Cancer (carcinoma)

- Characterized by rapid, uncontrolled growth of cells
- Cells lose normal functions and invade normal tissues.
- Metastasize: travel to another location

Tumor (neoplasm)

- Named for tissue of origin

Causes of Cancer

- Chemical
  - Tobacco (responsible for one-third of all cancers)
  - Asbestos (lung cancer)
  - Benzene (leukemia)
- Physical
  - X-rays (leukemia)
  - Ultraviolet (UV) light from sun (skin cancer)
Causes of Cancer (continued)

• Biological
  – Viruses (associated with 15% of all cancers)
    • Examples: herpes simplex viruses, Epstein-Barr, papillomavirus, cytomegalovirus
  – Factors that suppress immune system
    • HIV
    • Medications given after transplants
  – Oncogenes (genetic predisposition)
  – Damage to tumor suppressor gene

Environmental and Lifestyle Factors

• Many associated with higher risk of cancer
• Encourage clients to adopt healthy lifestyle habits
  – Eliminate use and exposure to tobacco.
  – Limit alcohol use
  – Reduce animal fats in diet

Environmental and Lifestyle Factors (continued)

– Increase plant fiber in diet
– Exercise regularly; keep weight normal
– Use protection from sun
– Get periodic screenings (mammogram, prostate exam, fecal occult blood test, Pap test, pelvic exam)

Treatment of Cancer

• Surgery
• Radiation therapy
• Drug therapy (chemotherapy)
  – To cure
  – For palliation
  – For prophylaxis

Surgery

• Performed to remove tumor
  – When localized
  – When pressing on nerves, airways, or other vital tissues
• Radiation and drug therapy more successful
• Surgery sometimes not an option
  – If tumors affect blood cells
  – If surgery would not extend lifespan or improve quality of life

Radiation

• Can destroy tumor cells
• Ionizing radiation aimed directly at tumor
• May follow surgery
• Used as palliation for inoperable cancers
  – Shrinks size of tumor
  – Relieves pain, difficulty breathing or swallowing
Chemotherapy

- Transported through blood
  - Has potential to reach each cancer cell
- Some drugs can cross blood-brain barrier
- Some drugs distilled directly into body cavities (ex: bladder)
- Often combined with or done after surgery and radiation to increase chance of cure
  - Called adjuvant therapy

Growth Fraction

- Measure of how many cells are undergoing mitosis
  - Ratio of replicating cells to resting cells
- Major factor in determining success of chemotherapy
- Chemotherapy is most effective against rapidly dividing cells

Growth Fraction (continued)

- High growth fraction = many replicating cells
- Solid tumors have low growth fraction; thus less sensitive to chemotherapy

Growth Fraction (continued)

- Leukemias and lymphomas have high growth fraction; thus chemotherapy more effective
- Hair follicles, bone marrow, gastrointestinal tissue have high growth factor—this explains many adverse effects

Cell Cycle

- Cell cycle
  - G0 Phase: resting stage
  - G1 Phase: synthesizes material needed to duplicate DNA
  - S Phase: duplicates DNA
  - G2 Phase: premitotic phase
  - M Phase: mitosis occurs
  - Cell returns to G0 phase
Role of the Nurse

- Monitor client’s condition
- Provide client education
- Obtain medical, surgical, drug history
- Assess lifestyle and dietary habits
- Obtain description of symptomology and current therapies

Alkylating Agents

- Discontinue if RBC, WBC, and platelet counts fall
- Use caution with hepatic or renal impairment, recent steroid therapy, leukopenia, or thrombocytopenia
- Hydrate clients with IV or oral fluids before starting chemotherapy
- Advise clients to avoid crowds and those with respiratory infections

Alkylating Agents (continued)

- Be alert to possible development of blood dyscrasias
- Monitor nutritional intake
- Assess for nausea and vomiting
  – Be prepared to administer antiemetic drugs
- Offer ice chips or ice pops to relieve mouth pain
- Assess skin integrity

Alkylating agents (continued)

- Monitor for signs of hearing loss
- Inform clients of potential adverse impact on fertility
- Alkylating agents range from pregnancy category C to X
- Maintain strict medical asepsis

Antimetabolites

- Contraindicated in pregnancy, hepatic, cardiac, and renal insufficiency; myelosuppression; and blood dyscrasias
- Avoid pregnancy for at least six months after therapy with category X drug
- Adverse effects common to other antineoplastics may occur
### Antimetabolites
- Monitor for photosensitivity and idiosyncratic pneumonitis
- Teach clients to use good oral hygiene and encourage mouth rinses
- Monitor IV site frequently for extravasation

### Antitumor Antibiotics
- Assess cardiac status—obtain baseline ECG
- Assess for pregnancy and lactation
- Produce same cytotoxic effects as other antineoplastics
- Risk of hypersensitivity reactions exists as with other antibiotics

### Antitumor Antibiotics (continued)
- Changes in rectal mucosa contraindicate suppositories or rectal temperatures
- Wear protective clothing (gloves, mask, and apron) when preparing drug
- Monitor IV site because doxorubicin is a severe vesicant
- Give drug through large-bore, quickly running IV; monitor for extravasation

### Hormones and Hormone Antagonists
- Assess for pregnancy and breast-feeding
- Hormones other than tamoxifen (Nolvadex) may be palliative rather than curative
  - Important that both client and family understand this limitation
- Development of cross-gender secondary sexual characteristics
  - Common, yet distressing, side effects of sex-hormone therapy
- Fertility sometimes affected
- Discuss these effects frankly with client, and offer support

### Natural Products
- Assess allergy to plants or flowers, including herbs or foods
- Vincristine (Oncovin) may produce acute bronchospasm and skin rashes
- Inquire if female clients are pregnant or breast-feeding
- Many of same cytotoxic effects as other antineoplastics
Natural Products (continued)

• Emphasize need to establish nutritional plan to combat constipation
  – High fluid and fiber intake
• Monitor blood pressure
• Observe clients for symptoms such as headache, dizziness, or syncope
• May produce severe mental depression; assess possibility of suicidal ideation

Multiple-Drug Strategy

• Multiple drugs from different classes
  – Affect different stages in cell cycle
  – Use different mechanisms of action to increase cell kill
• Combinations allow for lower doses
  – Reduce toxicity
  – Slow development of resistance

Dosing Schedules

• Specific dosing protocols
  – Depend on type of tumor, stage of disease, overall condition of client
  – Given as single dose or several doses
  – May be given within days or after several weeks
    • Gives normal cells chance to recover

Dosing Schedules

• Sometimes optimum dose must be delayed
  – Lets client recover from drug toxicities
  – Example: in case of bone-marrow depression

Serious Toxicity Limits Therapy

• Difficult to kill cancer cells without killing normal cells
• Adverse effects of therapy
  – Alopecia
  – Mucositis (severe nausea, vomiting, diarrhea)
    • Drugs with high emetic potential pretreated with antiemetics (Compazine, Reglan, Ativan)

Serious Toxicity Limits Therapy (continued)

• Adverse effects of therapy (continued)
  – Bone-marrow depression (anemia, leukopenia, thrombocytopenia)
    • Treated with bone-marrow transplantation, platelet infusions, or growth factors
  – If absolute neutrophil count (ANC) falls below 500/mm³, infection risk grows
Serious Toxicity Limits Therapy (continued)

- **Vesicants**
  - Can cause tissue injury (extravasation)
  - Know emergency treatment before giving vesicants IV
- **Long-term consequences**
  - Possible infertility
  - Increased risk for secondary tumors

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Alkylationing Agents

- **Prototype drug**: cyclophosphamide (Cytoxan)
- **Mechanism of action**: attaches to DNA and disrupts replication
- **Primary use**: to treat wide variety of cancers, including Hodgkin's disease, lymphoma, multiple myeloma, breast cancer, ovarian cancer
- **Adverse effects**: immunosuppressant effects, thrombocytopenia
  - Nausea, vomiting, anorexia, diarrhea
  - Alopecia, hemorrhagic cystitis

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Cyclophosphamide Animation

[Click here to view an animation on the topic of cyclophosphamide.]

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Antimetabolites

- **Prototype drug**: methotrexate (Folex, Mexate, others)
- **Mechanism of action**: blocks synthesis of folic acid (vitamin B9) to inhibit replication
- **Primary use**: to treat choriocarcinoma, osteogenic sarcoma, leukemias, head and neck cancers, breast carcinoma, lung carcinoma

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Methotrexate Animation

[Click here to view an animation on the topic of methotrexate.]

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Antimetabolites (continued)

- **Adverse effects**: fatal bone-marrow toxicity at high doses
  - Hemorrhage and bruising, low platelet counts
  - Nausea, vomiting, anorexia
  - Gastrointestinal ulceration, intestinal bleeding
Antitumor Antibiotics

- **Prototype drug**: doxorubicin (Adriamycin)
- **Mechanism of action**: attaches to DNA
  - Distorts double helical structure and prevents normal DNA and RNA synthesis
- **Primary use**: solid tumors of the lung, breast, ovary, and bladder, and for various leukemias and lymphomas

**Adverse effects**:
- Cardiotoxicity, dysrhythmias
  - Irreversible heart failure, lower blood-cell counts
  - Nausea, vomiting

Natural Products

- **Prototype drug**: vincristine (Oncovin)
- **Mechanism of action**: cell-cycle-specific (M-phase) agent that kills cancer cells by preventing their ability to complete mitosis
- **Primary use**: treatment of Hodgkin’s and non-Hodgkin’s lymphomas
  - Leukemias, Kaposi’s sarcoma, Wilms’ tumor
  - Bladder carcinoma, breast carcinoma

**Adverse effects**:
- Nervous system toxicity, numbness and tingling in limbs
  - Muscular weakness, loss of neural reflexes, pain
  - Paralytic ileus, constipation, alopecia

Hormones/Hormone Antagonists

- **Prototype drug**: tamoxifen (Nolvadex)
- **Mechanism of action**: blocks estrogen receptors on breast cancer cells
- **Primary use**: clients with breast cancer
  - Also given to high-risk clients to prevent disease

**Adverse effects**:
- Nausea and vomiting
  - Association with increased risk of endometrial cancer and thromboembolic disease
  - Hot flashes, fluid retention, vaginal discharges common
**Alkylating Agents**
- Broad spectrum of activity
- Act by changing structure of DNA in cancer cells
- Use is limited—can cause significant bone-marrow suppression

**Antimetabolites**
- Act by disrupting critical pathways in cancer cells
  - Example: folate metabolism or DNA synthesis
- Three types of antimetabolites
  - Purine analogs
  - Pyrimidine analogs
  - Folate inhibitors

**Antitumor Antibiotics**
- Act by inhibiting cell growth through cytotoxicity
  - Actions similar to alkylating agents
- Narrow spectrum of clinical activity
- Cardiotoxicity is major limiting factor
  - May occur within minutes or years later

**Natural Products**
- Plant extracts
  - Structurally very different
  - Kill cancer cells by preventing cell division
  - Called mitotic inhibitors

**Mitotic Inhibitors**
- Vinca alkaloids
- Taxanes
- Topoisomerase inhibitors
- Camptothecins

**Hormones and Hormone Antagonists**
- Antineoplastic agents slow growth of reproductive-related tumors
  - Breast, prostate, uterine
- Less cytotoxic than other antineoplastics
Biologic Response Modifiers

- Stimulate or assist client’s immune system to rid itself of cancer cells
  - Less toxic than other classes of antineoplastics
  - Includes interferons, interleukins, monoclonal antibodies
  - Given concurrently with other neoplastics to limit immunosuppressive effects

Miscellaneous Antineoplastics

- Asparaginase deprives cancer cells of essential amino acid
- Mitotane (Lysodren) is similar to insecticide DDT
- Two new antineoplastics inhibit enzyme tyrosine kinase in tumor cells
  - Imatinib (Gleevec) and sorafenib

Assessment

- Obtain complete health history, including lab values
  - Platelets, hematocrit (Hct), leukocyte count
  - Liver- and kidney-function tests, serum electrolytes

Assessment (continued)

- Obtain drug history to determine possible drug interactions and allergies
- Assess neurological status, including mood and sensory impairment
- Assess for history or presence of herpes zoster or chickenpox

Nursing Diagnoses

- Risk for infection, related to compromised immune system
- Risk for deficient fluid volume, related to decreased platelet count
- Imbalanced nutrition, less than body requirements

Nursing Diagnoses (continued)

- Impaired skin integrity, related to extravasation
- Disturbed body image, related to physical changes as result of drug side effects
- Fatigue, related to decreased production of RBCs
Planning—client will

- Experience reduction in tumor mass and/or progression of abnormal cell growth
- Demonstrate understanding of drug’s action
- Maintain WBC count higher than 4,000 and platelet count greater than 50,000

Implementation

- Monitor CBC and temperature
- Collect stool samples for guaiac testing of occult blood
- Monitor vital signs, cardiorespiratory and respiratory status
- Monitor renal status, urine, intake and output, and daily weight
- Monitor GI status and nutrition

Implementation (continued)

- Administer antiemetics 30–45 minutes prior to antineoplastic administration
- Monitor for constipation
- Monitor neurological/sensory status
- Monitor genitourinary status
- Monitor for hypersensitivity or other adverse reactions

Implementation (continued)

- Monitor hair and skin status
- Monitor for conjunctivitis
- Monitor liver-function tests
- Administer with caution to clients with diabetes mellitus

Evaluation

- Client experiences reduction in tumor mass and/or progression of abnormal cell growth
- Client accurately describes drug side effects, precautions, therapeutic goals
- Client’s WBC is greater than 4,000
- Client’s platelet count is greater than 50,000

Alkylation Agents

Table 37.4 Alkylation Agents
## Biologic Response Modifiers and Miscellaneous Antineoplastics

### Table 37.9 Biologic Response Modifiers and Miscellaneous Antineoplastics

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