New 2018 OCN Test Blueprint

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Sub-Content Areas</th>
<th>2018 Test%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care Continuum</td>
<td>• Health Promotion &amp; Disease Prevention</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>• Screening &amp; Early Detection</td>
<td></td>
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<td>• Navigation, Advanced Care Planning</td>
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<td>• Epidemiology</td>
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<td></td>
<td>• Survivorship</td>
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<td></td>
<td>• Treatment-related Considerations</td>
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<td></td>
<td>• End-of-Life Care</td>
<td></td>
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<tr>
<td>Oncology Nursing Practice</td>
<td>• Scientific Basis</td>
<td>17%</td>
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<tr>
<td></td>
<td>• Site-Specific Cancer Considerations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Scope, Standards, &amp; Related Issues</td>
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<td>• Standards of Professional Performance</td>
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<tr>
<td>Treatment Modalities</td>
<td>• Surgery; Blood and Marrow Transplant; Radiation Therapy; Chemotherapy; Biotherapy; Immunotherapy; Targeted Therapy; Vascular Access</td>
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<tr>
<td>Symptom Management &amp; Palliative Care</td>
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<td>Oncologic Emergencies</td>
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<td>12%</td>
</tr>
<tr>
<td>Psychosocial Dimensions of Care</td>
<td></td>
<td>10%</td>
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</tbody>
</table>

Study Resources

  - Treatment Modalities – Part 3
    • Surgical Treatment
    • Blood and Marrow Transplantation
    • Radiation Therapy
    • Chemotherapy
    • Targeted Therapies and Biotherapy
    • Support Therapies & Procedures

  - Section II: Treatment Options
    • Surgery
    • Radiation Therapy
    • Precision Medicine, Biologics, & Targeted Therapies
    • Hormone Therapies
    • Clinical Trials
    • Complementary & Alternative Medicine
**Study Resources**


**Online Resources**

- Oncology Nursing Society Online Courses
  - www.ons.org/education/courses-activities
- OCN Certification Review Bundle
  - $234.00 for ONS members, $490.00 for non-members
  - 40.87 CE credits
  - Four courses (may be purchased individually) + Practice Tests
    - Prevention, Detection, and the Science of Cancer
    - Treatment and Symptom Management
    - Quality of Life Issues
    - Professional Practice – Oncology Nurse
  - OCN Practice Test (only available with purchase of review bundle)

**Radiation Therapy Overview**

- Use of ionizing radiation as part of cancer treatment to control malignant cells
- Biologic effects of ionizing radiation:
  - Cellular Target – most important target is DNA
    - Direct effect on cell: DNA damage (single-strand and double-strand breaks, formation of crosslinks)
    - Indirect effect on cell: Causes ionization of water which creates free radicals that damage DNA
  - Biologic Response – is affected by level of DNA damage
    - Well oxygenated tumors show greater response
    - Sensitivity of cell to radiation
Principles of Radiation Therapy (RT)

• Course of RT planned to deliver dose high enough to destroy the tumor but not to exceed tolerance of normal tissue in radiation field

• Side effects of RT generally result of radiation effect on normal tissue

Radiosensitivity of Cells

• Cells vary in sensitivity to radiation

• In general, rapidly dividing cells (normal cells and cancer cells), are most sensitive.
  – Examples: epithelial cells, bone marrow, lymphoid tissue

• Nondividing or slowly dividing cells are generally less radiosensitive
  – Examples: muscle cells, neurons

Side Effects of Radiation Therapy

• Early side effects:
  – Occur during RT or immediately after and generally heal after RT course
  – Usually exhibited first by rapidly proliferating tissues (e.g., GI mucosa, bone marrow, skin)

• Late side effects:
  – Occur months to years after RT and are permanent
  – Slow proliferating tissues develop injury slowly (e.g., CNS, kidney, cartilage, bone)

Tissue Response to Radiation Therapy (RT)

<table>
<thead>
<tr>
<th>Tissue Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute-Responding</td>
<td>Early side effects occur during or immediately after RT and generally heal after RT course. Usually exhibited by tissues with rapidly proliferating cells (e.g., GI mucosa, bone marrow, skin).</td>
</tr>
<tr>
<td>Tissues</td>
<td></td>
</tr>
<tr>
<td>Sub-Acute</td>
<td>Few (if any) early side effects. Damage occurs weeks to months after RT. Tissues with slower proliferating cells (e.g., lung, liver, kidney, heart, spinal cord, brain).</td>
</tr>
<tr>
<td>Responding Tissues</td>
<td></td>
</tr>
<tr>
<td>Late-Responding</td>
<td>Late effects occur months to years after RT and are permanent. Slowing proliferating cells develop injury slowly (e.g., CNS, peripheral nervous system, kidney, cartilage, bone).</td>
</tr>
<tr>
<td>Tissues</td>
<td></td>
</tr>
</tbody>
</table>
Methods of Delivery

• **Teletherapy (External Beam)**
  – Precise dose delivered from outside the body
  – Delivered by treatment machines: linear accelerator, cobalt-60 sources

• **Brachytherapy**
  – Radiation delivered from sealed radioactive sources implanted in body
  – Placed temporarily or permanently:
    - adjacent to tumor (intracavitary or surface application)
    - into the tumor or into a lumen (interstitial application)
    - into a lumen (intraluminal)

• **Systemic Treatment**
  – Systemic administration of a radioactive preparation that selectively targets tissue

**Teletherapy**

External Beam Radiation Therapy (EBRT)

• Most common type of radiation therapy
• Most often delivered in the form of photon beams (either x-rays or gamma rays)
  – Photon is the basic unit of light and other forms of electromagnetic radiation
  – Can be thought of as a bundle of energy
  – The amount of energy in photon can vary (e.g. gamma rays have the highest energy, followed by x-rays)
• Many types of Teletherapy delivered using machine called linear accelerator (also called LINAC)
  – LINAC uses electricity to form a stream of fast-moving subatomic particles
  – Creates high-energy radiation

Teletherapy Treatment Process

- Patient consultation with Radiation Oncologist
- Simulation
  - X-ray examinations (scans) to “simulate” treatment volume
  - Facilitates decisions for treatment fields
  - CT or MRI used for tumor localization to plan fields
  - Immobilization devices
  - Treatment marks placed on skin
- Treatment planning
- Patient Education
- Treatment
- Weekly management evaluation
  - “OTV”: On-Treatment Visit; Radiation Oncologist & Radiation Nurse evaluate status & side effects
- Long-term follow-up

Brachytherapy

• Placement of sealed radioactive isotope, temporarily or permanently, into:
  - Tissue (interstitial)
  - Into hollow body cavity (intracavitary)
  - On surface of the body

• Rationale:
  - Delivery of high dose radiation to tumor site over continuous period
  - Minimizes radiation dose to adjacent tissue
  - Increased local control, decreased long-term side effects
### Unsealed Sources (Radiopharmaceutical Therapy)

- Radioactive materials administered IV, orally, or into body cavity
- Systemic administration of a radioactive preparation that selectively targets tissue
- Delivers to target tissue causing little or no damage to adjacent tissue
- Short duration of radioactivity within the body
- Uses:
  - Hyperthyroidism: Iodine 131 (I 131)
  - Metastatic bony lesions: Strontium chloride – Sr 89
  - Non-Hodgkin Lymphoma: Ibritumomab tiuxetan (Zevalin), CD-20 monoclonal antibody conjugated with yttrium-90

### Brachytherapy (Sealed Sources)

- Radiation delivered from radiation sources (radioactive materials) placed inside or on the body
- Radioactive isotopes sealed in tiny pellets or “seeds”
- Seeds placed in patients using delivery devices (needles, catheters, or other type of carrier).
- As the isotopes decay naturally, they give off radiation that damages nearby cancer cells
- Placement can be temporary or permanent
- Types of Brachytherapy:
  - Interstitial brachytherapy
  - Intracavitary brachytherapy

### Radiation Safety

- Regulations regarding radiation exposure
- Federal requisite safety standards
  - Maximal permissible dose limits
- State regulations & guidelines
- Institutional guidelines

### Safety Practices Depend On Radioisotope Characteristics

- Energy of isotope
- Half-life of isotope
  - Time required for half of the atoms of a given quantity of radioactive material to decay
  - Important in unsealed sources of Radiation Therapy
Types of Radioactive Particles

- **Alpha particles** (large particles, shallow penetration)
- **Beta particles** (deeper penetration when injected or ingested, body provides adequate shielding)
- **Gamma particles** (wide range of energy & penetration, lead shielding)

Monitoring Radiation Exposure

- Personal monitoring devices
  - Film badge or ring badge
  - Pocket dosimeter
- Patient or in-room monitoring devices
  - Geiger counter
  - Ionization chamber monitor

Radiation Safety Personnel

- Radiation safety officer
- Radiation control committee
- Radioisotope authorized user personnel

Radiation Safety Principles

- Minimize **TIME** of exposure to radiation
- Maximize **DISTANCE** from exposure
- Use appropriate **SHIELDING** between radiation source and exposed person

Side Effects of Radiation Therapy

- Great table in Core Curriculum for Oncology Nursing on Side Effects of Radiation Therapy & Nursing Implications (pages 233 – 235)

Skin Side Effects of Radiation Therapy

<table>
<thead>
<tr>
<th>Potential Early Effects</th>
<th>Potential Intermediate or Late Effects</th>
<th>Nursing Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythema</td>
<td>Fibrosis</td>
<td>Early effects:</td>
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<tr>
<td>Pigmentation</td>
<td>Telangiectasis</td>
<td>• Non-moist reaction:</td>
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<tr>
<td>Dry desquamation</td>
<td>Atrophy</td>
<td>• Wash with mild</td>
</tr>
<tr>
<td>Moist desquamation</td>
<td>Telangiectasis</td>
<td>• soap and water and</td>
</tr>
<tr>
<td>Alopecia</td>
<td>Slow healing of trauma</td>
<td>• use calendula or</td>
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<tr>
<td></td>
<td></td>
<td>• hyaluronic-based</td>
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<tr>
<td></td>
<td></td>
<td>cream.</td>
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<td></td>
<td></td>
<td>• Use only electric</td>
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<td></td>
<td>• razor, per institutional</td>
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<tr>
<td></td>
<td></td>
<td>• guidelines.</td>
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<tr>
<td></td>
<td></td>
<td>• Moist desquamation:</td>
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<td>• Wash with mild</td>
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<td>• cleanser and use</td>
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<td></td>
<td></td>
<td>• hydrocolloid or</td>
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<tr>
<td></td>
<td></td>
<td>• Silver leaf dressing</td>
</tr>
<tr>
<td>Early and later effects:</td>
<td></td>
<td>• Observe for increased</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• reaction in skin</td>
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<tr>
<td></td>
<td></td>
<td>• folds.</td>
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<tr>
<td></td>
<td></td>
<td>• Observe for increased</td>
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<td>• expected reactions if</td>
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<td></td>
<td>• patient has had</td>
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<td></td>
<td>• chemotherapy that</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• enhances skin reaction</td>
</tr>
</tbody>
</table>

Exam Question Examples

A patient is scheduled for brachytherapy. When asked what this means, the nurse’s best response to the patient would be that brachytherapy involves the:

a. Placement of a radioactive source in or near the tumor site
b. Use of a split course of external-beam irradiation aimed at the tumor site
c. Instillation of a radioactive substance for purposes of palliation
d. Use of both irradiation and chemotherapy for inaccessible tumors

Exam Question Examples

Which of the following statements best describes the radiobiology of treatment with ionizing radiation?

a. Ionizing radiation injures cellular DNA of both normal & cancer tissues
b. Only normal cells can repair damage to DNA
c. Altered DNA always produces hereditary changes
d. Cells that are lethally damaged by ionizing radiation die within an hour of the radiation dose
Exam Question Examples

Another name for external-beam radiation therapy is:

a. Teletherapy  
b. Brachytherapy  
c. Radioimmunotherapy  
d. Sealed source therapy

Exam Question Examples

One of the primary goals of dose fractionation is to:

a. Redistribute cell age within the cell cycle, making normal cells less radiosensitive  
b. Allow tumor cells to repopulate, making them more vulnerable to the late consequences that occur if new growth was inhibited  
c. Deliver a dose sufficient to prevent tumor cells from being repaired while allowing normal cells to recover before the next dose is given  
d. Provide time between treatments for normal cells to reoxygenate, thus making them less radiosensitive

Exam Question Examples

Complications and side effects of radiotherapy for esophageal cancer include all of the following except:

a. Esophageal stricture  
b. Radiation pneumonitis  
c. Skin reaction  
d. Nausea and vomiting

Chemotherapy
Resources for Studying Chemotherapy, Biotherapy & Targeted Therapies

- Chemotherapy & Biotherapy Guidelines and Recommendations for Practice, 3rd Ed.
  - Excellent tables reviewing biotherapy, targeted agents
- ONS Online Resources (www.ons.org)
  - Chemotherapy/Biotherapy Fundamentals of Administration (9.10 Contact hours)
    - ONS members: $99, Non-ONS Members: $139
  - ONS/ONCC Chemotherapy/Biotherapy Certificate Course
    - (15 Contact hours)
    - ONS Members: $199, Non-ONS Members $279

ONS Online Resources: Cancer Therapies Resource Page

- https://www.ons.org/practice-resources/cancer-therapies

- Comprehensive listing of available Cancer Therapy resources

Goals of Cancer Therapy

- Prevention
- Cure
- Control
- Palliation

Treatment Approaches

- Adjuvant Therapy
  - Therapy given after the primary treatment modality such as surgery
  - Example: adjuvant chemotherapy following lumpectomy for breast cancer
  - Rationale & goal of adjuvant therapy:
    - Reduce risk of recurrence by eliminating small sites of disease or microscopic disease (micrometastases)
- Neoadjuvant Therapy
  - Use of one or more treatment modalities prior to the primary treatment (i.e. chemotherapy prior to surgery)
  - Rational for neoadjuvant therapy:
    - Decrease tumor size for surgical removal (shrink tumor prior to removal)
    - Evaluate effectiveness of chemotherapy (before surgery)
Cell Life Cycle

- **G-0 Phase**
  - Resting (cells not committed to cell division)
- **G-1 Phase**
  - RNA & protein synthesis (enzymes produced necessary for DNA synthesis)
- **S Phase (Synthesis)**
  - DNA synthesis
- **G-2 Phase**
  - RNA, protein synthesis
- **M Phase (Mitosis)**
  - Cellular division

Action of Antineoplastic Drugs

- Alter cellular activity during one or more phases of cell cycle
- Affects both normal & malignant cells

Pharmacologic Classifications

**Cell Cycle Non-specific**
- Alkylating agents
- Nitrosoureas
- Antitumor antibiotics

**Cell Cycle Specific**
- Antimetabolites
- Plant Alkaloids (Mitotic inhibitors)
  - Vinca alkaloids
  - Taxanes
  - Epipodophyllotoxins
- Camptotecins

Cell Cycle Specific Agents

- Exerts effect only in specific phases of cell cycle
- Most effective against rapidly proliferating (cycling) cells
- Cell kill dependent on schedule (duration & timing rather than dose)
**Cell Cycle Non-Specific Agents**

- Affect cells in all phases of the cell cycle (including G0).
- Both proliferating & nonproliferating cells killed.
- Cell kill dependent on total dose rather than schedule.
- Combined with cell cycle-specific agents.

**Alkylating Agents**

- Cell cycle non-specific.
- Break DNA helix, interferes with DNA replication.
- **Examples of alkylating agents**
  - Bendamustine
  - Cyclophosphamide
  - Ifosfamide
  - Cisplatin
  - Carboplatin
  - Oxaliplatin
  - Melphalan

**Common Chemotherapy Agents**

<table>
<thead>
<tr>
<th>Phase of Cell Cycle</th>
<th>Alkylating Agents</th>
<th>Generic (Brand) Names</th>
<th>Common Toxicities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonspecific Alkylating</td>
<td>Bendamustine (Treanda)</td>
<td>Cyclophosphamide (Cytoxan)</td>
<td>Myelosuppression</td>
</tr>
<tr>
<td>Agents</td>
<td>Cyclophosphamide (Cytoxan)</td>
<td>Ifosfamide (Ifex)</td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td>Cisplatin (Platinol)</td>
<td>Carboplatin (Paraplatin)</td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td>Melphalan (Alkeran)</td>
<td>Oxaliplatin (Eloxatin)</td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nausea/vomiting</td>
</tr>
</tbody>
</table>

**Alkylating Agents Toxicities**

- **Hematopoietic**
  - Myelosuppression
- **GI**
  - Nausea/vomiting
- **Reproductive**
  - Azoospermia, amenorrhea
- **Integumentary**
  - Alopecia
  - Many agents are vesicants or irritants

- **Carcinogenic**
  - Secondary malignancies
- **Hemorrhagic cystitis**
  - Ifosfamide, cyclophosphamide
- **Neuropathy**
  - Cisplatin analogs
- **Hypersensitivity**
  - Carboplatin (after 6-7 doses), oxaliplatin

Mesna

• Uroprotective Agent
  – Binds to acrolein (liver metabolite of ifosphamide & cyclophosphamide)
  – Prevents hemorrhagic cystitis
• Administered with:
  – Ifosphamide
  – High-dose Cyclophosphamide (e.g., hematopoietic stem cell transplant)
• May be administered oral or IV
• Usually administered in divided doses every four hours, up to 24 hours after last dose of chemotherapy

Nitrosureas

• Cell cycle non-specific
• Breaks DNA helix, interferes with DNA replication
• Cross blood-brain barrier
• Examples of Nitrosureas:
  – Carmustine (BiCNU)
  – Lomustine (CeeNU)
  – Streptozocin (Zanosar)

Nitrosureas Toxicities

• Hematopoietic
  – Delayed myelosuppression
  – Nadir 4-6 weeks after therapy starts
• GI
  – Severe nausea/vomiting

Antitumor Antibiotics

• Cell cycle non-specific (most agents)
• Binds with DNA, inhibits DNA & RNA synthesis
• Examples of antitumor antibiotics
  – Bleomycin (Blenoxane)
  – Daclomycin (Cosmegen)
  – Mitomycin (Mutamycin)
  – Mitoxantrone (Novantrone)
  – Anthracycline Antitumor antibiotics
    • Daunorubicin (Daunorubicin)
    • Daunorubicin liposomal
    • Doxorubicin (Adriamycin)
    • Doxorubicin liposomal (Doxil)
    • Epirubicin (Ellence)
    • Idarubicin (Idamycin)
Antitumor Antibiotics Toxicities

- **Hematopoietic**
  - Myelosuppression (all drugs except Bleomycin)

- **GI**
  - Nausea/vomiting
  - Stomatitis, mucositis

- **Reproductive**
  - Gonadal suppression

- **Integumentary**
  - Alopecia
  - Vesicants (except Bleomycin, and some liposomal anthracyclines)

- **Cardiotoxicity**
  - Anthracyclines (dose dependent)

- **Pulmonary fibrosis**
  - Bleomycin

**Cumulative Dose Limits Antitumor Antibiotics**

<table>
<thead>
<tr>
<th>Antitumor Antibiotic</th>
<th>Cumulative Dose Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleomycin</td>
<td>400 Units</td>
</tr>
<tr>
<td>Daunorubicin</td>
<td>550 mg/m² without cardiac risks; 400 mg/m² in adults receiving chest irradiation</td>
</tr>
<tr>
<td>Doxorubicin</td>
<td>550 mg/m² (450 mg/m² if prior chest irradiation or concomitant cyclophosphamide administration)</td>
</tr>
<tr>
<td>Epirubicin</td>
<td>900 mg/m²</td>
</tr>
<tr>
<td>Idarubicin</td>
<td>&gt; 150 mg/m² associated with decreased ejection fraction</td>
</tr>
</tbody>
</table>

**Dexrazoxane (Zinecard) Cardioprotectant**

- Iron-chelating agent, prevents formation of free radicals
- Administered IV during or prior to administration of doxorubicin
- Indicated in patients who have received > 300 mg/m² cumulative dose of doxorubicin

**Common Chemotherapy Agents**

<table>
<thead>
<tr>
<th>Class</th>
<th>Agent</th>
<th>Generic (Brand) Names</th>
<th>Toxicities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkylating Agents</td>
<td>Bleomycin (Blenoxane)</td>
<td>Daunorubicin (Daunomycin)</td>
<td>Hematopoietic</td>
</tr>
<tr>
<td>Nitrosoureas</td>
<td>Carmustine (BCNU)</td>
<td>Lomustine (CeeNu)</td>
<td>Hematopoietic (delayed)</td>
</tr>
<tr>
<td>Antitumor Antibiotics</td>
<td>Mitomycin (Mutamycin)</td>
<td>Bleomycin (Blenoxane)</td>
<td>Hematopoietic</td>
</tr>
<tr>
<td>Anthracycline Antitumor Antibiotics</td>
<td>Daunorubicin (Daunomycin)</td>
<td>Daunorubicin liposomal (Doxil)</td>
<td>Hematopoietic</td>
</tr>
<tr>
<td></td>
<td>Mitomycin (Mutamycin)</td>
<td>Doxorubicin (Adriamycin)</td>
<td>Hematopoietic</td>
</tr>
<tr>
<td></td>
<td>Etoposide (Eptosan)</td>
<td>Idarubicin (Idamycin)</td>
<td>Hematopoietic</td>
</tr>
</tbody>
</table>

Pharmacologic Classifications

Cell Cycle Non-specific
- Antimetabolites
- Plant Alkaloids (Mitotic inhibitors)
  - Vinca alkaloids
  - Taxanes
  - Epipodophyllotoxins (also Topoisomerase inhibitors)
- Camptothecins (Topoisomerase inhibitors)

Common Chemotherapy Agents

<table>
<thead>
<tr>
<th>Phase of Cell Cycle</th>
<th>Class</th>
<th>Common/ Generic (Brand) Names</th>
<th>Common Toxicities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Cycle Specific</td>
<td>Antimetabolites</td>
<td>Azacitidine (Vidaza)</td>
<td>Hematopoietic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capcitabine (Xeloda)</td>
<td>G1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cladribine (Leustatin)</td>
<td>Integumentary</td>
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<tr>
<td></td>
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<td>Cytarabine (Ara-C)</td>
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<td>Fluorouracil (5-FU)</td>
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<td>Methotrexate (Mexate)</td>
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<td>Gemcitabine (Gemzar)</td>
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<td>Vinblastine (Velban)</td>
<td>Hematopoietic</td>
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<td></td>
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<td>Vincristine (Oncovin)</td>
<td>G2</td>
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<td>Vinorelbine</td>
<td>Integumentary</td>
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<td>Etoposide (VP-16, VePesid)</td>
<td>Hematopoietic</td>
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<td>Teniposide (VM-26, Vumon)</td>
<td>Neurologic</td>
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<td></td>
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<td>Paclitaxel (Taxol)</td>
<td>Hematopoietic</td>
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<td>Paclitaxel protein-bound</td>
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<tr>
<td></td>
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<td>particles (Abraxane)</td>
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<td>Irinotecan (Camptosar)</td>
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<td>Topotecan (Hycamtin)</td>
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<td>Cabazitaxel (Jevtana)</td>
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<td></td>
<td>Docetaxel (Taxotere)</td>
<td>Reproductive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paclitaxel (Taxol)</td>
<td>Pulmonary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paclitaxel protein-bound</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>particles (Abraxane)</td>
<td></td>
</tr>
</tbody>
</table>

Antimetabolites

- Cell cycle specific (S Phase)
- Mimics & incorrectly substitutes for metabolites (nutrients) needed for cellular function (e.g. folate)

<table>
<thead>
<tr>
<th>Antimetabolite examples</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Azacitidine (Vidaza)</td>
<td>Fludarabine (Fludara)</td>
</tr>
<tr>
<td>Capecitabine (Xeloda)</td>
<td>Fluorouracil (5-FU)</td>
</tr>
<tr>
<td>Cladribine (Leustatin)</td>
<td>Gemcitabine (Gemzar)</td>
</tr>
<tr>
<td>Clofarabine (Oblar)</td>
<td>Methotrexate</td>
</tr>
<tr>
<td>Cytarabine (Ara-C)</td>
<td>Pemetrexed</td>
</tr>
<tr>
<td>Flouxuridine (FUDR)</td>
<td></td>
</tr>
</tbody>
</table>

Antimetabolites

Methotrexate

5FU

Antimetabolite Toxicities

- Hematopoietic
  - Myelosuppression
- GI
  - Nausea, vomiting
  - Mucositis/stomatitis
  - Diarrhea
- Integumentary
  - Capecitibine: “Hand/foot syndrome” (palmar-plantar erythrodynesthesia)
  - 5FU: photosensitivity
- Ocular toxicity
  - Cytarabine (Ara-C) high-dose: keratitis
  - 5FU: photosensitivity

Plant Alkaloids

- Vinca alkaloids
- Taxanes
- Epipodophylotoxins

Vinca Alkaloids

- Acts in late G2 & M phase
- Prevents formation of mitotic spindle (prevents cell mitosis)
- **Examples of Vinca Alkaloids**
  - Vinblastine
  - Vincristine
  - Vinorelbine

Vinca Alkaloid Toxicities

- Hematopoietic
  - Myelosuppression (except vincristine)
- GI
  - Nausea/vomiting (except vincristine)
- Integumentary
  - All are vesicants
  - Alopecia
- Neurotoxicity
  - Sensory-motor peripheral neuropathy
  - Constipation (autonomic neuropathy)
Epipodophyllotoxins

- Interferes with topoisomerase II enzyme reaction
- Induce irreversible blockade of cells in premitotic phases of cell cycle (late G2 & S phases)
- **Examples of Epipodophyllotoxins:**
  - Etoposide (VP-16, VePesid)
  - Teniposide (VM-26, Vumon)

Epipodophyllotoxin Toxicities

- Myelosuppression
- **GI**
  - Nausea/vomiting
  - Mucositis (high-dose etoposide)
  - Diarrhea (high-dose etoposide)
- **Cardiovascular**
  - Hypotension if infused too rapidly (etoposide)

Taxanes

- Inhibits cell division in G2 & M phase
- Promotes early microtubule assembly and prevents disassembling, arresting mitosis
- **Examples of Taxanes:**
  - Cabazitaxel (Jevtana)
  - Docetaxel (Taxotere)
  - Paclitaxel (Taxol)
  - Paclitaxel Protein-bound particles (Abraxane)

Taxane Toxicities

- **Hematopoietic**
  - Myelosuppression
- **GI**
  - Nausea/vomiting
- **Integumentary**
  - Alopecia
  - Vesicant potential (paclitaxel)
  - Irritant (docetaxel)
- **Neurologic**
  - Sensory-motor peripheral neuropathy
  - Arthralgia & myalgias
- **Hypersensitivity reactions**
  - Paclitaxel & docetaxel
Camptothecins

- Cell cycle phase specific
- Acts in S phase; inhibit topoisomerase I; cause double-strand DNA changes
- **Examples of Camptotecans**
  - Irinotecan (*Camptosar*)
  - Topetecan (*Hycamtin*)

Camptothecin Toxicities

- **Hematopoietic:**
  - Myelosuppression
- **GI:**
  - Early diarrhea
    - Cholinergic – reversed with atropine
  - Late diarrhea
- **Integumentary:**
  - Alopecia

### Common Chemotherapy Agents

<table>
<thead>
<tr>
<th>Phase of Cell Cycle</th>
<th>Class</th>
<th>Common Agent</th>
<th>Generic/Brand Names</th>
<th>Common Toxicities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Cycle Specific</td>
<td>Antimetabolites</td>
<td>Azacitidine (Vidaza)</td>
<td>Capetabine (Valrubicin)</td>
<td>Glutathione (Gulstatin)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vinca Alkaloids</td>
<td>Vinblastine (Velban)</td>
<td>Vinorelbine (Navelbine)</td>
<td>Vincristine (Oncovin)</td>
</tr>
</tbody>
</table>

### Hormonal Agents

**Glucocorticosteroids**
- Dexamethasone
  - Antiemetic
  - Prevention of cerebral edema with brain tumors
  - Management of severe pain associated with brain metastases, spinal cord compression and bone pain
  - Prevention of hypersensitivity reactions
  - Cancer treatment i.e. multiple myeloma

**Hypercorticism (Cushing’s syndrome), hyperthyroidism, hyperglycemia, and aggravation of diabetes mellitus in susceptible patients, gastrointestinal side effects, dermatologic effects, neurologic effects, mental disturbances**
**Hormone Therapy for Breast**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Drug</th>
<th>Mechanism of Action</th>
<th>Common / potential side effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective Estrogen Receptor Modulators</td>
<td>Tamoxifen (Nolvadex®)</td>
<td>Blocks estrogen receptors in breast cells</td>
<td>Menopausal symptoms, potential for blood clots &amp; endometrial cancer</td>
</tr>
<tr>
<td>Estrogen receptor antagonist</td>
<td>Fulvestrant (Faslodex®)</td>
<td>Blocks &amp; eliminates estrogen receptors</td>
<td>Weakness, mild nausea, hot flashes, back and joint pain, flu-like symptoms</td>
</tr>
<tr>
<td>Aromatase Inhibitors (not for use in premenopausal women)</td>
<td>Letrozole (Femara®), Anastrozole (Arimidex®) &amp; Exemestane (Aromasin®)</td>
<td>Blocks enzyme aromatase in fat tissue that makes small amounts of estrogen, not effective in stopping ovarian production of estrogen.</td>
<td>Muscle and joint pain, bone thinning, menopausal symptoms</td>
</tr>
</tbody>
</table>

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**Hormone Therapy for Prostate**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Drug</th>
<th>Mechanism of Action</th>
<th>Common / potential side effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luteinizing hormone-releasing hormone agonists (LHRH)</td>
<td>Leuprolide depot (Leupron)</td>
<td>Causes decreased secretion of LH and FSH from the pituitary resulting in castration levels of testosterone</td>
<td>Hot flashes, decreased libido, impotence, gynecomastia, tumor flare, discomfort at injection site</td>
</tr>
<tr>
<td>Non-steroidal anti-androgen agents</td>
<td>Flutamide (Eulexin®)</td>
<td>Binds to androgen receptors and inhibits androgen uptake</td>
<td>Hot flashes, decreased libido, gynecomastia, visual disturbances, potential for interstitial pneumonitis</td>
</tr>
</tbody>
</table>

Chu & DeVita, 2014

**Verification of Dose Calculation**

- Requires complete prescriber order
  - Height, weight, BSA or AUC, & total calculated dose
- Two chemotherapy-competent individuals (nurse and/or pharmacist), in addition to prescriber, independently double-check dosage calculations


**Hazardous Drug Safe Handling**

Drugs defined as hazardous if they exhibit one or more of the following characteristics:

a. Carcinogenicity
b. Tetratogenicity or developmental toxicity
c. Reproductive toxicity
d. Organ toxicity at low doses
e. Genotoxicity
Principles of Safe Handling

- Personal protective equipment
- Preparation in biologic safety cabinet with vertical laminar airflow
- Label as hazardous drugs
- Safe techniques during storage, transport, administration

Personal Protective Equipment

- **Gloves:** 2 pair, meet testing standards for hazardous drugs
- **Gown:** disposable, long sleeve, tight cuffs, back closure
- **Eye & face protection:** worn whenever splashing possible
- **Respirators:** NIOSH approved, worn for clean-up of HD spills

Central Venous Catheters

- For all chemotherapy administration:
  - Verify catheter placement and function by x-ray or fluoroscopic dye study prior to initial use
  - Check for blood return by aspiration
  - DO NOT administer cytotoxic agents in the absence of blood return
  - If no blood return:
    - Attempt to flush with normal saline, and gently pull back
    - Reposition patient
    - Ask patient to cough, and take a deep breath
    - Obtain order for declotting procedure, and follow institutional policy
    - Use x-ray or dye study to confirm proper placement and to rule out catheter malfunction or migration in absence of blood return

Peripheral Venous Access

- Avoid ventral surface of wrist
- Use nondominant arm whenever possible
- Avoid areas of flexion
- Avoid using lower extremities
- Avoid using arms of patients who have had axillary lymph node dissection
- Avoid using an established IV site that is more than 24 hours old, whenever possible
- Use smallest catheter possible
Vesicant Chemotherapy IV Administration

- **Via peripheral IV site**
  - Avoid using IV pump or syringe pump to minimize pressure on the vein
  - Remain with the patient during the entire infusion
  - Limit administration to no longer than 30-60 minutes
  - Verify blood return:
    - IV push: every 2-5 ml
    - IV Minibag: every 5 – 10 minutes during short infusion
- **Via central venous catheter**
  - Monitor IV site & verify blood return before, during, & after per institutional policy


Exam Question Examples

Which of the following chemotherapy medications is a vesicant?

a. Topotecan
b. Dacarbazine
c. Melphalan
d. Doxorubicin

Exam Question Examples

Prior to the fourth dose of high-dose cisplatin, a patient reports that he has trouble manipulating his silverware and toothbrush. The nurse’s best initial response is to:

a. Reassure the patient that these problems are temporary side effects of chemotherapy
b. Document the findings and report them to the physician
c. Instruct the patient to seek assistance with meals and oral hygiene
d. Arrange for an occupational therapy consultation

Exam Question Examples

A nursing assistant obtained a height that is two inches less than the information on the physician’s order form. What action does the nurse administering chemotherapy take?

a. Measure and verify height
b. Call the physician with the new height
c. Proceed with the order as written
d. Validate the order with the pharmacist
Exam Question Examples

Which of the following chemotherapy agents is least likely to cause constipation?

a. Vinorelbine  
b. Vincristine  
c. Vinblastine  
d. Carmustine

Surgery in Cancer Therapy

Role of Cancer Surgery

- Establish tissue diagnosis  
- Determine stage of disease  
- Treat disease  
- Place access devices  
- Assess responses to treatment  
- Reconstructive

Establishing Tissue Diagnosis

- Tumor sample obtained to confirm diagnosis and to determine specific type of cancer (histology)  
- Variety of biopsy techniques available  
  - Provide sufficient tissue for pathologic and histologic diagnosis
Biopsy Techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Needle Biopsy</strong></td>
<td></td>
</tr>
<tr>
<td>• Radiologic guidance</td>
<td>Use of live computed tomography to view nonpalpable mass and guide needed to site (e.g. lung nodule, breast nodule, adrenal nodule)</td>
</tr>
<tr>
<td>• Ultrasound guidance</td>
<td>Use of ultrasound to view area of palpable tumor and guide needle to desired biopsy site (e.g. muscle tumor, breast mass)</td>
</tr>
<tr>
<td>• Fine needle aspiration</td>
<td>Use of needle &amp; syringe to aspirate cells from palpable cyst or mass (e.g. SQ nodule, fluid-filled cyst)</td>
</tr>
<tr>
<td>• Cutting-core needle biopsy</td>
<td>Use of large, open-bore needle to retrieve a small piece of intact tumor tissue (e.g. muscle mass, liver nodule)</td>
</tr>
<tr>
<td><strong>Incisional Biopsy</strong></td>
<td>Surgical removal of a portion of a tumor for pathologic diagnosis. Usually used on larger masses (e.g. SQ, muscle, abdominal tumor). May be achieved by surgical incision via bronchoscopy, colonoscopy, laparoscope, thoroscope</td>
</tr>
<tr>
<td><strong>Excisional Biopsy</strong></td>
<td>Surgical removal of entire mass or lesion with adequate margins for diagnosis (e.g. skin lesions, breast mass, mets of primary tumor to lung). Usually used on discrete masses 2-3 cm in diameter.</td>
</tr>
</tbody>
</table>


Surgery to Treat Disease

• **Primary Treatment**
  – Removal of malignant tumor and a margin of adjacent normal tissues
  – Surgical techniques used that
    • Decrease the local and systemic spread of cancer and
    • Minimize the functional and cosmetic impact

• **Adjuvant Treatment**
  – Removal of tissue to decrease risk of cancer incidence, progression, or recurrence
  • **Prophylactic surgery:** removal of tissue at risk of developing cancer (removal of colon polyps to prevent colon cancer or prophylactic mastectomy)
  • **Cytoreductive therapy:** removal of tumor volume to improve effect of other cancer treatment modalities (e.g. ovarian cancer)

Surgery to Treat Disease

• **Salvage Therapy:** Surgery after local recurrence
  – Extensive surgical approach to treat local recurrence after the use of a less extensive primary approach
  – E.g.: recurrence of breast cancer after lumpectomy and radiation therapy → mastectomy as salvage therapy

• **Palliative Therapy:** Promote comfort & QOL without goal of curing disease
  – Bone stabilization
  – Relief of obstruction
  – Therapy for oncologic emergencies
  – Management of cancer pain

• **Combination Treatment:** Surgery combined with chemotherapy, radiation, biotherapy or targeted therapies

Role of Nursing & Surgical Team

• Expert assessment
• Psychosocial support
• Education
• Symptom management
• Prevention of complications
Sample Question

The purpose of an excisional biopsy is to:

A. Establish tissue diagnosis and provide definitive treatment
B. Establish tissue diagnosis and determine surgical stage of disease
C. Establish tissue diagnosis and perform prophylactic surgery
D. Establish tissue diagnosis only

Sample Question

Surgery alone with a goal of cure is the cancer treatment of choice in which of the following situations?

a. The patient & family prefer this treatment
b. The cancer responds equally well to all modalities
c. The cancer is localized & metastases are unlikely
d. The patient had previous cancer surgery

Review of Surgical Issues in Selected Cancers

  - Lung Cancer
  - Colorectal Cancer
  - Prostate Cancer
  - Breast Cancer
Sample Question

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a. The patient & family prefer this treatment  
b. The cancer responds equally well to all modalities  
c. **The cancer is localized & metastases are unlikely**  
d. The patient had previous cancer surgery

Sample Question

What is the name of the adjuvant surgical treatment used to reduce tumor volume to improve the effect of other cancer treatment modalities?

a. Prophylactic surgery  
b. Cytoreductive surgery  
c. Palliative surgery  
d. Salvage surgery

Sample Question

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b. Cytoreductive surgery  
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d. Salvage surgery

Sample Question

A 45-year-old client with a history of moderate ulcerative colitis for over 12 years is scheduled for a total colectomy with ileostomy creation. The surgeon described this surgery as a “prophylactic” cancer surgery which is defined as:

A. The reconstruction of anatomic defects created by cancer surgery to improve function and cosmetic appearance.  
B. Surgery performed on an organ that has an extremely high risk of developing cancer  
C. The insertion of various therapeutic hardware during active treatment periods to facilitate the delivery of treatment and increase client comfort.  
D. The removal of hormonal influence of cancer
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