critical care nursing
lecture 5
Burns

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learning objectives commonly associated with burns:

1. Understand what burns are.
2. Identify the classification of burns based on depth
3. Describe the pathophysiological response of the body to burn
4. Understand the phases of burn injury.
5. Recognize signs and symptoms of different degrees of burn injury.
6. Identify common complications associated with burns.
7. Explain the primary goals of burn management.
8. Understand the different types of wound care and dressing techniques.
9. Describe nursing care priorities and interventions
10. Learn about psychosocial support.
11. Describe nursing care priorities and interventions
12. Discuss education points for patients and their families.

The **integumentary system** is the body's largest organ system, providing a barrier between the internal environment and the external world. It includes the skin, hair, nails, sweat glands, and sebaceous (oil) glands. Here’s a breakdown of the components and their functions:

Layers of the Skin

1. **Epidermis**:
   - The outermost layer of the skin, made up of tightly packed epithelial cells.
   - Acts as the primary barrier to pathogens and environmental hazards.
   - Contains specialized cells:

Keratinocytes: Produce keratin, a protein that strengthens the skin and makes it waterproof.

Melanocytes: Produce melanin, the pigment responsible for skin color and protection from UV radiation.

Langerhans Cells: Part of the immune system, protecting against foreign invaders.

Merkel Cells: Play a role in sensory perception.

Dermis:

- Located beneath the epidermis, this layer is thicker and contains connective tissue.
- Supports and nourishes the epidermis with blood vessels, nerves, and lymphatic vessels.
- Contains:
  - **Collagen and Elastin Fibers**: Provide strength, elasticity, and resilience to the skin.
  - **Hair Follicles**: Sites of hair growth, associated with sebaceous glands that produce sebum (oil).
  - **Sweat Glands**: Help regulate body temperature through perspiration.
  - **Sensory Receptors**: Detect pressure, pain, temperature, and touch.

Subcutaneous Layer (Hypodermis):

- The deepest layer, composed of adipose (fat) tissue and connective tissue.
- Functions as insulation, padding, and an energy reserve, while anchoring the skin to underlying structures like muscles and bones.
- Contains larger blood vessels and nerves.

Accessory Structures

1. **Hair**:
   - Made of keratin and grows from hair follicles in the dermis.
   - Provides insulation and protection, particularly on the scalp and eyebrows.
2. **Nails**:
   - Hard, keratinized structures at the tips of fingers and toes.
   - Protects the ends of digits and assists with gripping.

Sebaceous (Oil) Glands:

- Associated with hair follicles, these glands secrete sebum, an oily substance that keeps the skin and hair moisturized and has antibacterial properties.

Sweat Glands:

- **Eccrine Sweat Glands**: Widely distributed, they regulate body temperature through sweat.
- **Apocrine Sweat Glands**: Found in specific areas like armpits and groin, they become active during puberty and are associated with body odor.

Functions of the Integumentary System

1. **Protection**: Acts as a barrier against mechanical injury, pathogens, chemicals, and UV radiation.
2. **Sensation**: Contains sensory receptors that detect touch, pressure, pain, and temperature.
3. **Thermoregulation**: Regulates body temperature through sweat production and blood flow to the skin.
4. **Metabolic Functions**: Synthesizes vitamin D when exposed to sunlight, which is essential for bone health.

1. **Excretion**: Eliminates waste products through sweat.
2. **Immune Defense**: Provides a first line of defense against pathogens through immune cells in the skin.

The integumentary system’s structure and functions are crucial for maintaining homeostasis, protecting the body, and enabling sensory interaction with the environment.

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Definition of Burns

A burn is a type of injury to the skin or deeper tissues caused by heat, chemicals, electricity, sunlight, or radiation. Burns can damage skin cells and underlying structures, potentially leading to pain, scarring, and other complications depending on the severity.

Types of Burns

1. **Thermal Burns**:
   - Caused by contact with heat sources like fire, hot liquids, steam, or heated objects.
   - Common in household and industrial accidents.

2. Chemical Burns:

- Result from contact with harmful chemicals such as acids, alkalis, or corrosive substances.
- Occur in industrial settings or during exposure to household cleaning agents.

3. Electrical Burns:

- Caused by electrical currents passing through the body, which can damage both surface skin and internal tissues.
- These burns can result from contact with live wires or lightning.

4. Radiation Burns:

- Caused by prolonged exposure to UV rays from the sun or radiation therapy.
- Common in sunburns or as a side effect of cancer treatment.

Classification of Burns Based on Depth

1. **Superficial (First-Degree) Burns**:
   - Affect only the epidermis, the outermost skin layer.
   - Symptoms include redness, mild pain, and no blistering (e.g., sunburn).
   - Healing typically occurs within a week without scarring.

2. Partial-Thickness (Second-Degree) Burns:

- Involve the epidermis and part of the dermis.
- Symptoms include redness, blisters, swelling, and more intense pain.
- Healing may take a few weeks and may result in some scarring.

3. Full-Thickness (Third-Degree) Burns:

- Extend through the entire dermis, affecting deeper tissues.
- The skin may appear white or charred, and pain may be absent due to nerve damage.
- Healing requires medical intervention such as skin grafting and may lead to scarring.

4. Fourth-Degree Burns:

- Extend beyond the skin into muscles, bones, or other structures.
- The affected area may appear charred, with a complete lack of sensation.
- Healing involves extensive medical care, often including surgery.

Classification of Burns Based on Extent

- **Total Body Surface Area (TBSA)**:
  - Used to estimate the percentage of body surface affected, which helps guide treatment and predict outcomes.
  - The "Rule of Nines" and the Lund and Browder chart are common tools used to assess TBSA, varying by age.

Pathophysiological Response to Burn Injuries

burn injuries result in a complex pathophysiological response that significantly impacts multiple systems in the body. This response can lead to serious complications if not managed properly, and it affects skin integrity, fluid balance, and immune function

1. Impact on Skin Integrity:

- Burns damage the skin’s protective barrier, which normally prevents fluid loss, regulates temperature, and protects against infection.
- Loss of skin integrity exposes underlying tissues, leading to an increased risk of dehydration, infection, and difficulty in maintaining body temperature.

- This breakdown of the protective barrier can allow pathogens to enter, increasing the risk of infection and sepsis.

2. Fluid and Electrolyte Imbalance:

- **Fluid Shift and Edema**: After a burn, the blood vessels near the injury site dilate, and their permeability increases due to inflammatory mediators (e.g., histamine and cytokines). This results in the leakage of fluid, plasma proteins, and electrolytes from the vascular space into the interstitial space, leading to edema.

- **Hypovolemic Shock (Burn Shock)**: The significant fluid loss from the vascular space results in hypovolemia (decreased blood volume), leading to reduced cardiac output and perfusion to organs. This condition, known as burn shock, can be life-threatening if not treated promptly with fluid resuscitation.
- **Electrolyte Imbalances**: Electrolyte levels, particularly sodium and potassium, become unbalanced due to the shift of fluids. Hypokalemia (low potassium) or hyperkalemia (high potassium) may occur, affecting cardiac and neuromuscular function.

3. Immune Response and Risk of Infection:

- **Systemic Inflammatory Response**: The body mounts a systemic inflammatory response to the burn injury. This response involves the release of cytokines and other inflammatory mediators, which, while helping to repair damaged tissues, can also lead to systemic effects that may cause further complications (e.g., increased capillary permeability and tissue edema).

- **Immunosuppression**: Severe burns impair immune function, as immune cells are either destroyed or become less effective. The loss of the skin’s protective barrier and the increased demand on the immune system can lead to immunosuppression, increasing the risk of infection and sepsis.
- **Wound Infection and Sepsis**: The open, damaged skin is highly susceptible to bacterial colonization. Without proper wound care, local infections can spread systemically, leading to sepsis, a potentially fatal complication.

4. Metabolic Response:

- Burn injuries trigger a hypermetabolic response, increasing the body's need for energy, oxygen, and nutrients.
- This response can lead to increased body temperature, higher resting energy expenditure, and a catabolic state (muscle breakdown).
- High-calorie, high-protein nutrition is often required to meet these increased metabolic demands and support healing and tissue repair.

5. Pulmonary Complications:

- **Inhalation Injury**: Burns involving the face or upper body may lead to inhalation injuries from smoke, chemicals, or heated gases. Inhalation injuries can cause airway edema, respiratory distress, and potentially lead to acute respiratory distress syndrome (ARDS).
- **Carbon Monoxide Poisoning**: In cases of fire, carbon monoxide exposure may occur, leading to hypoxemia (reduced oxygen levels in the blood) as carbon monoxide binds with hemoglobin, reducing oxygen transport to tissues.

Assessment:

Nursing emphasizes a systematic approach to ensure rapid, comprehensive evaluation and appropriate intervention. The **ABCDE approach** (Airway, Breathing, Circulation, Disability, and Exposure) is used to prioritize care and stabilize the patient. Following this, a more detailed assessment is conducted to determine the degree and extent of the burn.

ABCDE Approach for Initial Burn Assessment

1. **Airway**:
   - Assess for airway patency, as airway compromise is a major concern, especially in facial or neck burns or if there is suspicion of inhalation injury.

- Look for signs of airway obstruction, such as hoarseness, stridor, or coughing up carbonaceous sputum (soot in saliva), which may indicate inhalation of smoke or hot gases.
- Immediate intubation may be required if there is swelling or obstruction, as respiratory compromise can worsen rapidly.

2. Breathing:

- Assess breathing and ventilation to ensure adequate oxygenation. This includes observing chest movements, respiratory rate, and breath sounds.
- Monitor for signs of respiratory distress, particularly in cases of chest burns that can restrict chest wall movement.

- Check oxygen saturation and administer supplemental oxygen as needed; inhalation injuries may require advanced respiratory support.

3. Circulation:

- Assess circulation, including checking pulse rate, blood pressure, and capillary refill.
- Monitor for signs of hypovolemic shock due to fluid loss, particularly in patients with extensive burns.
- Initiate fluid resuscitation early, guided by formulas like the Parkland formula, to prevent burn shock and maintain organ perfusion.

4. Disability:

- Evaluate neurological status using the Glasgow Coma Scale (GCS) to assess alertness and responsiveness.
- Altered mental status may indicate hypoxia, carbon monoxide poisoning, or associated head trauma, and should be addressed immediately.

5. Exposure:

- Expose the patient by removing clothing and jewelry to assess the full extent of burn injuries, but avoid prolonged exposure to prevent hypothermia.
- Assess the burn area, noting the location, size, depth, and any other injuries.
- Ensure a warm environment or use warming blankets as burns can impair the body’s temperature regulation.

Detailed Assessment of Burn Injuries

1. **Determining the Depth of Burn (Degree)**:
    - **Superficial (First-Degree)**: Only affects the epidermis. Symptoms include redness, pain, and no blistering. The skin remains intact.
    - **Partial-Thickness (Second-Degree)**: Involves the epidermis and part of the dermis. Symptoms include redness, blisters, moist appearance, and severe pain.

- **Full-Thickness (Third-Degree)**: Extends through the entire dermis, potentially affecting deeper tissues. The skin appears white, charred, or leathery, and pain may be absent due to nerve damage.
- **Fourth-Degree**: Involves muscle, bone, or underlying structures. These burns are painless in the burned area but may be associated with severe pain around it.

2. Estimating Total Body Surface Area (TBSA):

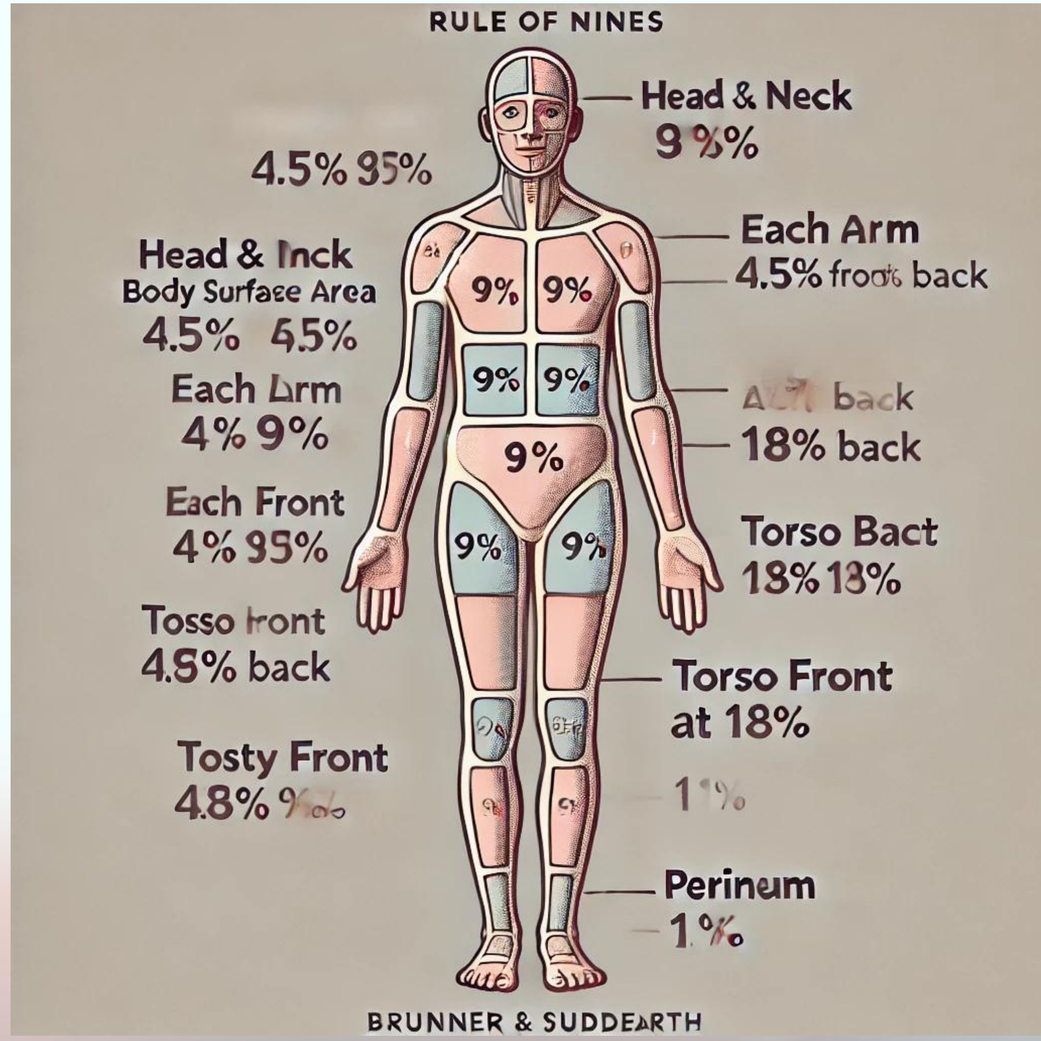
- Use tools like the **Rule of Nines** (for adults) or the **Lund and Browder chart** (for children) to estimate the percentage of TBSA affected.
- Accurate estimation of TBSA helps guide fluid resuscitation and overall management.

3. Signs and Symptoms to Recognize:

- **Superficial Burns**: Redness, mild swelling, and tenderness. Heals in a few days.

Rule of Nines Breakdown for Adults

- **Head and Neck**: 9% (4.5% for the front and 4.5% for the back)
- **Each Arm**: 9% (4.5% for the front and 4.5% for the back)
- **Each Leg**: 18% (9% for the front and 9% for the back)
- **Torso**:
  - **Front** (Chest and Abdomen): 18%
  - **Back** (Upper and Lower Back): 18%
- **Perineum/Genital Area**: 1%



- .**Partial-Thickness Burns**: Blisters, severe pain, and moist, red skin. Healing may take weeks, and scarring can occur.
- **Full-Thickness Burns**: Charred, leathery, or white appearance, with little to no pain at the site. Often requires surgical intervention for healing.
- **Fourth-Degree Burns**: Exposed muscle, bone, or tendons, with a high risk of infection and systemic complications.

5. Other Considerations:

- **Inhalation Injury**: Look for signs like facial burns, singed nasal hairs, soot in the mouth, or coughing black sputum.
- **Associated Injuries**: Assess for any fractures, wounds, or trauma that may have occurred during the burn event.

Diagnosis

1. **Assessing Burn Depth, Location, and Severity**:
    - **Depth**: Categorized into superficial, partial-thickness, full-thickness, and fourth-degree burns based on tissue involvement and appearance.
    - **Location**: Burns on the face, neck, hands, feet, or over major joints require specialized care due to their functional importance and higher risk of complications.
    - **Severity**: Determined by the total body surface area (TBSA) affected, using tools like the Rule of Nines or Lund and Browder chart to classify burns as minor, moderate, or major.

2.Identifying Complications:

- **Infection**: Due to the loss of skin integrity, burns have a high risk of infection, which can lead to sepsis if not controlled.
- **Hypovolemic Shock (Burn Shock)**: Fluid loss from capillary leak can lead to hypovolemia, requiring prompt fluid resuscitation.
- **Respiratory Distress**: Inhalation injuries, carbon monoxide poisoning, and potential airway edema can lead to breathing difficulties and require close monitoring and respiratory support.

Management and Treatment

1. **Primary Goals of Burn Management**:
    - **Fluid Resuscitation**: Essential to prevent hypovolemic shock and ensure adequate perfusion. Formulas like the Parkland formula are used to calculate fluid requirements in the first 24 hours.
    - **Wound Care**: Involves cleaning, debridement, and dressing changes to reduce infection risk and promote healing. Specialized dressings and techniques, such as antimicrobial and moisture-retentive dressings, are used.

- **Pain Management**: Burn pain can be severe and is managed with a combination of pharmacologic (opioids, nonsteroidal anti-inflammatory drugs, and anxiolytics) and nonpharmacologic methods.
- **Infection Prevention**: Aseptic techniques, antimicrobial dressings, and close monitoring for signs of infection are key to preventing complications.

2.Types of Wound Care and Surgical Interventions:

- **Wound Dressing Techniques**: Dressings may include silver-impregnated dressings, hydrocolloids, or synthetic skin substitutes to maintain a moist environment and protect against pathogens.

Debridement: Removal of dead tissue through surgical, enzymatic, or mechanical methods to promote healthy tissue growth.

Grafting: Skin grafts, often from an uninjured part of the patient's body (autografts), are used to cover extensive wounds, reduce infection risk, and facilitate healing.

Nursing Interventions

1. **Acute Phase Care**:
    - **Fluid and Electrolyte Monitoring**: Continuous monitoring of fluid balance, electrolytes, and urine output to prevent hypovolemia and maintain homeostasis.

- **Wound Care and Infection Control**: Performing meticulous wound care using aseptic techniques, monitoring for signs of infection, and providing patient education on wound healing.
- **Pain and Comfort Management**: Providing adequate pain relief, positioning the patient to minimize discomfort, and using anxiety-reduction techniques.

Rehabilitative Phase Care:

- **Physical Rehabilitation**: Encouraging mobility, performing range-of-motion exercises, and supporting physical therapy to prevent contractures and maintain joint function.
- **Psychosocial Support**: Addressing body image concerns, self-esteem, and coping strategies, and facilitating connections with support groups or counselors to support mental and emotional well-being.
- **Patient Education**: Teaching patients and families about wound care, prevention of contractures, and signs of complications to monitor for after discharge.

Patient and Family Education

1. **Wound Care at Home**:
   - Instruct on proper techniques for dressing changes, signs of infection, and the importance of keeping wounds clean and protected.
   - Explain the use of prescribed ointments, and when to seek medical help if concerns arise.
2. **Nutrition**:
   - Emphasize the need for a high-protein, high-calorie diet to support the body’s increased metabolic demands and promote wound healing

- Encourage hydration and discuss any nutritional supplements that may be beneficial during recovery.

3. Prevention of Burn Injuries:

- Educate on safety practices to prevent future burns, such as safe cooking techniques, proper handling of electrical devices, and fire safety in the home.
- Discuss the importance of smoke alarms, fire escape plans, and using caution around open flames and hot liquids.

4. Support:

- Highlight the importance of family and community support, including support groups, counseling services, and rehabilitation programs.
- Provide information on resources for ongoing physical and emotional support, such as burn survivor organizations, social services, and outpatient therapy.