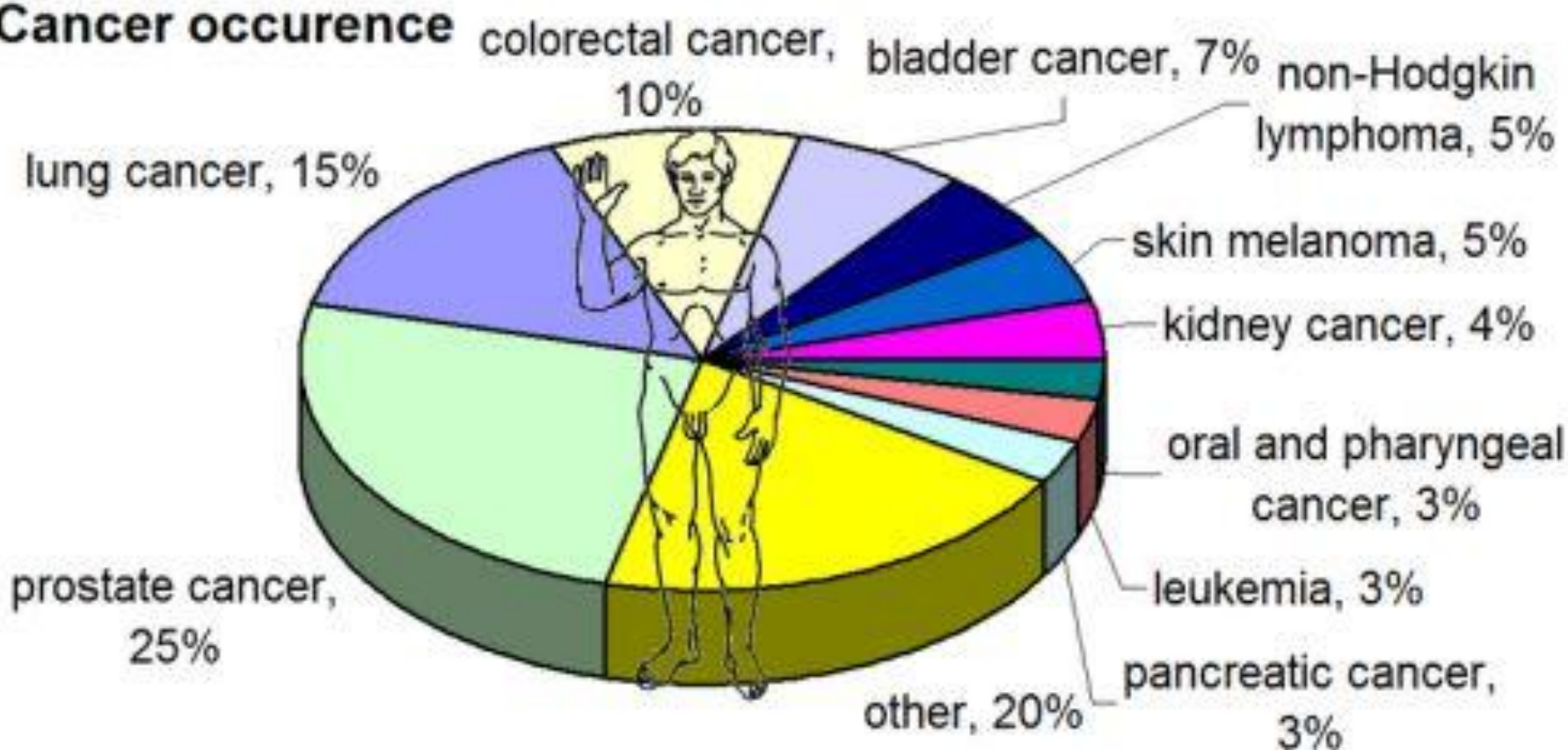


- One of every two men
- One of every three women
- Median age 67
- [National Cancer Institute - Comprehensive Cancer Information](#)
- [Minnesota Cancer Stats](#)



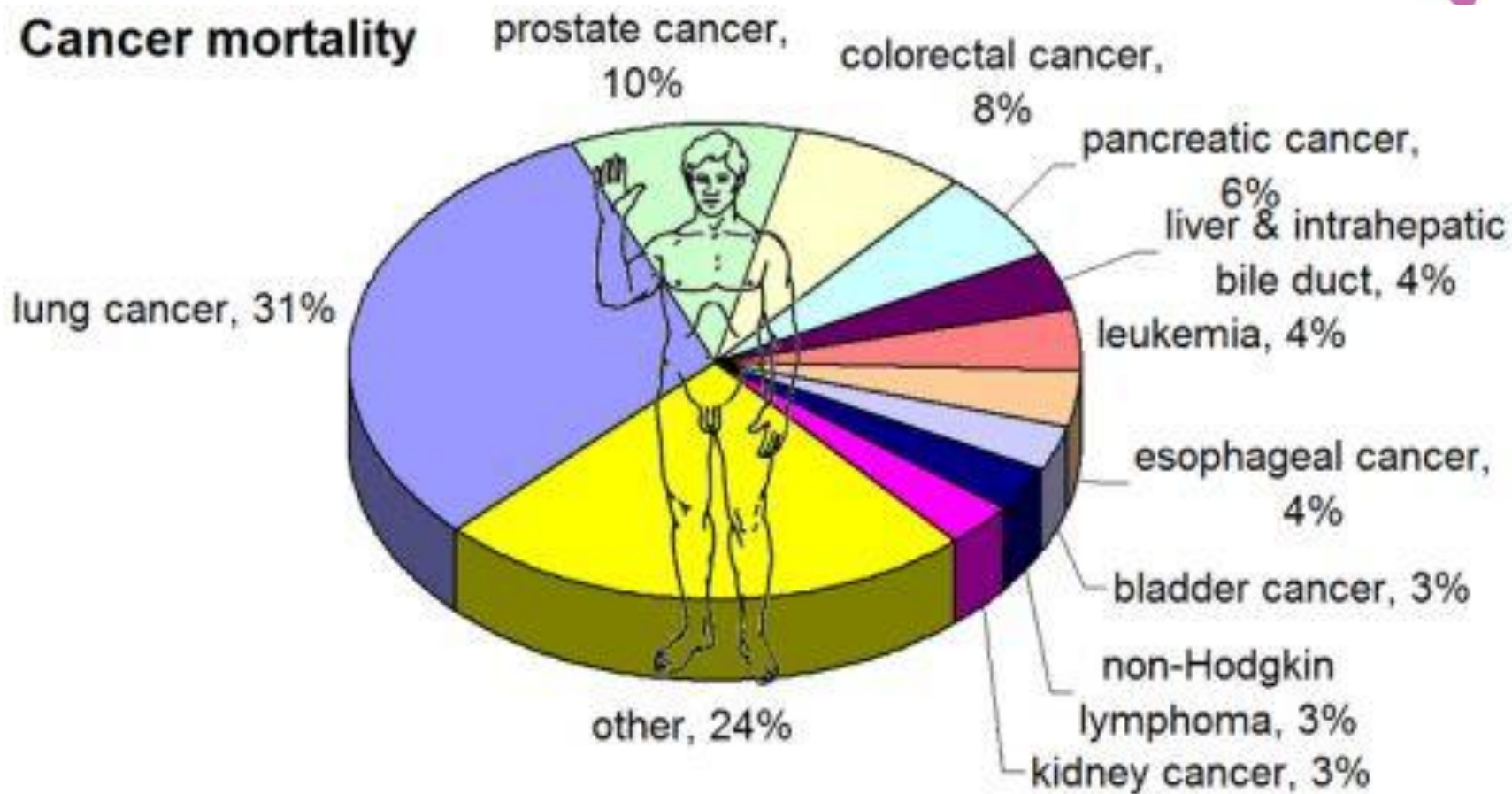


## Cancer occurrence





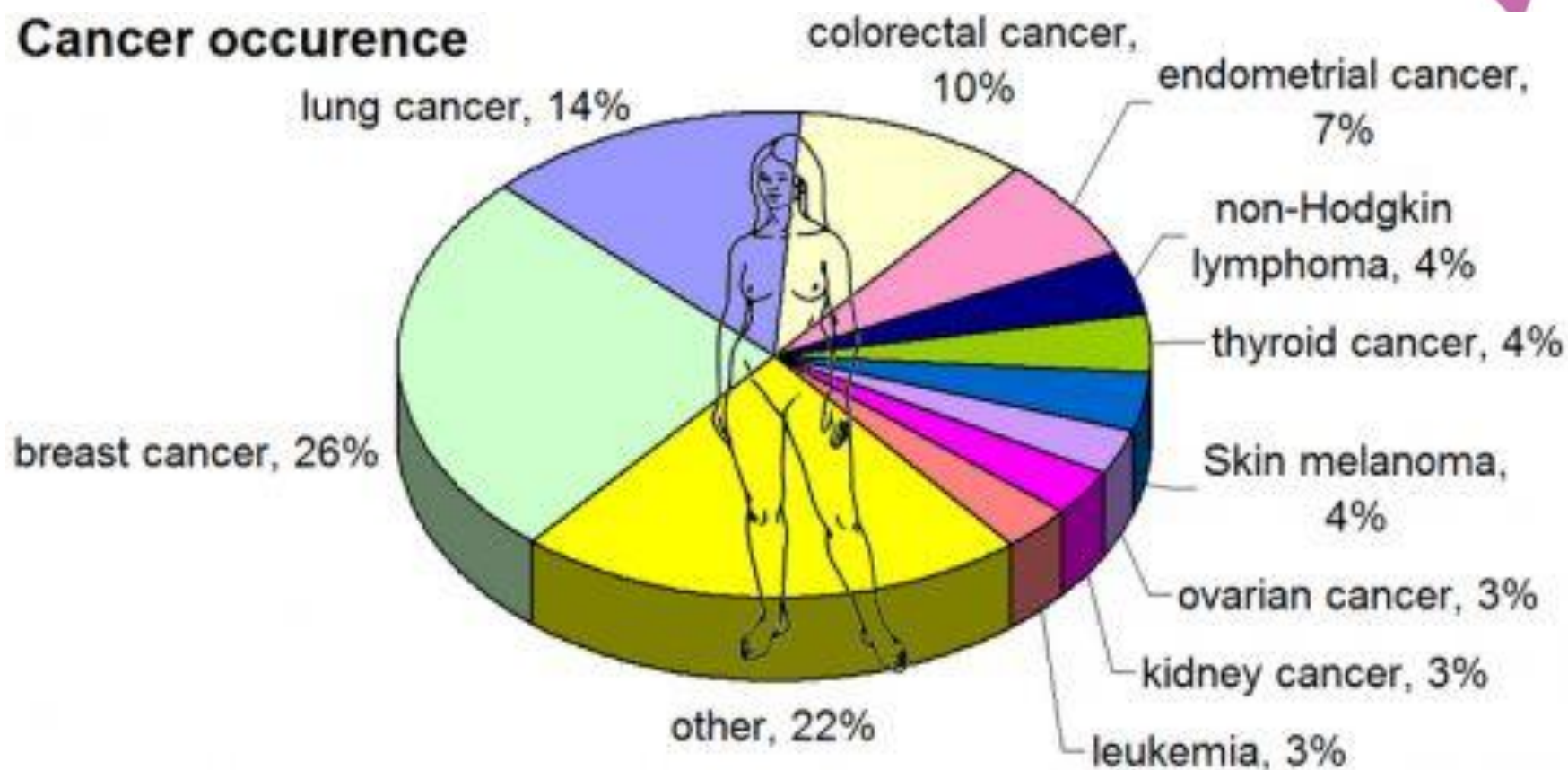
## Cancer mortality





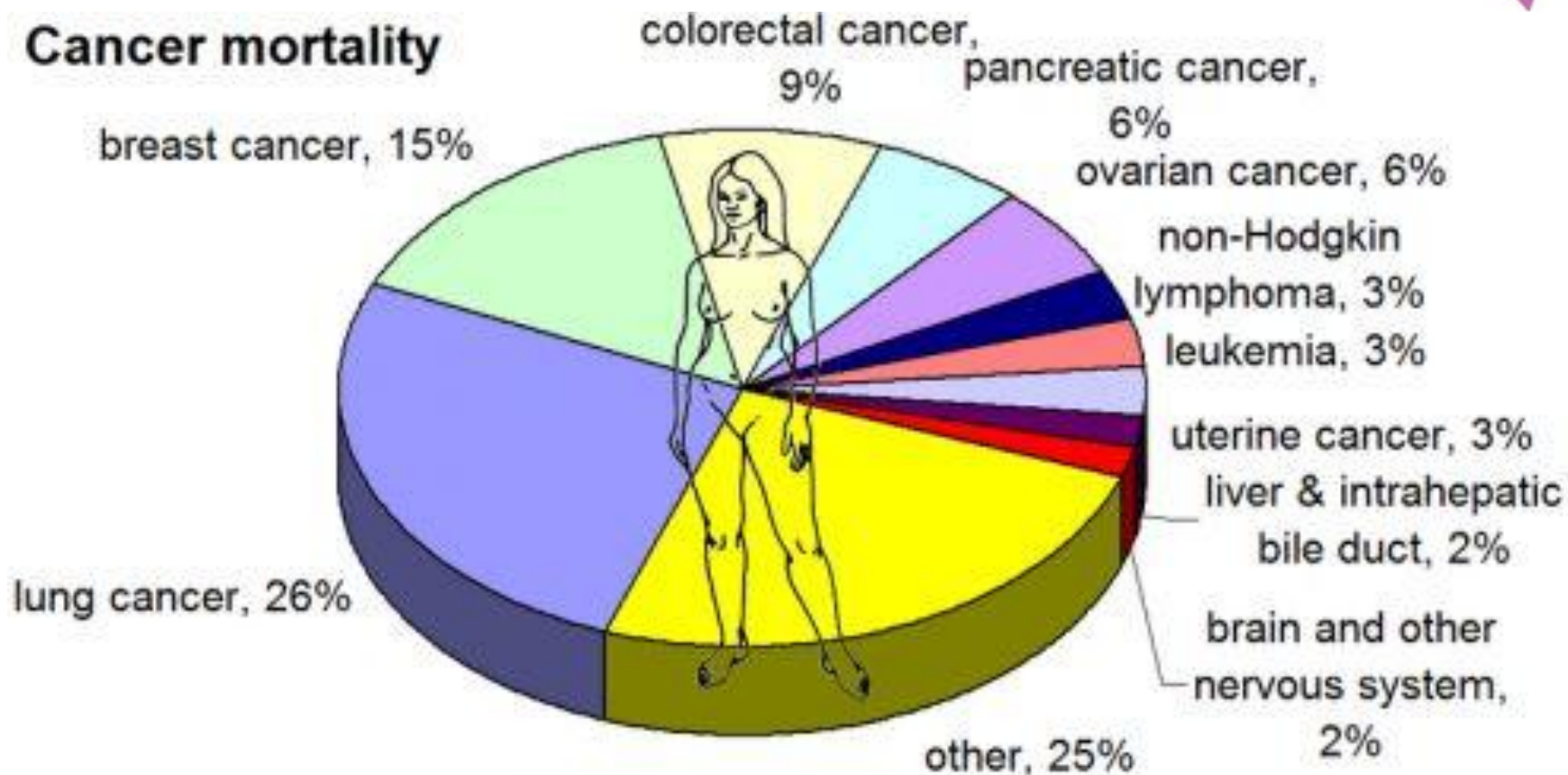


## Cancer occurrence





## Cancer mortality





# Reasons for increased incidence



- Increased environmental toxins
  - Over 100,000 new chemicals in the past century
- Radiation from sun, x-rays and nuclear waste
- Sedentary society
- Poor dietary habits
- Smoking effects
  - 400,000 deaths per year in the USA are directly related
- Alcohol abuse
- Increased incidence of STD
- Stress and personality factors
- Longer life-spans mean longer exposures
- Electromagnetic fields

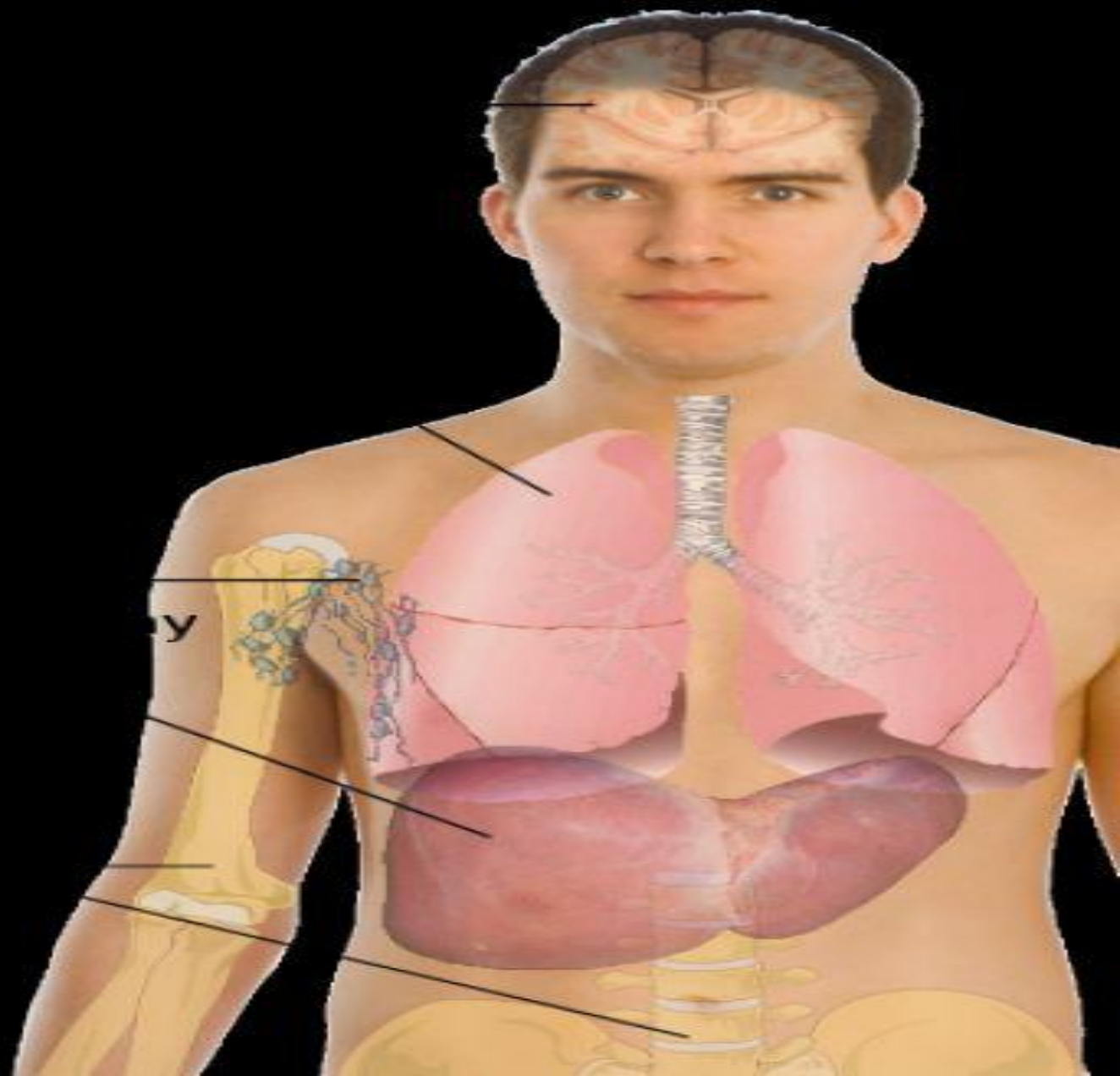


# Types of Cancer



- **Carcinomas** are cancers of the cells that line the inner and outer surfaces of the body – 86%
- **Sarcomas** are cancers of the cells in connective tissue – in muscles, bones, cartilage, fat, fibrous tissue, synovial tissue – 2%
- **Leukemias** - cancers of the white blood cells – 7%
- Misc. cancers are of the endocrine glands, sense organs, brain, nervous tissue – 5%





# Most Common USA Cancers



- Skin cancer – 600,000 new cases per year
- Breast cancer – 200,000 new cases
  - 87% five year survival rate
- Lung cancer – 170,000 new cases
  - 12% five year survival rate
- Colon and rectal cancer – 160,000 new cases
  - 70% five year survival rate
- Prostate cancer – 130,000 new cases
  - 70% five year survival rate
- Cervical and uterine cancer – 100,000 new cases

50% carcinoma insitu, 50% invasive cervical and uterine cancer



# Four Personality Types & Cancers



- Psychological and personality factors
- Type I
  - Very controlled, rational and non-emotional approach to life events
  - When stressed, they do not express feelings like anger or fear
  - This is the cancer prone personality
- Type II
  - React to stress with anger, frustration and aggression
  - Do not handle stress well







- Type III
  - Personalities have no consistent reaction to life events
  - Shift back and forth between anger and repression depending on the level of the stress
- Type IV
  - Strong sense of autonomy, personal control and well-being
  - Are the most psychologically healthy



# Effects of the Personality Types



- Type I – 45% died of cancer
  - Few died of heart disease
- Type II – 5% of those who passed away died of cancer
  - Most died of heart disease
- Type III – 5% died of cancer
- Type IV – 2.5% of those died of cancer
- Conclusion was that things can happen inside of people who repress their true feelings about life that may prove to be cancer-prone



# The Cytology of Cancer Development



- Cancer cells develop from normal cells through a process called transformation
- 1<sup>st</sup> step – initiation
  - Normal cells undergo genetic changes which can be caused by environment, behavior, personality, stress
- 2<sup>nd</sup> step – promotion
  - Often due to the loss of a suppressor gene, which causes the promotion of initiation cells to form cancer cells
- 3<sup>rd</sup> step – immune system failure
  - In this final step, the immune system fails to destroy the newly-formed cancer cell



# Cancer Epidemiology



- 1.3 million new cases per year
- 600,000 deaths per year
- 1:2 men and 1:3 females
- Big four (lung, breast, prostate, colorectal) cause 55% of all cancers and all cancer deaths
- Lung cancer has increased 25X in the last century
- Prostate, breast and colon cancer are more common in the USA than Asia or Africa
- Bladder, liver and bile duct cancer are more common in Africa and Asia due to parasites



# Cancer Screening Tests



- Pap test – cervical cancer – yearly 18-65
- Mammography and breast exam
- PSA
- Stool test for occult blood – yearly after 50
- Check for testicular lumps, mouth sores and unusual bleeding
- Pelvic exam – every 3 years 18-30, then yearly
- Sigmoidoscopy – every 5 years after 50
- Testing for genetic factors





# Principles of Cancer Treatment



- Surgery
  - If caught early, the cancer can be surgically removed with clear margins of normal tissue removed and the cancer is forever gone
- Chemotherapy
  - Anticancer chemical agents
  - Cancers that respond best to chemotherapy
    - Leukemias
    - Diffuse lymphomas
    - Non-seminoma testicular tumors





- Radiation therapy

- Is actually the primary treatment for certain cancers such as head and neck cancer, prostate and testicular cancer
- Some cancers are best treated with radiation
  - Testicular seminoma
  - Small cell carcinoma of the lung
  - Lymphomas, both Hodgkins and non-Hodgkins
  - Prostate carcinoma
  - Most head and neck cancers





- Other approaches to cancer therapy
  - Interferon – boosts the immune system
  - Killer cell therapy – killer cell lymphocytes are removed, treated with interleukin 2 growth factor, then re-injected
  - Humoral antibody therapy – injecting attenuated TB bacteria stimulates a large immune response, which then fights the tumor
  - Monoclonal antibody therapy – These antibodies are injected and then attaches to the cancer cells and moves them toward the chemotherapy agents
  - Bone marrow transplant – bone marrow is removed from the cancer and put in culture followed by patient receiving chemotherapy and then the marrow is re-injected



# Current Usage of Chemotherapy



- Primary treatment
  - Treats certain malignancies
- Adjuvant therapy
  - Decreases the rate of relapse and improves the disease free time after the primary treatment
- Combined therapy
  - Combined with surgery and or radiation
- Palliative therapy
  - Decreases symptoms and prolongs survival
- Preoperative therapy
  - Reduces tumor size prior to surgery



# Commonly-used Chemotherapies



- Cytotoxic agents
  - Selectively destroys tumor cells with all side effects
- Antimetabolites
  - Interferes with cell growth and cell division
- Natural anticancer agents
  - Natural chemicals occurring in nature
  - Front line treatment for ovarian and breast cancer
- Androgens and androgen antagonists
  - Used for prostate cancer and some leukemias
  - Main side effect - gynecomastia







- Estrogen receptor modulators
  - Used in breast and uterine cancer
  - Has thromboembolic side effects and severe acne
  - Does show dramatic reduction of recurrence rates
- Progesterone agents
  - Used in uterine cancer
- Adrenocorticosteroids
  - Used for reduction of inflammation and edema
- Biologic response modifiers
  - Improves the immune system's function



# Supportive Cancer Care



- Outcome of cancer treatment is tied to the functional status of the patient before and during therapy
  - Success is related to age and the general health of the patient, their level of motivation, amount of support and the tumor staging
- Quality of life
  - Oncologists tend to focus on outcomes and not the ongoing quality of the cancer patient's life
    - Appetite, Weight loss or gain, Pain level
    - Level of sedation, Functional status and ADL
    - General outlook and personality – optimism
    - Social network and support group involvement





- Pain management

- There usually is not enough pain control in the end stage cancer patient
- Increased pain medication has sedating effects and diminished functional status
- Morphine is the mainstay for severe pain control
- Hospice nurses often mix and balance opioid narcotics with NSAIDs to avoid over-sedation

“It is through the pain on confronting and resolving problems that we learn our greatest lessons in life. Those things that hurt, instruct us.”

Benjamin Franklin





- Questions to constantly ask regarding ongoing supportive care:
  - Is the care worth the side effects for the terminal disease?
  - Is the patient processing his/her cancer course?
  - What is the patient learning through the cancer experience?
  - Is the patient dealing with end of life issues?
  - How can we improve the level of outside support?
  - Is the patient connected to a faith community?
  - How do we, as caregivers, deal with end of life issues?
    - Our attitudes are always transferred to the patient
    - Consider Caregivers Fatigue
  - How do we deal with cancer survivors who have several follow-up symptoms and conditions?



# Head & Neck Cancer



- Epidemiology
  - 6<sup>th</sup> most common cancer – 50,000 cases / 12,000 deaths
  - Risk increased 25 times in smokers
  - Risk increased 40 times in smokers with alcohol consumption
- S & S
  - Leukoplakia in the oral cavity
  - Most common first sign is painless neck mass, which is node metastasis
  - Dysphagia and persistent hoarseness
  - Non-healing mouth lesions suggest cancer
  - Recurrent epistaxis or hemoptysis suggests cancer





# Seven Warning Signs for Head & Neck Cancer

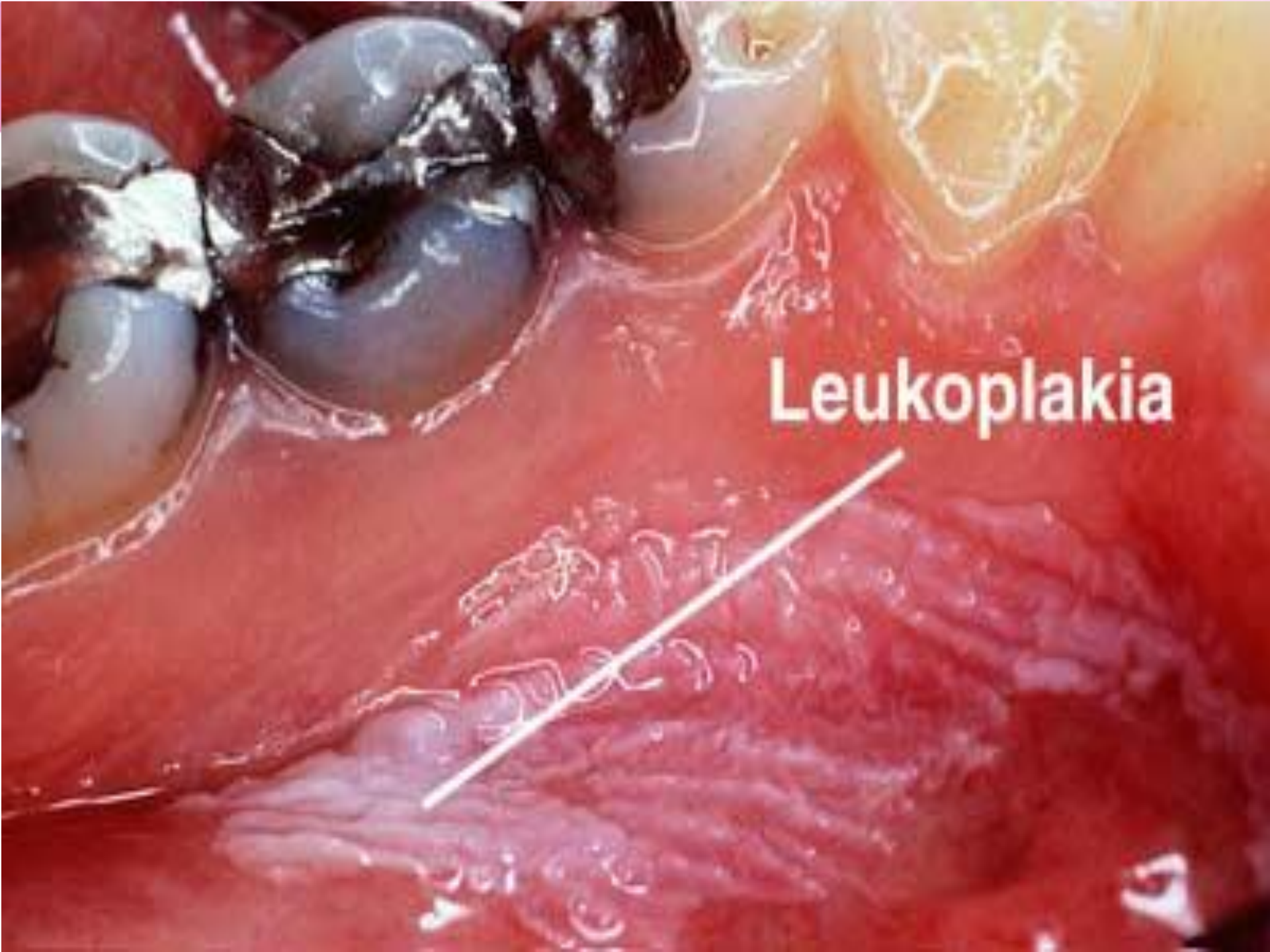
1. **Change in mole or new skin lesion**
2. **Non-healing mouth ulcer**
3. **Change in denture fit**
4. **Hoarseness**
5. **Persistent throat / ear pain**
6. **Neck lump**
7. **Unilateral nasal obstruction or bleeding**





- Diagnosis
  - Laryngoscopy, bronchoscopy, esophagoscopy, otoscopy, nasopharyngoscopy
  - Fine needle aspiration is the best diagnostic method
  - Palpation and flashlight examination
- Treatment
  - Surgery performed for stage I-III
    - Extensive lymph node dissection not usually performed
  - Radiation for stage I-II is just as effective as surgery
  - Radiation with surgery for stage III-IV
  - Chemotherapy not very effective
- Prognosis
  - Stage I – 5 year survival is 80%
  - Stage II – 5 year survival is 60%
  - Stage III – 5 year survival is <40%





**Leukoplakia**

# Lung Cancer



- The leading cause of death in men and women
  - 170,000 new cases per year & 150,000 deaths
- Etiology
  - Cigarette smoking – 85% of cases
  - Occupational exposure – 15% of cases
  - Genetic factors may make a difference
    - 1<sup>st</sup> and 2<sup>nd</sup> degree relatives have increased risk
  - Scar tissue from previous long infections
  - Radon exposure from soil





- Pathophysiology

- Vast majority of causes are bronchiogenic with four major histological types:

- Squamous cell carcinoma – 35% - proximal airways
    - Adenocarcinoma – 35% - starts in the glandular cells
    - Small cell carcinoma – 20%
    - Large cell carcinoma – 15%

- S & S

- Hemoptysis and cough with bronchial obstruction

- Diagnosis

- CT scan, PET scan, bronchoscopy, chest x-ray





- Treatment
  - 1<sup>st</sup> choice – surgery
  - 2<sup>nd</sup> choice – chemotherapy
  - 3<sup>rd</sup> choice – radiation
  
- Prognosis
  - Five year survival rate – 12%









Normal Chest

Chest with Nodule





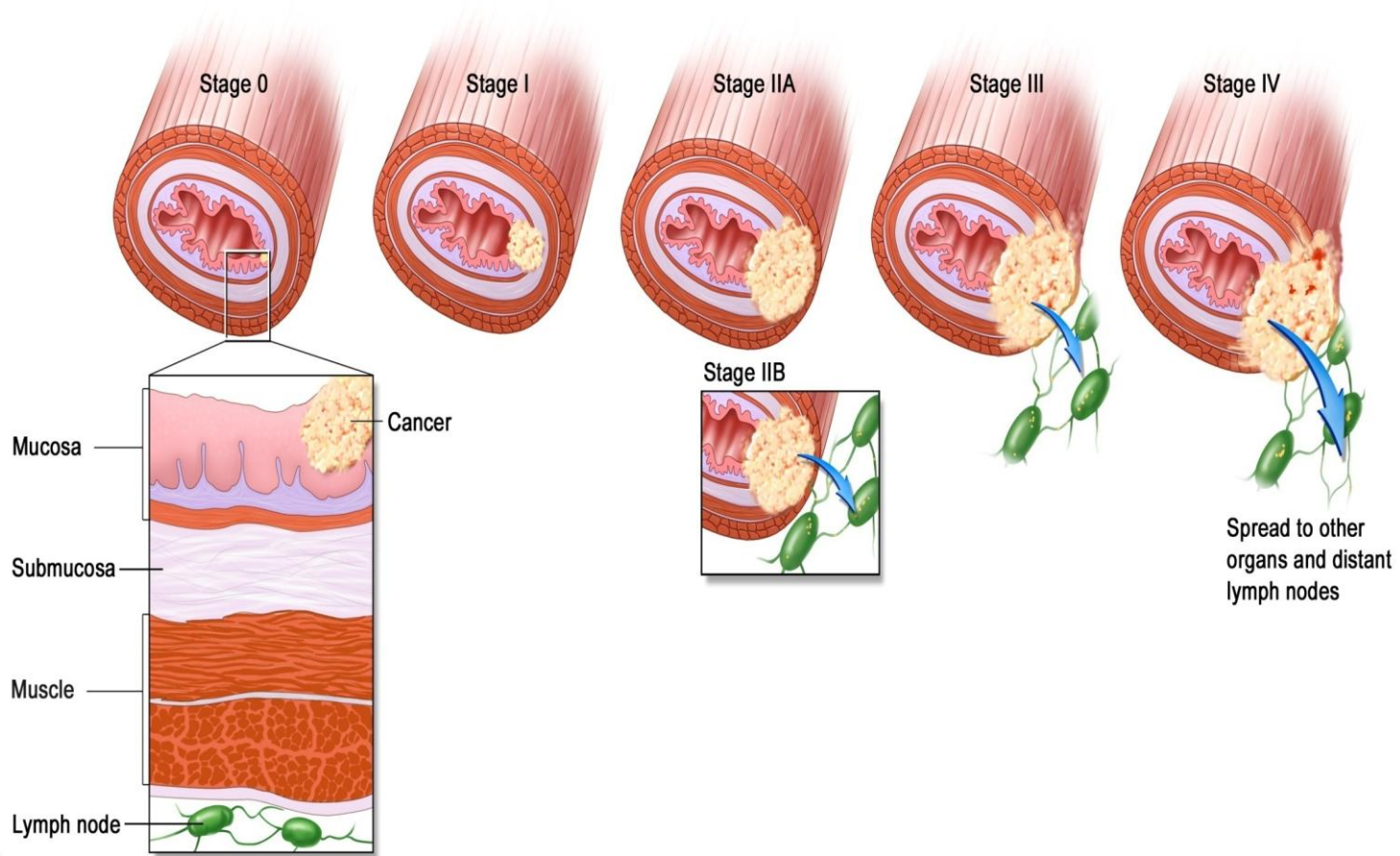
# Esophageal Cancer



- 9<sup>th</sup> most common cancer – highly curable in early stages
  - 4 times more common in women
  - Heavy alcohol ingestion, especially with smoking, greatly increases the risk
  - GERD and lower esophageal inflammatory changes may predispose to esophageal cancer
- S & S
  - Dysphagia in 90% of cases
  - Odynophagia (swallowing pain) 50% of cases
  - Unexplained weight loss 50% of cases



# Esophageal cancer staging





- Treatment

- Surgery is the mainstay of treatment

- With surgery, the five year survival rate is only 5-20%

- Surgery is extensive with a abdominal laparotomy and a thoracotomy at the same time

- Surgical mortality is up to 20%

- Radiation is used only when surgery is not an option

- Chemotherapy is used when it has metasasized

- Prognosis

- 5 year survival rate 5-20%

- Usually 10 months with surgery

- Usually 4 months with radiation



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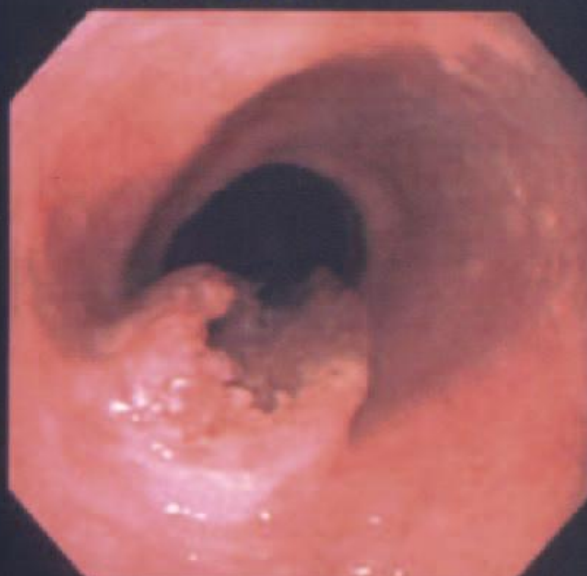
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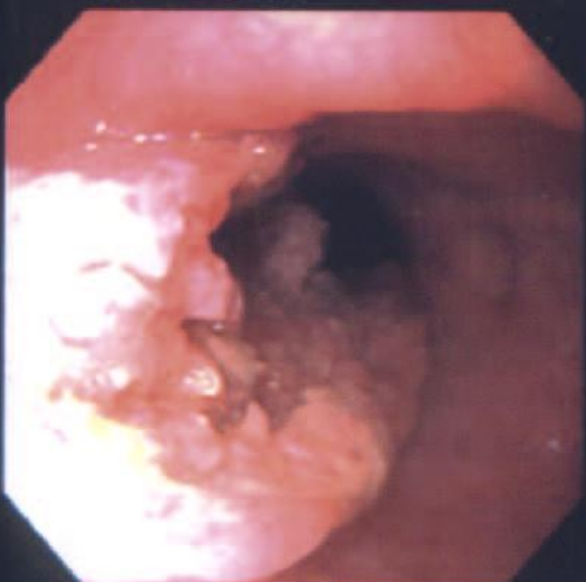
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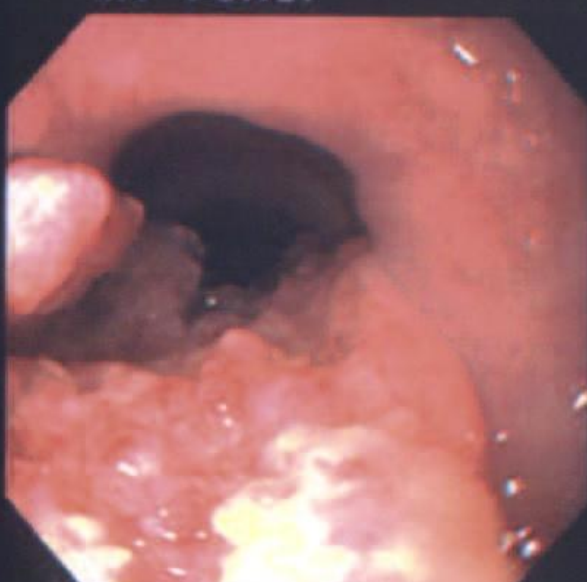
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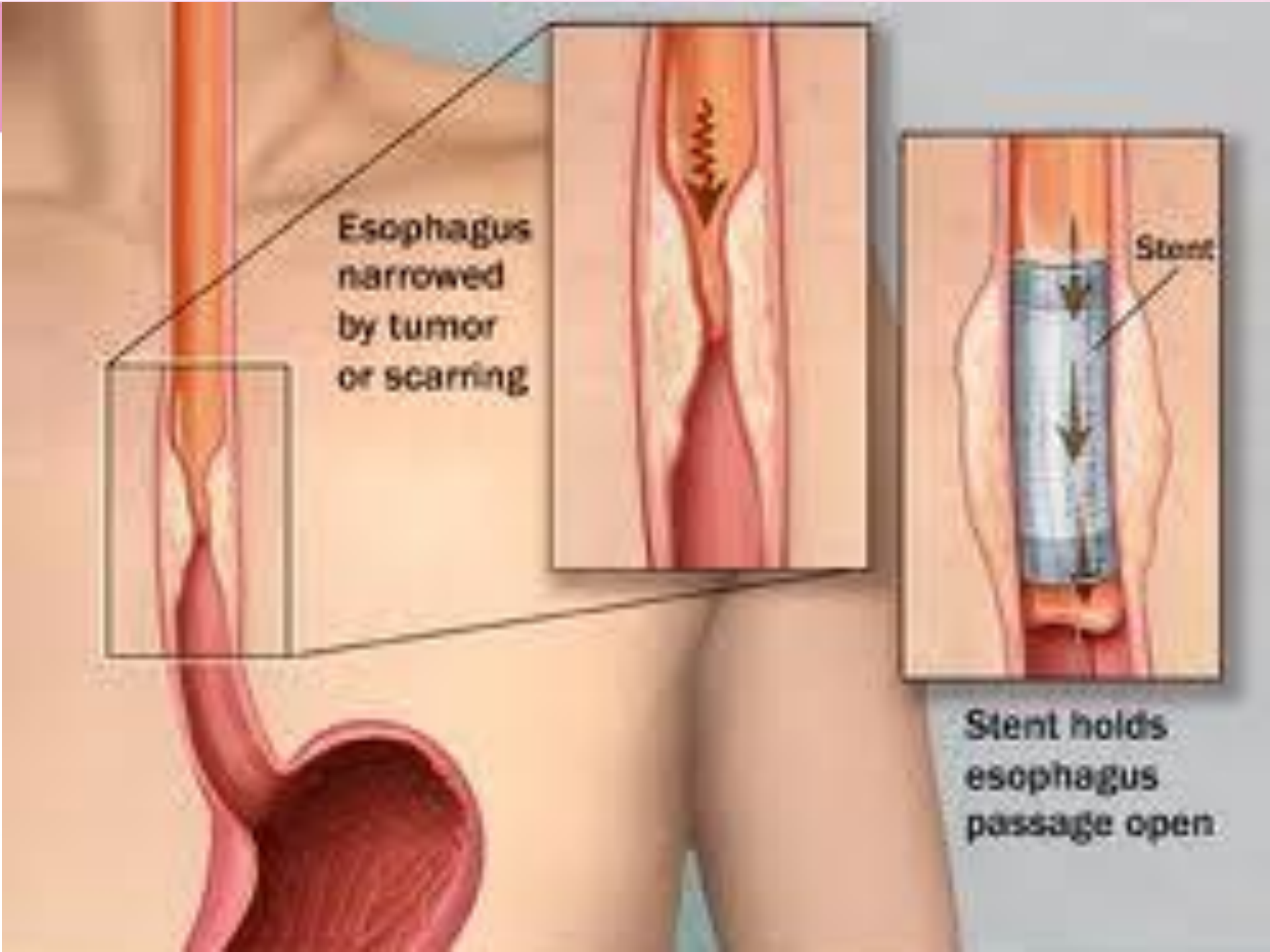
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Esophagus  
narrowed  
by tumor  
or scarring

The diagram illustrates the process of esophageal stenting. It starts with a view of the human torso showing the esophagus. A box highlights a section where the esophagus is significantly narrowed. A magnified view of this section shows a dark, irregular mass (tumor) or a thick, fibrous band (scarring) constricting the lumen. A second magnified view shows a blue, cylindrical stent being inserted into the narrowed area. The stent is shown expanding to fit the shape of the esophagus, effectively pushing the tumor or scar tissue aside and creating a clear passage. A label 'Stent' points to the device. A final view shows the stent in place, with arrows indicating the restored flow of food and liquids through the esophagus.

Stent holds  
esophagus  
passage open

# Stomach Cancer



- Gastric adenocarcinoma is very malignant with a poor prognosis
  - Tends to grow silently (like the esophagus) until it has spread to the distant areas which carries a grim prognosis
- S & S
  - Abdominal and epigastric pain
  - Weight loss
  - Upper GI bleeding
  - Dysphagia, nausea and vomiting
- Diagnosis
  - History of the above symptoms
  - Upper GI x-ray and gastroscopy







- Treatment
  - Surgery with total gastrectomy and node removal
  - Radiation – only used for local recurrences around the surgical site
  - Chemotherapy – best for advanced tumors
- Prognosis
  - Stage I is localized with no perforation of the stomach wall and no metastasis has a 50% five year survival rate
  - Stage IV with invasion to adjacent structures has a 3% five year survival rate





# Biliary Tract Cancer



- Very aggressive with poor survival rate (<1 year)
- S & S
  - Similar to gallstones (RUQ pain, nausea, vomiting, fat food intolerance) with significant weight loss
- Diagnosis
  - Jaundice with dark urine, RUQ tenderness
  - Abdominal mass, fever
  - US and CT
- Treatment
  - Surgery and radiation
- Prognosis
  - Average survival rate <17 months, if spreads to nodes <6 months, further metastasis < 3 months



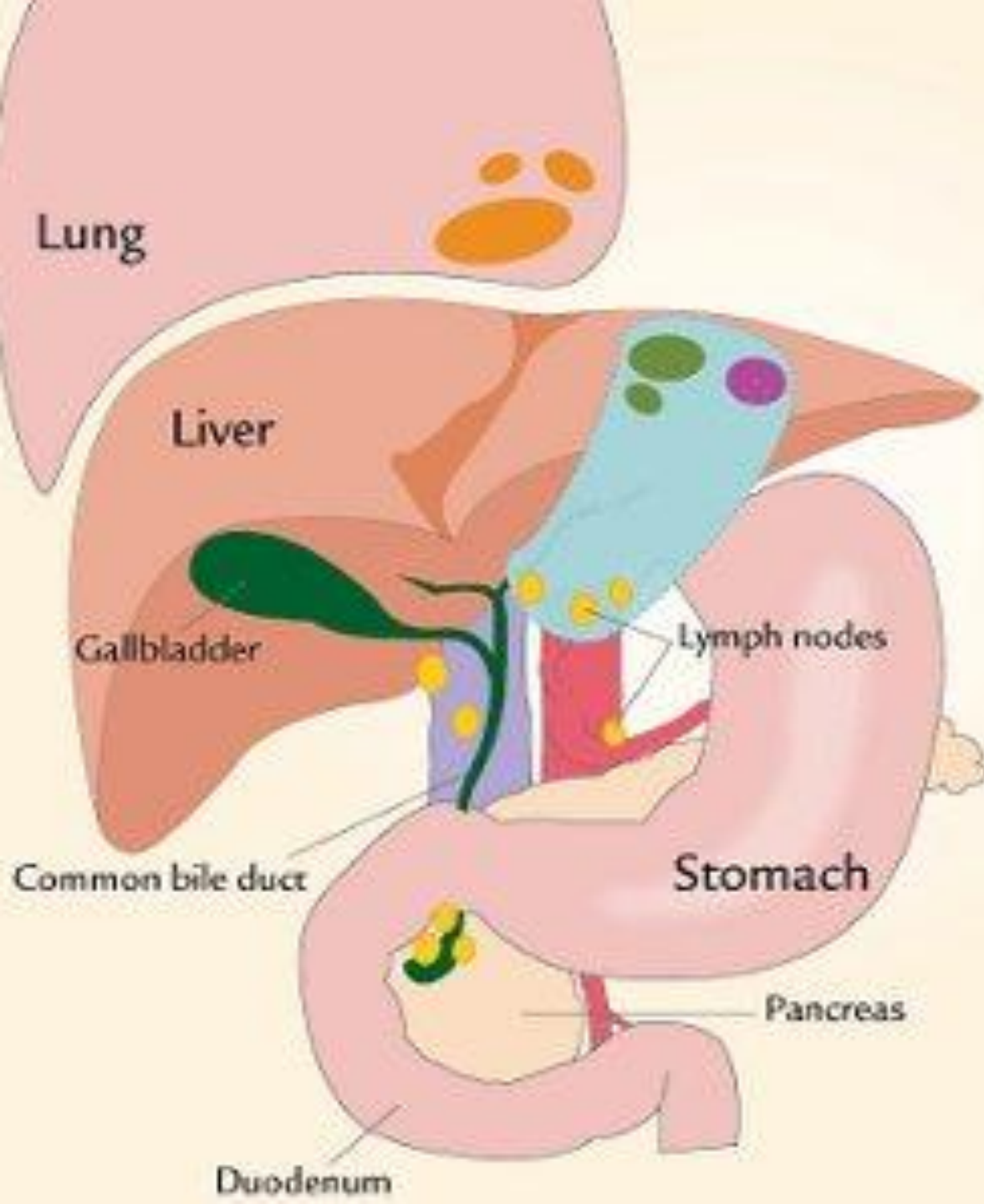
# Liver Cancer



- Aggressively fatal (like bile duct cancer)
  - Survival of < few months is not surgical
  - Strong relationship to Hepatitis A & B
- S & S
  - Grows silently until they are too big to be cured
  - As the tumor grows, abdominal pain is pronounced
- Diagnosis
  - Hepatomegaly, ascites, increased enzymes, CT, MRI
- Treatment
  - Surgical for stage I & II only (surgical mortality 15%)
  - Radiation and chemotherapy marginally effective







### Stage I

The tumor is small and found in 1 part of the liver.

### Stage II

There are several small tumors or a single tumor that has spread to nearby blood vessels.

### Stage III

There are 1 or more tumors that might have spread to nearby parts of the body, such as the stomach, blood vessels, or lymph nodes.

### Stage IV

There are 1 or more tumors in the liver, and cancer cells have spread to other parts of the body.



# Colorectal & Anal Cancer



- 2<sup>nd</sup> leading cause of cancer death
  - 99% are colorectal & 1% are anal
  - 135,000 cases per year with 65,000 deaths per year
- Risk factors
  - High fat diet with low fiber content
  - Tobacco increases polyps and cancer
  - Deficiency of folic acid, vitamin D and vitamin E
  - Ulcerative colitis increases risk 8 times
  - Crohn's increases risk 2 times
  - Increased risk after 50 years old





- Screening

- Yearly fecal blood test over 50 (still misses 2/3)
- Yearly rectal exam over 50
- Sigmoidoscopy or colonoscopy every five years over 50 and every three years in high risk patients or yearly with ulcerative colitis and Crohn's

- S & S

- Grows without symptoms in the early stages
- Bleeding is the first sign
- Pencil shaped or ribbon-shaped stools often seen

- Diagnosis

- Endoscopic exam with biopsy
- Lab studies
- CT pelvis and abdomen





- Treatment
  - Surgery is the only hope with clear margins
  - Polypectomy by endoscopy
  - Radiation post surgical
  - Chemotherapy usually only for advanced disease
- Prognosis – very poor
  - Indicators of bad prognosis
    - Four or more nodes involved
    - Vascular or lymph invasion
    - Distant metastasis
    - Advanced age
    - Obstruction and perforation



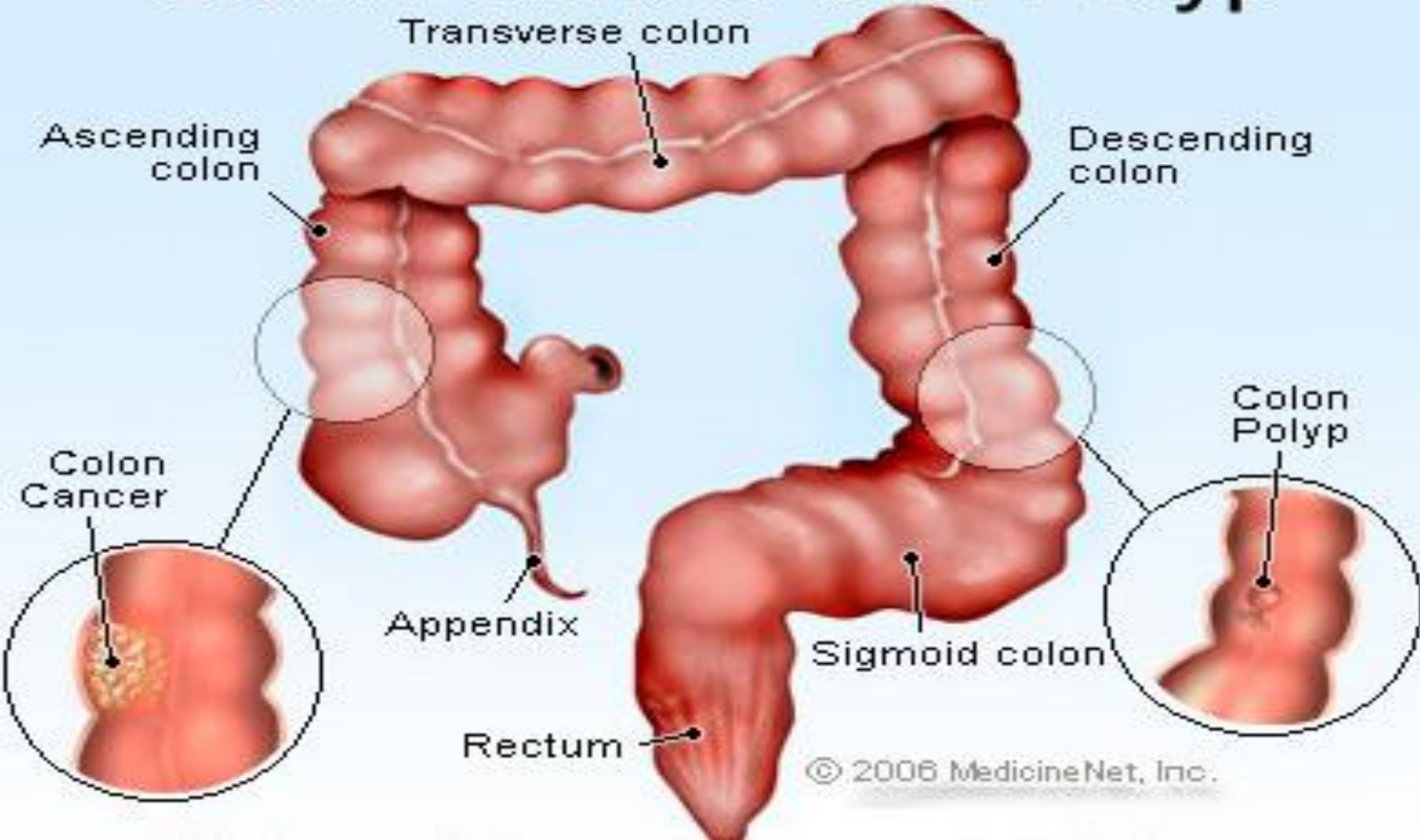


- Five year survival
  - Stage 0 >90%
  - Stage 1 – T1 or T2 no nodes – 80%
  - Stage II – T3 or T4 no nodes – 70%
  - Stage III – nodes – 60%
  - Stage IV – metastasis – 25%
- Normal Colonoscopy





# Colon Cancer and Polyp





# Prostate Cancer



- Most common malignancy in men
- 2<sup>nd</sup> most fatal cancer of men
- Average diagnosis age 72
  - Every man will eventually develop prostate cancer if they were to live long enough
  - Main risk factor is increasing age
- S & S
  - Same as for BPH, but can also have hematuria and pelvic pain
- Prostate cancer

Prostatectomy





- Screening

- PSA testing with yearly digital examination
- [Fletch moon river scene - YouTube](#)





- **Diagnosis**
  - Transrectal ultrasound with needle biopsy if PSA > 4.0
  - Bone scan if PSA > 10.0
- **Treatment**
  - Radical prostatectomy
  - Radiation is best approach due to side effects of surgery
  - Hormonal therapy
- **Prognosis**
  - 80% ten year survival with localized cancer
  - 20% five year survival with metastasis



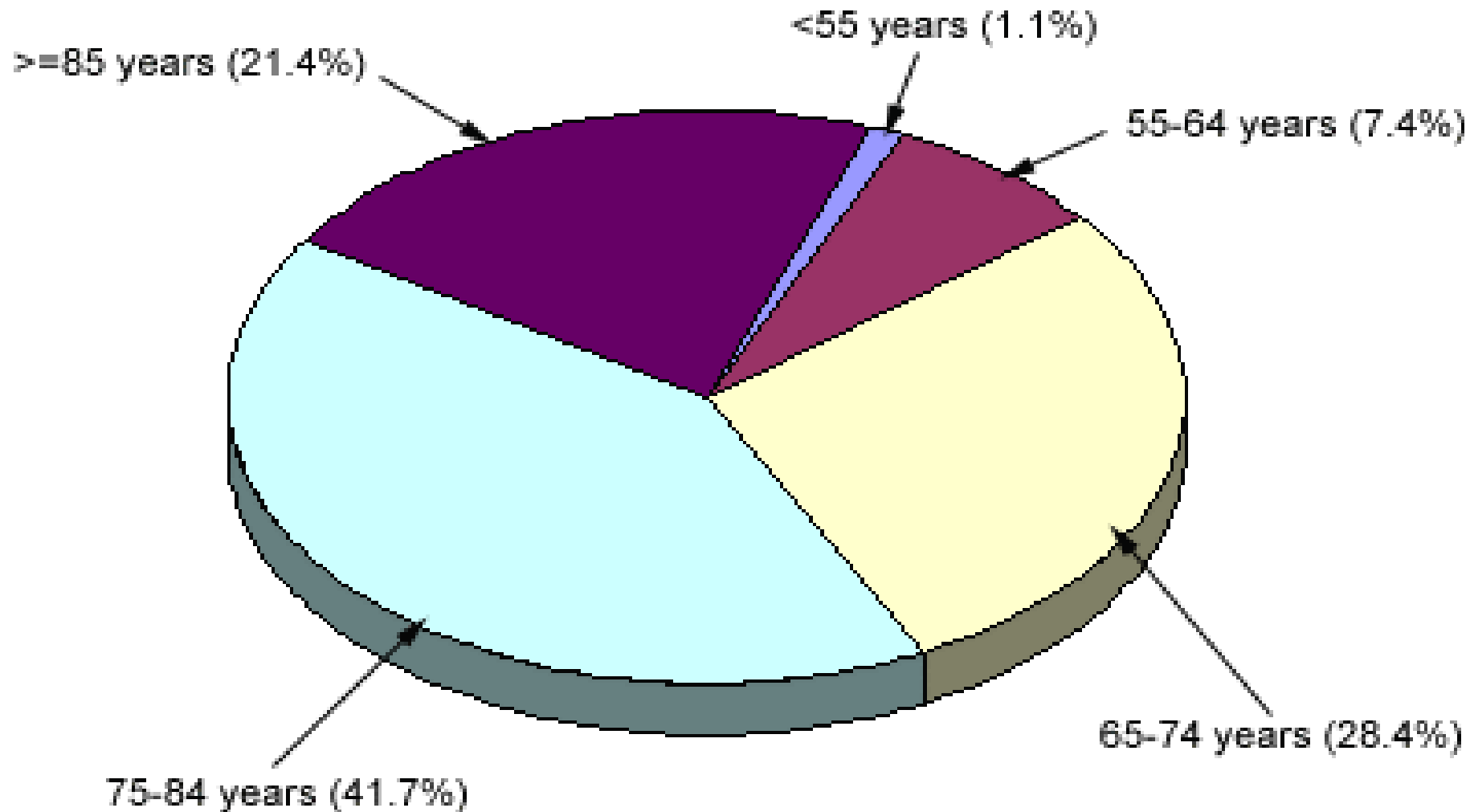


**Normal prostate**



**Prostate cancer**

# Prostate Cancer Ages



# Bladder Cancer



- 55,000 new cases and 12,000 deaths
  - 4<sup>th</sup> leading cancer of men and 8<sup>th</sup> leading cancer of women
  - Strong relationship to cigarette smoking and industrial toxicity in western countries
  - Can be caused by a parasite that enters via the feet in developing countries
- S & S
  - Painless hematuria in 85% of patients
  - Bladder instability, dysuria, urgency and frequency
  - Weight loss, abdominal pain
  - Bone pain in advanced cases





- Diagnosis
  - IVP, ultrasound, cystoscopy with biopsies
  - CT and bone scans in advanced cases
- Treatment
  - Surgery
    - Transurethral local resection if in-situ
    - Radical cystectomy with pelvic node dissection if invasive
  - Radiation and chemotherapy if not surgical
- Prognosis
  - Five year survival 95% - superficial bladder cancer
  - 50% - regional bladder cancer
  - 8% - metastatic bladder cancer





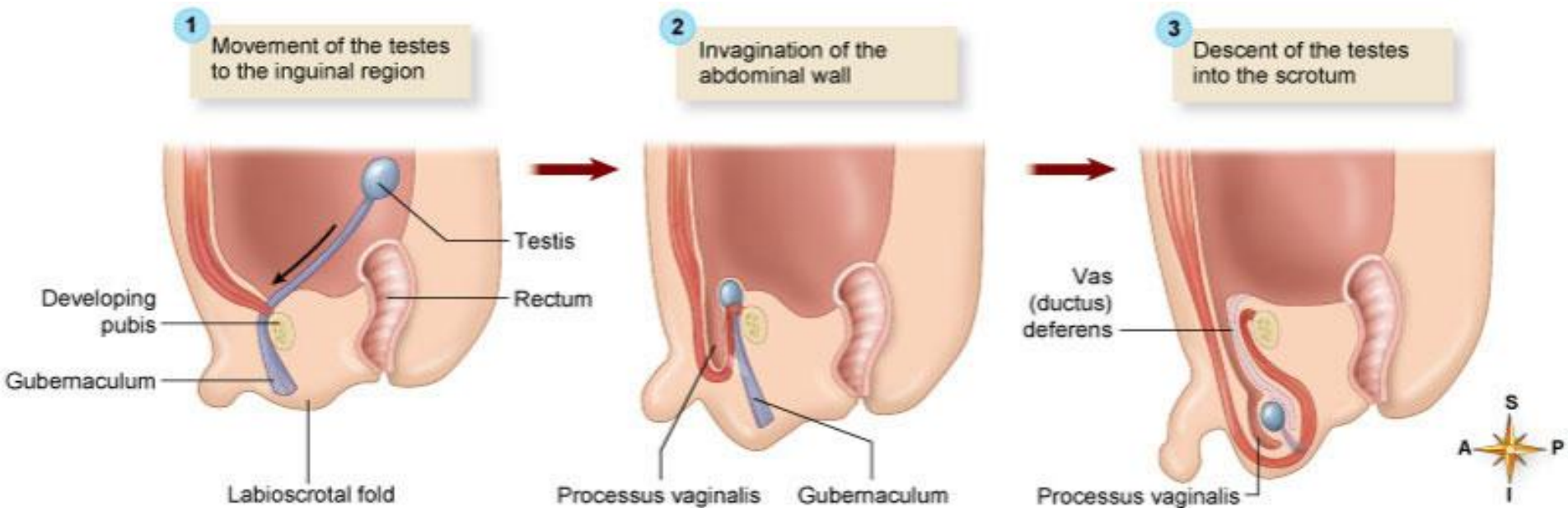
# Testicular Cancer



- Rare cancer (<1%) of all cancers but the most frequent tumor of young men
  - 7000 cases per year and 300 deaths
- Only known risk factor is undescended testes
- S & S
  - Symptomatic nodule or swelling, testicular pain, heaviness
- Exam
  - Palpatory mass, US, CT chest, abdomen & pelvis
- Treatment

Orchiectomy and removal of spermatic cord followed by radiation therapy





Adapted from Boron W, Boulpaep E: *Medical physiology*, updated version, ed 1, Philadelphia, 2005, Saunders.

Fig. 31-16. **Descent of the testes.** Prior to birth, the testes move from their retroperitoneal location near the kidneys and through the inguinal canal to the scrotum.



# Sarcomas



- Uncommon tumors of connective tissues
  - Lipomas – fat tissue tumors
  - Leiomyomas – smooth muscle tumors
  - Rhabdomyomas – skeletal muscle tumors
  - Osteomas – bone tumors
  - Fibromyomas – fibrous tissue tumors
  - Synnoviomas – synovial lining tumors
- Only 2% of cancers because they are not exposed to the outside environment
- Children get sarcomas more often than they get carcinomas





- S & S
  - Painless or tender lumps on extremities or soft tissues
  - Bone pain
  - Pathological fractures
- Diagnosis
  - X-rays for bone tumors
  - CT and MRI for soft tissue tumors
- Treatment
  - Surgical resection of muscle and bone tumors
  - Amputation or eye removal (eye muscle cancer)
  - Radiation and chemotherapy post surgical



# Skin Cancer



- Basal Cell Carcinoma
  - Most common skin cancer –  $\frac{3}{4}$  of non-melanoma cases
  - Basal cell carcinoma
- Squamous Cell Carcinoma
  - $\frac{1}{4}$  of non-melanoma cases
  - Squamous cell carcinoma
- Malignant Melanoma
  - Seventh most common cancer with 41,000 new cases and 7,500 yearly deaths
  - Extremely aggressive tumor













- S & S
  - Persistent skin lesion changes
- Treatment
  - Wide surgical excision
  - Radiation
  - Chemotherapy
- Staging and prognosis
  - Based upon the depth of the lesion
  - 85% of stage I and II cured with surgery
  - 40% five year survival with node metastasis
  - 5% five year survival with distant metastasis





# YouTube - Olay Skin Cancer Video



Normal Mole	Melanoma	Sign	Characteristic
		Asymmetry	when half of the mole does not match the other half
		Border	when the border (edges) of the mole are ragged or irregular
		Color	when the color of the mole varies throughout
		Diameter	if the mole's diameter is larger than a pencil's eraser

# CNS Tumors



- 13,000 deaths per year
- 2<sup>nd</sup> most common cause of brain death (after CVA)
- Brain tumors are seen in childhood (20% of brain tumors) and the elderly (80% of brain tumors)
  - Due to immature immune system of childhood and weakened immune system of old age
  - Most adult brain tumors are in the hemispheres
  - Most child brain tumors are mid and lower brain
- Metastatic brain tumors are fairly common
  - Found in 1/3 of all cancer deaths

– Median survival rate of all brain tumors is two years



- Brain tumors S & S
  - Headache is most common complaint
    - New intense and different from migraine, cluster, sinus
  - Often associated with other neurological changes
    - Mental changes, ataxia, paresthesias, weakness
  - Sensory changes
  - Memory changes
  - Unilateral pupil dilatation or change
- Brain tumor diagnosis
  - CT, MRI, contrast MRI
- Treatment of primary brain tumors
  - Surgical resection
  - Radiation
  - Chemotherapy







# Brain tumor







- **Spinal cord tumors**

- 10% are inside the cord and 90% are inside or outside the dura mater
- Neurofibromas are from nerve cells
- Meningiomas are from the meninges
- Metastatic tumors of the cord are usually from the lung, breast, prostate or kidney

- **S & S**

- Back pain, leg paresthesias, loss of sphincter control

- **Diagnosis**

- CT scans

- **Treatment**

- Surgical resection without causing paralysis
- Radiation with high dose of steroids





# Cancer Red Flag Cases



- Cardiac tamponade
- Pleural effusion from cancer
- Superior vena cava compression from tumor
- Spinal cord compression from tumor
- Hypercalcemia from tumor
- Active GI bleeding from a tumor
- Gastric or esophageal perforation from a tumor
- Vaginal bleeding from genital tract tumor
- Change in consciousness from CNS
- Inflammatory carcinoma of breast
- Urinary retention from prostate cancer
- Suspected PE in cancer patient

