Treatment Modalities

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Objectives
Review OCN Test Content Outline
Discuss Treatment Modalities
- Surgery
- Radiation Therapy
- Chemotherapy
- Biotherapy
- Targeted Therapies
- Blood and Bone Marrow Transplantation

2017 OCN Test Blueprint Content Areas

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Percentage of 2017 Test</th>
<th># of Scored Questions*</th>
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<tbody>
<tr>
<td>Health Promotion, Screening &amp; Early Detection</td>
<td>6%</td>
<td>9</td>
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<tr>
<td>Scientific Basis for Practice</td>
<td>9%</td>
<td>13</td>
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<tr>
<td>Treatment Modalities</td>
<td>16%</td>
<td>23</td>
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<td>Symptom Management</td>
<td>22%</td>
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<td>Psychosocial Dimensions of Care</td>
<td>8%</td>
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<td>Palliative &amp; End of Life Care</td>
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<td>16</td>
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<tr>
<td>Professional Performance</td>
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*To determine the number of scored items from each subject area, multiply the percentage by 145.

Surgery

Oldest and most investigated therapy for cancer
Remains the single most effective single modality used to treat and cure cancer
Varied roles of cancer-related surgery
- Diagnostic
- Curative
- Preventative
- Palliative
- Rehabilitation or reconstructive
- Treatment access
- Treatment of oncologic emergencies
- Intraoperative chemotherapy

Surgical Roles - Diagnostic

Diagnostic: Obtain tissue for diagnosis and staging
- Biopsy
  - Needle (often utilizes radiologic or ultrasonographic guidance)
  - Core needle aspiration
  - Excision (requires surgical removal)
  - Incisional biopsy - remove a portion of the mass
  - Excisional biopsy - remove the entire mass

Surgical Roles

Preventive – to reduce the risk of cancer developing in high-risk patients
- Bilateral mastectomy for BRCA mutations
Curative – to remove entire tumor with negative margins
Palliative – to enhance comfort, not cure
- Cytoreduction - remove bulk of disease
- Decompression/diversion
- Stent placement
- Colostomy

Surgical Roles

Rehabilitation or reconstruction – improve the function and appearance of a surgical site
- Breast reconstruction
Treatment access
- Intravascular catheter placement
Treatment of oncologic emergencies
- To relieve spinal cord compression, cardiac tamponade
Surgery Techniques

- **Local excision** – removal of cancer and small margin of surrounding tissue
- **Wide excision** – removal of cancer and some adjacent tissue and lymph nodes
- **En bloc resection** – removal of bulky cancer with contiguous tissues
- **Debulking** – remove significant part of tumor
  - Decrease overall tumor burden
  - Greater chemosensitivity of remaining tumor

**Adjuncts to surgical resection**
- **Ablation** – use of thermal energy to destroy tumor
  - Cryosurgery
  - Radiofrequency ablation
  - Laser
- **Cryoablation** – liquid Nitrogen destroy malignant tissue & provide local control
- **Control of metastatic liver disease**

Surgical Approaches

- **Traditional open approach** – large incision to completely expose target organs and other structures
- **Minimally invasive approaches**
  - Laparoscopic
  - Robotic
  - Natural orifice transluminal endoscopic surgery (NOTES)
  - Percutaneous

Pre-operative Considerations

- **Patient history**
  - Allergies, current medications
  - Previous surgeries
  - Current medications
- **Physical examination**
  - Cardiovascular, Pulmonary
  - Hematologic
  - GU
  - Endocrine
  - Integumentary
- **Psychosocial evaluation**
  - Stress/coping mechanisms
  - Caregiver access and readiness

Safety Measures

- **General safety interventions**
  - Informed consent
  - Surgical safety checklist
  - Asepsis
  - Patient positioning
  - Electrical safety
  - Equipment availability

- **Sign in – Time out – Sign out**
Post-operative considerations

- Hemodynamic & cardiopulmonary stability
- Pain management
- Pulmonary toilet
- Venous thromboembolism
- Wound healing
- Nutrition
- Bowel function
- Tubes & drains
- Patient/caregiver education

Discharge Planning

- Psychosocial options
  - Safe discharge destination
  - Caregivers
- Level of care options
  - Durable medical equipment
  - Care supplies
- Insurance limitations
- Rehabilitation needs

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
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

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

References


Radiation therapy
Radiation Therapy

More than 60% of patients with cancer will receive radiation therapy

Ionizing radiation – a form of energy when used in a controlled way to destroy cancer

Forms of ionizing radiation
- Electromagnetic – energy waves
  - (x-rays, gamma rays)
- Particulate - subatomic particles
  - Electrons, protons, neutrons, alpha/beta particles

Radiation Therapy

Radiobiology
- Physical, chemical and biologic changes

Cellular targets
- DNA most important target
  - Double strand breaks
  - Creates free radicals

Biologic response affected by
- Oxygen effect
- Tumor cell sensitivity

Radiation Therapy

Normal tissue and tumor are both affected by ionizing radiation

Biologic effect of fractionation on tumors depend on
- Repair
- Redistribution
- Repopulation
- Reoxygenation

Radiation Therapy

Radiosensitivity
- All cells are vulnerable
- Cells will vary in sensitivity
  - Rapidly dividing will be most sensitive or radiosensitive
  - Non-dividing or slowly dividing less sensitive or radioresistant
Radiation Therapy

Principles behind radiation therapy
- Deliver dose high enough to destroy tumor while not exceeding tolerance of normal tissue
- Side effects generally the result of the effect of RT on normal tissue

Side effects
- Early side effects—occur during RT or immediately after
  - Acute responding tissue
    - Rapidly dividing cells affected first
- Subacute responding tissue—weeks to months after RT
- Late responding tissue—months to years after RT
- Combined treatment modality
  - Increases risk of late effects on normal tissue

Tissue response to fractionation
- External beam—total dose tolerated by tissues and the RT field is prescribed and fractionated
  - High dose per fractionation + large total dose + increased severity of side effects
- Radioactive source therapy—total dose tolerated by the tissues is prescribed
  - May be given over several days - continuous
    - In single or several doses - over several minutes

Clinical uses for radiation therapy
- Cure
- Definitive treatment
- Neoadjuvant treatment
- Advanced treatment
- Prophylaxis
- Control
- Palliation
### Radiation Therapy

#### Methods of delivery
- **Local treatment**
  - External beam
  - Inner applicator (need with x-rays, electrons or both)
  - Cobalt-60 – gamma rays
- **Radioactive source**
  - Brachytherapy
  - Beta particles and gamma rays
  - Sealed source
- **Systemic therapy**
  - Radioactive source
  - Radiopharmaceuticals

#### Technologic advances
- Allow more precise planning and delivery of external beam radiation therapy
- Intensity modulated RT
- Image guided RT
- Allows difficult tumors to be treated
- Minimizes dose administered to healthy tissue
- Cyber knife
- Proton therapy

### Radiation Therapy

#### Internal radiation therapy – radioactive source therapy
- Brachytherapy – sealed sources
  - Seeds, ribbons, plaques, or rods
  - Place close to the tumor
- Radiation dose emitted
  - Low dose rate
  - High dose rate

#### Treatment techniques
- Interstitial – placement of seeds
- Intracavitary – rigid applicator next to the tumor
- Intraluminal – seeds in a lumen
- Superficial – plaque or mold on a body surface
Can effectively deliver a high dose of radiation to the tumor while sparing surrounding normal tissue
Radiation Therapy

Radiopharmaceutical therapy
- Unsealed sources
  - Ingested, injected, or instilled into a body cavity
  - Characteristics that determine where they will concentrate
  - Conjugated to monoclonal antibodies

Radiation Therapy

Radiation safety and protection
- Dose limitation – dose limits applied to all individuals
  - ALARA (as low as reasonably achievable)
  - Should be continual monitored and controlled
- Radiation monitoring
  - Film badge – read and exchanged monthly
  - Dosimeter – x-ray, beta, gamma
  - Survey meters – Geiger counter

Radiation Therapy

Radiation safety
- Essential considerations
  - Time
  - Distance
  - Shielding

Radiation Therapy

Nursing implications
- Assessment
- Education
- Symptom management
- Emotional support/counseling
- Physical care
- Coordination of care
Sample Question
Which of the following are identified as acute responding tissues for radiation therapy:
A. Testis, small bowel, and thyroid
B. Oral mucosa, vagina, and larynx
C. Salivary gland, liver, and lymph vessels
D. Bone marrow, ovaries, and uterus

Sample Question
Which of the following is most accurate? Radiation therapy (RT) involves
A. electromagnetic radiation in the form of energy waves; examples include protons, x-rays, and gamma rays.
B. particulate radiation in the form of subatomic particles; examples include electrons, alpha particles, and photons
C. ionizing radiation in the form of x-rays, gamma rays, protons, and cosmic radiation.
D. the ionizing radiation interacting with the atoms and molecules of the tumor cells, especially RNA.

Sample Question
Mr. B is scheduled to undergo external beam radiotherapy to his lumbar spine for his metastatic prostate cancer. During the initial nursing assessment, his nurse notes that his baseline hemoglobin (Hgb) is 10 g/dL. The treatment plan includes evaluation of his energy level weekly because
A. external beam radiation to any field involving the bone marrow will decrease the baseline hemoglobin by half within 1 week.
B. Mr. B will likely be nauseated from his therapy and be unable to maintain an iron-rich diet.
C. hematuria commonly occurs after this type of radiation therapy, resulting in an increase in his anemia.
D. the standard of care during radiation therapy includes a weekly physical assessment to optimally manage all possible side effects of the therapy or underlying disease.

Sample Question
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Chemotherapy

An integral component of systemic therapy
Role in cancer care
- Cure
- Control
- Palliation
First used to treat cancer in the 1500s
Systemic therapies: distributed throughout the body by the bloodstream

Based on concepts of
- Cellular kinetics
  - Cell cycle
  - Phase
  - Growth kinetics
  - Tumor burden

The Cell Cycle

- 5-stage cellular reproduction process
- Cycle occurs in all cells.
- Cycle phase times differ per cell.
  - Gap 0 (G0) = resting phase
  - Gap 1 (G1) = post-mitotic
  - Synthesis (S) = DNA synthesis occurs
  - Gap 2 (G2) = pre-mitotic
  - Mitosis (M)
    - Prophase
    - Metaphase
    - Anaphase
    - Telophase

References

Chemotherapy

Key terms:
- Cell cycle time – amount of time required for a cell to move from one mitosis to the next
- Growth fraction – percentage of cell actively dividing at a given point in time
- Tumor burden – volume of cancer present
- Mitosis – nuclear division and cytokinesis, where there is cytoplasmic division

Approaches to Chemotherapy

Single agent
- Commonly used in recurrence

Combination chemotherapy
- Increase # of cells exposed
- Decrease drug resistance
- Effective in large tumors

Regional chemotherapy
- Delivering dose of chemotherapy to specific site
- Example: peritoneal cavity
- Decreases intensity of systemic toxicity

High-dose chemotherapy
- Administered with supportive therapy
- Example: high-dose methotrexate with leucovorin rescue

Factors that influence response

Characteristics of the tumor
- Size or tumor burden
- Growth rate/fraction

Genotype

Characteristics of the patient
- Physical status
- Performance status
- Age
- Comorbidities
Chemotherapy Treatment

- Administration or schedule:
  - Combination vs single agent
  - Dose density
  - Dose intensity

- Routes of administration:
  - Oral
  - Intravenous
  - Intraperitoneal
  - Intra-arterial
  - Intrathecal
  - Intraperitoneal

Classification of Antineoplastic Agents

- Classified according to:
  - Phase of action during the cell cycle
    - Cell cycle specific
      - Major effects on cells actively dividing
      - Schedule dependent
      - Usually not effective when the cell is in resting phase (G0)
    - Cell cycle non-specific
      - Major effects on cells at any phase including G0
      - Dose dependent
      - Mechanism of action, biochemical structure or physiological action

Alkylating agents

- Interfere with DNA replication
- Most agents cell cycle non-specific

Major toxicities

- Dose dependent
- Hematopoietic, GI/GU, Neurological, Reproductive systems, secondary malignancy

Agents

- Cyclophosphamide, Platin, Busulfan, Ifosfamide

Antimetabolites

- Inhibit protein synthesis
- Most agents cell cycle specific (S phase)

Major toxicities

- Hematopoietic, GI

Agents

- Azacitadine, Cytosarben, Fludarabine, 5FU, Gemcitabine, Methotrexate
Classification of Antineoplastic Agents

Antitumor antibiotics/anthracyclines
- Inhibit DNA and RNA synthesis
- Most agents cell cycle non-specific
- Topoisomerase II

Major toxicities
- Hematopoietic, GI, Organ, cutaneous, Cardiac

Agents
- Bleomycin, Doxorubicin, Mitoxantrone
- Rubios family (Doxorubicin, Idarubicin, Daunorubicin, Epirubicin)

Major toxicities
- Hematopoietic, GI, Neurologic

Agents
- Arsenic trioxide, Asparaginase, Ixabepilone

Miscellaneous agents
- Mechanism of action poorly understood
- Most agents cell cycle non-specific

Major toxicities
- Hematopoietic, GI

Agents
- Carmustine, Lomustine

Nitrosoureas
- Interfere with DNA replication
- Cross the blood brain barrier
- Long nadir 4-6 weeks

Major toxicities
- Hematopoietic, GI

Agents
- Carmustine, Lomustine

Topoisomerase targeting agents
- Topoisomerase I
  - Prevents DNA realignment
- Cell cycle specific

Major toxicities
- Hematopoietic, GI

Agents
- Camptosar
Classification of Antineoplastic Agents

Plant Alkaloids
- Variety of mechanisms
  - Topoisomerase II inhibitors, spindle poisons
  - Cell cycle specific

Major Toxicities
- Hematopoietic, Neurotoxicity, Hypersensitivity

Agents
- Epothilones – Etoposide
- Taxanes – Docetaxel, Paclitaxel
- Plant alkaloids – Vinblastine, Vincristine

Safe Handling

Many drugs considered hazardous
- Carcinogenic, teratogenic, genotoxic

Potential risks for exposure
- Increased risk for malignancies, embryofetal toxicities, chromosomal damage

Routes of exposure
- Absorption, Inhalation, Ingestion, Injection

Mixing/compounding
- Guidelines and recommendations
  - ONS, OSHA, ASHP, NIOSH
  - All preparations should take place in a primary engineering control (PEC) setting
  - Use of closed system transfer devices
  - Double gloving
  - Luer-lock fittings

Chemotherapy Administration

Review orders
- References, drug protocol
- Regimen specific, pre-printed electronic
- Verbal orders not allowed
- Complete orders

Determine drug dose
- Actual height and weight
- BSA, AUC
Chemotherapy Administration

- Review drugs
  - Potential side effects
- Current laboratory values
- Informed consent
- Patient assessment
  - Previous experience
  - Toxicties
  - Patient/family education

Chemotherapy Administration

- Double verification
  - Order, dose calculation, lab values
- PPE
  - Gloves, gowns
  - Respirators – NIOSH approved
  - Eye and face protection
- Peripheral IVs
  - Distal then proximal
  - Condition of veins
  - Avoid sites where damage to tendons or nerves is possible

Chemotherapy Administration

- Just prior to administration verify
  - Order, drugs, routes and sequence
- Monitor sites for
  - Blood return
  - Infiltration
- Administer pre-chemo medications
- Administer chemotherapy
  - 5 Rights

Immediate complications

- Extravasation
  - Irritants – local inflammatory reaction
  - Vesicants – potential to cause cellular damage/tissue destruction
- Prevention is key
  - Observe infusion site for
    - Pain, swelling, loss of blood return
    - Instruct patient to report pain, burning
    - Use larger veins
    - Administer medication
      - Every 3 ml for IV push
      - Every 5 min for IVPB
Immediate complications
If extravasation suspected
- STOP infusion
- Aspirate
- Remove IV
- Assess

Treatment
- For most medications
- Non-pharmacologic treatment
  - Cool area
  - Administer antihistamines
  - Hydrocortisone cream
  - Benzocaine
- Ruborn family – Enzyme
- Vincill (bleomycin) – Hypertensin

Sample Question
A patient receiving paclitaxel develops urticarial and pruritus above the site of the intravenous catheter. The nurse’s initial action would be to:

a. Administer diphenhydramine
b. Obtain vital signs and monitor the patient
c. Administer hydrocortisone cream to the affected area
d. Stop the paclitaxel infusion

Sample Question
While administering vinorelbine tartrate into a peripheral IV, the nurse notes redness along the vein proximal to the site. The patient denies discomfort, but states the area above the site is "itchy." The patient is likely experiencing:

A. Flare
B. Extravasation
C. Radiation recall
D. Psychosomatic response

References
Biotherapy and Targeted Therapy

Biotherapy – helps the immune system fight cancer

GOAL
- Enhance the body’s natural defense and its ability to fight cancer
- Stop or slow the growth of cancer cells
- Train the immune system to destroy cancer cells
- Prevent cancer from spreading to other parts of the body

Biotherapy & targeted therapy

Immune system - two basic types of defense mechanisms
- Natural immunity - first line of defense, non-specific response
- Adaptive immunity - recognizes invaders, remembers what they look like

Immune system cells
- Lymphocytes
  - T cells - directly attack foreign cells
  - B cells - secrete antibodies
- Natural killer (NK)
- Monocytes – White blood cells
  - Macrophages - engulf and digest invaders
Biotherapy and Targeted Therapy

Cytokines
- Messengers of the immune system
- Upregulate (increase response to a stimulus) or downregulate (reduce or suppress a response to a stimulus) other molecules of the immune system in response to physiologic or pathologic events in the body
- Regulate cells involved in innate (naturally present) and acquired (not present at birth) immunity

Agents
- Interleukins, interferons
- Colony stimulating factors

Hematopoietic growth factors
- Natural occurring proteins
- Hematopoietic stem cells
- GM-CSF - Neupogen, neulasta
- GM-CSF multi lineage growth factor - Leukine
- Erythropoietin - regulator of erythropoiesis
- Epogen, Procrit, Darbopoetin

Interferons
- Proteins produced by the human body in response to pathologic or physiologic events
- Secretes substance that interferes with viral replication

5 different types
- Alpha, beta, gamma, omega, tau
- Alpha – most application in cancer therapy
- Interferons are produced by the body in response to viral, bacterial, fungal, or parasitic infections

Interleukins (Il)
- Endogenous proteins that stimulate and interact with multiple immune system molecules
- Responsible for signaling and communication among cells of the immune system
- Immune response must already be mounted by T cells in order for Il-2 to respond

Agents
- Il-2 – renal cell carcinoma
Monoclonal antibodies
- Target the extracellular receptors
- Overexpressed or mutated
- Two groups:
  - Unconjugated – naked work by themselves
  - Conjugated – attached to something else
- Chemotherapy, radionuclide particle, toxin

Monoclonal antibody types
Dependent on amount of mouse antibody

Rituximab – CD20 antigen on surface of B lymphocytes
- B-cell lymphoma, ALL, CLL
- Breast cancer
- Bevacizumab – VEGF
- Metastatic colorectal cancer, renal cell cancer
- Panitumumab – EGFR
- Metastatic colorectal cancer

Small molecule – Tyrosine Kinase Inhibitors
- Block receptor binding sites intracellularly
- Interact at the ATP binding site to prevent cellular instructions to specific pathways
- Numerous signaling pathways (Multi-targeted)
- Administered orally
- Many metabolized by cytochrome P450
Biotherapy and Targeted Therapy

**Proteasome inhibitors**
- Enzymes that breakdown proteins no longer needed
  - Bortezomib

**Immunomodulatory agents**
- Regulate/modify the immune system
  - Antiangiogenic properties
  - Thalidomide, Lenalidomide

**Adverse events of targeted therapies**
- Drug-drug and food interactions
- Most oral medications metabolized by the liver (CYP450)
- Infusion reactions
  - Usually seen with the first 1-2 infusions
  - Cardiac Toxicity
    - Arrhythmia, decreased LVEF, prolonged QTc

**Vaccines**
- Condition immune system

**Types of vaccines**
- **Preventive** — Recombivax, Gardasil
- **Whole Cell**
- **Peptide**
- **Dendritic** — sipuleucel-T (Provenge)
- **Vector-based**
- **Heat shock proteins**
- **DNA & RNA**
- **Oncolytic** — Imlygic

**Adverse events of targeted therapy**
- **Diarrhea**
- **Metabolic disorders** — hypomagnesemia, hypercholesterolemia, hyperglycemia, hypothyroidism
- **Dermatologic reactions** — rash
Biotherapy and Targeted Therapy

Adverse events of targeted therapy
- GI perforation
- Renal failure, nephrotic
- Venous thromboembolism
- Wound healing
- Capillary leak syndrome
- Stomatitis
- Erythema

Nursing implications
- Assessment
  - History
  - Medications
  - Diagnostics
    - MUGA, lab work, ECG
  - Psychosocial
    - Coping, support
    - Ability to perform self care, adherence
  - Social
  - Financial status

Patient education
- Treatment plan
- Medications
  - Schedule
  - Side effects and management

Sample Question
Which of the following therapies is targeted toward the epidermal growth factor receptor?
A. Bortezomib
B. Bevacizumab
C. Cetuximab
D. Gemtuzumab
Sample Question

Rituximab is a monoclonal antibody used to treat patients with non-Hodgkin’s lymphoma. During the initial infusion a patient begins to shake and complains of feeling very cold. The first nursing intervention is:

a. Stop the infusion, start oxygen therapy, and notify the physician.
b. Stop the infusion, administer diphenhydramine, if ordered
c. Slow the infusion to 50% of the previous rate until symptoms have resolved, because the reactions are related to the infusion rate.
d. Monitor the patient for cardiac arrhythmias

References


Blood and Marrow Transplantation

Hematopoietic stem cell transplantation (HSCT) infusion of healthy stem cells in someone whose stem cells have been destroyed or are diseased.
In patients with cancer HSCT allows
  ♦ Administration of high-dose chemotherapy or radiation therapy
Transplant Terminology

- Related – donor is related to the recipient
- Unrelated – donor is not related to the recipient

HLA typing
Myeloablative therapy
Nonmyeloablative transplant

How Stem Cells Are Obtained

- Peripheral blood (PBSC)
- Umbilical cord blood (UCB)
- Bone marrow harvest

Major types of HSCT

**Autologous**
- Patients own bone marrow or peripheral blood stem cells (PBSCs)
- In older patients > 50 may be more desirable
- Treatment of Multiple Myeloma and lymphoma
- PBSC most commonly used
- Benefits – Minimal risk of GVHD
- Risks – potential for relapse

**Allogeneic**
- Bone marrow or PBSC from healthy related or unrelated donor
- Umbilical cord blood (UCB)
- Benefits – no disease contamination
- Related donor/UCB – decreased risk of GVHD
- Shorter period to engraftment
- Most commonly used for
  - AML, ALL, MDS, and NHL
Major types of HSCT

Allogeneic - Unrelated donor
- Benefits: no disease contamination
  - Shorter period to engraftment (PBSC)
  - Increased risk of GVHD
- Most commonly used for
  - AML, ALL, MDS, and NHL

Syngeneic
- A subtype of Allogeneic transplant
  - Bone marrow or PBSCs from identical twin
- Benefits: immunosuppression not needed
- Risks: no graft versus tumor effect (GVT)
  - Potential to transmit genetic defects

Stages of Transplantation

Pretransplant evaluation/donor matching
Mobilization/collection of stem cells
Conditioning
Engraftment

Pre-transplant Phase

Pre-transplant evaluation
- Patient factors
  - Medical history
- Prediagnostic studies
  - Lab work
  - Diagnostic studies - MUGA, PFTs
- Psychosocial evaluation
  - Decision to proceed with transplant
  - Understanding of involved
  - Coping mechanisms
Donor Matching (Allogeneic)

HLA Compatibility
- Medical evaluation of donor
  - CMV status
  - ABO compatibility
  - Age
  - Weight
  - Sex
  - Race

Mobilization

Increasing number of stem cells in peripheral blood
- G-CSF or GM-CSF
- Combination of chemotherapy and growth factors
- Goal is WBC count of 20,000

Collection of Stem Cells

Central vascular catheter placed
- Apheresis
- Umbilical cord blood
  - Cells harvested from UBC and placenta immediately following birth

Cell Processing and Storage

Quantifying # of CD34+ cells
- Minimum of 2.5 x 10^6 required for
  - Testing for
    - Tumor cells
    - Contaminants
    - Mononuclear cell counts
    - Viability of cells
  - Cryopreservation
### Conditioning

Treatment given prior to transplant to:
- Eradicate the disease
- Suppress bone marrow function
- Provide immunosuppression to prevent rejection

Includes chemotherapy and/or radiation therapy.

Conditioning regimens range from two to eight days prior to transplant.

### Intra-transplant Phase

Pre-medications:
- Diphenhydramine
- Acetaminophen
- Corticosteroids
- Antiemetics

Verification of product

Cell preparation

### Infusion of Cells

**Autologous transplants**
- Thawed cells may be drawn up in large syringes and given via IVP
- Cells may be hung and infused over a specified period of time

**Allogeneic transplants**
- Procedure resembles PRBC transfusions
- Unfiltered tubing must be used.

### Patient Safety Measures

- Emergency equipment at bedside
- Physician present during procedure
Post-transplant Phase
- Acute complications – occur within the first 100 days
- Chronic complications – occur after 100 days
- Neutropenic period – 1-4 weeks
- Time to engraftment – 2-4 weeks
- First signs WBC production

Prevention of Infection
- G-CSF
- Anti-infective agents
- Environmental interventions
- No visitors with respiratory symptoms
- Assessment for infection

Conditioning complications
- Nausea and vomiting
  - Antiemetics, distraction, relaxations, dietary modifications
- Pancytopenia
  - Blood products and anti-infective agents
- Mucositis
  - Oral care, pain management, nutritional support

Acute Graft-Versus-Host Disease
- Identify patient as risk
- Assessment and management of target organ involvement
  - Skin
  - GI tract
  - Liver
- Immunosuppressive agents
Chronic Graft-Versus-Host Disease

- Occurs 3-24 months after transplant
- May involve skin, liver, eyes, mouth, upper respiratory tract, and esophagus
- Erythematous skin rash is hallmark
- Cyclosporine and corticosteroids

Graft Failure

- Donor cell fail to regenerate in the bone marrow
- Use of growth factors
- Further treatment with second transplant

Survivor Issues

- Symptom surveillance for complications related to immune impairment and organ toxicities
- Education related to healthful lifestyle and behaviors

References

Exam Question Examples

The purpose of the “mobilization” regimen in the hematopoietic stem cell transplantation process is to:
A. Prevent graft-versus-host disease (GVHD)
B. Eradicate malignant cells and prevent graft rejection
C. Reduce the adverse effects of HSCT
D. Mobilize hematopoietic stem cells from the bone marrow to the peripheral blood.

Sample Question
Which patient is most likely to experience graft-versus-host disease?

a. 35-year-old who received an autologous hematopoietic stem cell transplant
b. 60-year-old who received an allogeneic transplant from an unrelated donor
c. 20-year-old who received a tandem autologous transplant
d. 45-year-old who received a syngeneic hematopoietic stem cell transplant

Example Exam Question
Mr. O. has just been given the diagnosis of Aplastic Anemia. His family members are human leukocyte antigen (HLA) typed for a possible match for a transplant. Unfortunately, there is no match. Mr. O. asks his physician if he could be considered for an autologous HSCT. The physician explains that an autologous transplantation is not possible because:
A. Autologous transplants for aplastic anemia are performed only on small children.
B. Aplastic anemia attacks and destroys the hematopoietic system, leaving diseased and insufficient cells to perform an autologous HSCT
C. The national marrow donor registry only recognizes unrelated transplants for patients with aplastic anemia
D. The cure rate for treating aplastic anemia with an autologous transplant is very low

Summary: Treatment Modalities
Summary: Surgery
Surgery:
- A precise local treatment
- May remove all or a portion of the primary tumor
- Can be used to obtain specimens for cytology
- May be the only treatment a patient requires
- May be preceded or followed by other modalities
- May be used in a palliative setting to alleviate or lessen intolerable symptoms

Summary: Radiation
Radiation therapy:
- Is a local treatment in which energy is precisely directed at a specific target
- May follow surgery to prevent recurrence of the primary tumor
- Is more effective for some diseases than others
- Is sometimes used after chemotherapy because radiation can permanently damage bone marrow, making it impossible to give chemotherapy in the doses needed for curative therapy
- Is often given in combination with chemotherapy (Chemoradiation)
- May be given as radioimmunotherapy (RIT), combining a radioisotope and a monoclonal antibody (mAb)

Summary: Chemotherapy
Chemotherapy:
- An integral component of systemic therapy
- Chemotherapy targets different phases of the cell cycle halting growth and division and leading to apoptosis (cell death)
- Chemotherapy can be grouped depending on where they exert their effect during the cell cycle and are referred to as cell cycle-specific or cell cycle-nonspecific.
- Chemotherapy agents are classified based on their mechanism of action, or where they exert their cytotoxic effect on the cancer cell.
- Within each of the classifications, agents are further subclassified; this is usually related to drug origin such as plant or metal.

Summary: Biotherapy/Targeted therapy
Biotherapy/Targeted therapies:
- Systemic treatments
- May modify the patient’s own immune defenses
- May be so specific as to target a single receptor on the surface of the tumor cells or an enzyme within the cell
- May cause side effects and toxicities different from those of other antineoplastic agents
- May be combined with other treatment modalities
- May promote tumor regression
- May stimulate hematopoiesis
Study resources:


