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UNIT TERMINAL OBJECTIVE

4-3 At the completion of this unit, the EMT-Critical Care Technician student will be able to utilize the assessment findings to formulate a field impression and implement the management plan for the patient with a burn injury.

COGNITIVE OBJECTIVES

At the completion of this unit, the EMT-Critical Care Technician student will be able to:

4-3.1 Describe the anatomy and physiology pertinent to burn injuries. (C-1)
4-3.2 Describe the epidemiology, including incidence, morbidity/ mortality, risk factors, and prevention strategies for the patient with a burn injury. (C-1)
4-3.3 Describe the pathophysiologic complications and systemic complications of a burn injury. (C-1)
4-3.4 Identify and describe types of burn injuries, including a thermal burn, an inhalation burn, a chemical burn, an electrical burn, and a radiation exposure. (C-1)
4-3.5 Identify and describe the depth classifications of burn injuries, including a superficial burn, a partial-thickness burn, a full-thickness burn, and other depth classifications described by local protocol. (C-1)
4-3.6 Identify and describe methods for determining body surface area percentage of a burn injury including the "rules of nines," the "rules of palms," and other methods described by local protocol. (C-1)
4-3.7 Identify and describe the severity of a burn including a minor burn, a moderate burn, a severe burn, and other severity classifications described by local protocol. (C-1)
4-3.8 Differentiate criteria for determining the severity of a burn injury between a pediatric patient and an adult patient. (C-3)
4-3.9 Describe special considerations for a pediatric patient with a burn injury. (C-1)
4-3.10 Discuss considerations which impact management and prognosis of the burn injured patient. (C-1)
4-3.11 Discuss mechanisms of burn injuries. (C-1)
4-3.12 Discuss conditions associated with burn injuries, including trauma, blast injuries, airway compromise, respiratory compromise, and child abuse. (C-1)
4-3.13 Describe the management of a burn injury, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, psychological support/ communication strategies, and other management described by local protocol. (C-1)
4-3.14 Describe the epidemiology of a thermal burn injury. (C-1)
4-3.15 Describe the specific anatomy and physiology pertinent to a thermal burn injury. (C-1)
4-3.16 Describe the pathophysiology of a thermal burn injury. (C-1)
4-3.17 Identify and describe the depth classifications of a thermal burn injury. (C-1)
4-3.18 Identify and describe the severity of a thermal burn injury. (C-1)
4-3.19 Describe considerations which impact management and prognosis of the patient with a thermal burn injury. (C-1)
4-3.20 Discuss mechanisms of burn injury and conditions associated with a thermal burn injury. (C-1)
4-3.21 Describe the management of a thermal burn injury, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, and psychological support/ communication strategies. (C-1)
4-3.22 Describe the epidemiology of an inhalation burn injury. (C-1)
4-3.23 Describe the specific anatomy and physiology pertinent to an inhalation burn injury. (C-1)
4-3.24 Describe the pathophysiology of an inhalation burn injury. (C-1)
4-3.25 Differentiate between supraglottic and infraglottic inhalation injuries. (C-3)
4-3.26 Identify and describe the severity of an inhalation burn injury. (C-1)

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4-3.27 Describe considerations which impact management and prognosis of the patient with an inhalation burn injury. (C-1)
4-3.28 Discuss mechanisms of burn injury and conditions associated with an inhalation burn injury. (C-1)
4-3.29 Describe the management of an inhalation burn injury, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, and psychological support/ communication strategies. (C-1)
4-3.30 Describe the epidemiology of a chemical burn injury and a chemical burn injury to the eye. (C-1)
4-3.31 Describe the specific anatomy and physiology pertinent to a chemical burn injury and a chemical burn injury to the eye. (C-1)
4-3.32 Describe the pathophysiology of a chemical burn injury, including types of chemicals and their burning processes and a chemical burn injury to the eye. (C-1)
4-3.33 Identify and describe the depth classifications of a chemical burn injury. (C-1)
4-3.34 Identify and describe the severity of a chemical burn injury. (C-1)
4-3.35 Describe considerations which impact management and prognosis of the patient with a chemical burn injury and a chemical burn injury to the eye. (C-1)
4-3.36 Discuss mechanisms of burn injury and conditions associated with a chemical burn injury. (C-1)
4-3.37 Describe the management of a chemical burn injury and a chemical burn injury to the eye, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, and psychological support/ communication strategies. (C-1)
4-3.38 Describe the epidemiology of an electrical burn injury. (C-1)
4-3.39 Describe the specific anatomy and physiology pertinent to an electrical burn injury. (C-1)
4-3.40 Describe the pathophysiology of an electrical burn injury. (C-1)
4-3.41 Identify and describe the depth classifications of an electrical burn injury. (C-1)
4-3.42 Identify and describe the severity of an electrical burn injury. (C-1)
4-3.43 Describe considerations which impact management and prognosis of the patient with an electrical burn injury. (C-1)
4-3.44 Discuss mechanisms of burn injury and conditions associated with an electrical burn injury. (C-1)
4-3.45 Describe the management of an electrical burn injury, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, and psychological support/ communication strategies. (C-1)
4-3.46 Describe the epidemiology of a radiation exposure. (C-1)
4-3.47 Describe the specific anatomy and physiology pertinent to a radiation exposure. (C-1)
4-3.48 Describe the pathophysiology of a radiation exposure, including the types and characteristics of ionizing radiation. (C-1)
4-3.49 Identify and describe the depth classifications of a radiation exposure. (C-1)
4-3.50 Identify and describe the severity of a radiation exposure. (C-1)
4-3.51 Describe considerations which impact management and prognosis of the patient with a radiation exposure. (C-1)
4-3.52 Discuss mechanisms of burn injury associated with a radiation exposure. (C-1)
4-3.53 Describe the management of a radiation exposure, including airway and ventilation, circulation, pharmacologic, non-pharmacologic, transport considerations, and psychological support/ communication strategies. (C-1)
4-3.54 Apply the to formulate a field impression and implement the management plan for a thermal burn injury. (C-3)
4-3.55 Apply the to formulate a field impression and implement the management plan for an inhalation burn injury. (C-3)
4-3.56 Apply the to formulate a field impression and implement the management plan for a chemical burn

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injury. (C-3)
4-3.57 Apply the to formulate a field impression and implement the management plan for an electrical burn injury. (C-3)
4-3.58 Apply the to formulate a field impression and implement the management plan for an radiation exposure. (C-3)

AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Critical Care Technician student will be able to:

4-3.59 Value the changes of a patient's self-image associated with a burn injury. (A-2)
4-3.60 Value the impact of managing a burn injured patient. (A-2)
4-3.61 Advocate empathy for a burn injured patient. (A-2)
4-3.62 Value and defend the sense of urgency in burn injuries. (A-3)

PSYCHOMOTOR OBJECTIVES
At the completion of this unit, the EMT-Critical Care Technician student will be able to:

4-3.63 Take body substance isolation procedures during assessment and management of patients with a burn injury. (P-2)
4-3.64 Perform assessment of a patient with a burn injury. (P-2)

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DECLARATIVE

I. Introduction
- A. Epidemiology
  - 1. Incidence
    - a. Supportive statistics
  - 2. Morbidity/ mortality
    - a. Supportive statistics
  - 3. Risk factors
  - 4. Prevention strategies
- B. Review the anatomy and physiology of the integumentary system

II. General system pathophysiology, assessment, and management
- A. Pathophysiology
  - 1. Pathophysiologic and systemic complications of a burn injury
    - a. Fluid loss
    - b. Electrolyte loss
    - c. Increased catecholamine release
    - d. Acidosis
    - e. Vasoconstriction
    - f. Renal failure
    - g. Liver failure
    - h. Heart failure
    - i. Hypoxia
    - j. Anoxia
    - k. Arrhythmia
    - l. Formation of eschar
    - m. Hypothermia
    - n. Hypovolemia
    - o. Infection
    - p. Complications of a circumferential burn
- B. Assessment findings
  - 1. Types of burn injuries
    - a. Thermal
    - b. Inhalation
    - c. Chemical
    - d. Electrical
      - (1) Lightning
    - e. Radiation exposure
  - 2. Depth classification of a burn injury
    - a. Superficial
    - b. Partial-thickness
    - c. Full-thickness
    - d. Other depth classifications according to local protocol
  - 3. Methods for determining body surface area percentage of a burn injury
    - a. The "rule of nines"
      - (1) Adult

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(2) Pediatric
b. The "rule of palms"
c. Other methods according to local protocol

4. Severity of a burn
   a. Minor
   b. Moderate
   c. Severe
   d. Other severity classifications according to local protocol
5. Criteria for determining severity of a burn injury
   a. The adult patient
   b. The pediatric patient
      (1) Special considerations
6. Considerations which impact management and prognosis of the burn injured patient
   a. Age
   b. Preexisting medical conditions
   c. Trauma
   d. <u>Factors Altering Severity of Injury</u>
      (1) <u>Incident related factors.</u>
         (a) <u>Confinement in area of fire.</u>
         (b) <u>Associated injuries.</u>
         (c) <u>Time elapsed prior to intervention.</u>
      (2) <u>Patient related factors.</u>
         (a) <u>Age.</u>
         (b) <u>Pre-existing diseases.</u>
         (c) <u>Nutritional status.</u>
         (d) <u>Area and classification of injury.</u>
         (e) <u>Injury to face, hands, feet, or genitalia.</u>
         (f) <u>Extent of burn.</u>
         (g) <u>Associated injuries.</u>
7. Mechanisms of burn injuries
   a. Burn trauma
   b. Blast/ explosion trauma
   c. Fall injury
   d. Other injuries
8. Conditions associated with burn injuries
   a. Trauma
      (1) Soft tissue injuries
      (2) Musculoskeletal injuries
   b. Blast injuries
   c. Airway compromise
   d. Respiratory compromise
   e. Child abuse
9. Signs and symptoms of burn injuries
   a. Pain
   b. Changes in skin condition relative to the affected burn site
   c. Adventitious sounds
   d. Sloughing of the affected skin

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e. Hoarseness
f. Dysphagia
g. Dysphasia
h. Burnt hair
i. Nausea/ vomiting
j. Unconsciousness
k. Altered level of consciousness
l. Edema
m. Paresthesia
n. Hemorrhage
o. Other soft tissue injuries
p. Musculoskeletal injuries
q. Dyspnea
r. Chest pain

C. Management
1. Airway and ventilatory support
2. Circulatory support
3. Pharmacological interventions
a. Analgesia
4. Non-pharmacological interventions
5. Transport considerations
a. Appropriate mode
b. Appropriate facility
6. Psychological support/ communication strategies
a. Patient and family advocacy

III. Specific burn injuries
A. Thermal burn injury
1. Epidemiology of a thermal burn injury
a. Incidence
(1) Supportive statistics
b. Morbidity/ mortality
(1) Supportive statistics
c. Risk factors
d. Prevention strategies
2. Review the specific anatomy and physiology pertinent to the integumentary system
3. Review of heat energy and the components of the burning agent
4. Pathophysiology of a thermal burn injury
a. The process of burn shock
(1) Emergent phase
(2) Fluid shift phase
(3) Hypermetabolic phase
(4) Resolution phase
b. Inhalation injury (present in 60-70% of all burn patients who die)
(1) Carbon monoxide poisoning
(2) Cyanide intoxication
c. Infectious insult

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d. Eschar formation
(1) Respiratory compromise secondary to circumferential eschar around the thorax
(2) Circulatory compromise secondary to circumferential eschar around an extremity
(3) Escharotomies

5. Assessment findings
a. Depth classifications of a thermal burn
b. Severity of a thermal burn
c. Criteria for determining severity of a burn injury
(1) The adult patient
(2) The pediatric patient
d. Considerations which impact care and prognosis of the thermal burn injured patient
e. Mechanisms of burn injury
(1) Scalding
(2) Steam
(3) Flame
(4) Flash
(5) Retained heat
(6) Other trauma
f. Conditions associated with thermal burn injuries

6. Management
a. Remove patient to safe area
b. Stop the burning process
c. Airway and ventilatory support
d. Circulatory support
e. Pharmacological interventions
(1) Topical applications
(2) Tetanus and antibiotic therapy
(3) Fluid therapy
f. Non-pharmacological interventions
(1) Thermal burn injury management according to local protocol
g. Transport considerations
(1) Appropriate mode
(2) Appropriate facility
(3) Transport considerations in conjunction with burn injury management according to local protocol
h. Psychological support/ communication strategies

B. Inhalation burn injury

1. Epidemiology
a. Incidence
(1) Supportive statistics (e.g., 20-35% of the patients admitted to burn centers have an inhalation injury)
(2) Chemical inhalation injuries are more frequent than thermal inhalation injuries
b. Morbidity/ mortality

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(1) Supportive statistics
c. Risk factors
(1) Often associated with a burn environment
(2) Factors that increase the risk for inhalation injury
(a) Standing
(b) Screaming
(c) Enclosed area
d. Prevention strategies
2. Review the specific anatomy and physiology pertinent to the respiratory system
3. Pathophysiology
a. Compromises the upper airway (supraglottic)
b. Compromises the lower airway (infraglottic)
c. Complications may occur later
4. Assessment findings
a. Mechanism of injury
(1) Toxic inhalations
(2) Smoke inhalation
(3) Carbon monoxide poisoning
(4) Thiocyanate intoxication
(5) Thermal burn
(6) Chemical burn
b. Criteria for determining severity of a burn injury
(1) The adult patient
(2) The pediatric patient
c. Considerations which impact care and prognosis
d. Conditions associated with inhalation burn trauma
e. <u>External findings</u>
(1) <u>Deep facial burns</u>
(2) <u>Singed nasal hair</u>
(3) <u>Blistering around mouth</u>
(4) <u>Sooty tongue/pharynx</u>
(5) <u>Restlessness, confusion</u>
(6) <u>Labored or rapid breathing</u>
(7) <u>Continued exhalation of smoke</u>
(8) <u>Coughing</u>
(9) <u>Fractured ribs</u>
f. <u>Breath sounds</u>
(1) <u>Usually normal first 1-2 hours</u>
(2) <u>Onset of rales ominous sign</u>
g. <u>Physical complication</u>
(1) <u>Upper airway injuries</u>
i. <u>Upper airway edema</u>
ii. <u>Upper airway collapse</u>
(2) <u>Membrane damage</u>
i. <u>Cilia damage</u>
ii. <u>Mucosal slough</u>

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(3) Surfactant lose
(4) Chemical bronchitis
(5) Chestwall musculature damage
i. Decreased chest wall movement
ii. Muscular burden
(6) Physical fatigue
h. Physiological response
(1) Bronchospasm
i. Irritating chemicals
ii. Smooth muscle reflexes
(2) Tidal volume breathing
i. Alveolar collapse
ii. Decreased compliance
iii. Decreased lung volume
iv. Atelectasis
v. Shunting
(3) Pulmonary edema
i. Fluid infusion in acute phase
ii. Myocardial decompensation
iii. Changes in capillary permeability

5. Focused history
a. Flames in close space.
b. Explosions.
c. Combustion within respiratory tract.
d. Chemical: toxic combustion.
(1) Wood, cotton, paper.
(2) Petroleum product.
(3) Wool, silk.
(4) Polymer plastics.
e. Toxin in Smoke.
(1) Oxides of sulphur nitrogen.
(2) Ozone
(3) Carbon monoxide
f. Thermal injury to the lung
(1) Steam
i. Increased latent heat
(2) Dry heat
i. Upper airway damage
ii. Limited lower airway damage
g. Pre-existing respiratory problems
h. History of smoking

6. Management
a. Airway and ventilatory support
b. Circulatory support
c. Pharmacological interventions
d. Non-pharmacological interventions

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(1) Thermal burn injury management according to local protocol
(2) Hyperbaric therapy - for carbon monoxide
e. Transport considerations
(1) Appropriate mode
(2) Appropriate facility
f. Psychological support/ communication strategies

C. Chemical burn injury
1. Epidemiology
a. Incidence
(1) Supportive statistics
b. Morbidity/ mortality
(1) Supportive statistics
c. Risk factors
d. Prevention strategies
2. Anatomy and physiology review
3. Pathophysiology
a. Types of chemicals which cause chemical burn injuries
(1) Acids
(2) Bases (alkali)
(a) Cement
(3) Dry chemicals
(4) Phenols
b. Characteristics of the burning process of chemicals
(1) The burning process of an acid
(2) The burning process of an alkali
(3) The burning process of dry chemicals
4. Assessment
a. Mechanism of injury
(1) Industrial accidents most frequent
b. Depth classification
c. Severity
d. Criteria for determining severity of a burn injury
(1) The adult patient
(2) The pediatric patient
e. Considerations which impact care and prognosis of a chemical burn injured patient
5. Management
a. Airway and ventilatory support
b. Circulatory support
c. Pharmacological interventions
d. Non-pharmacological interventions
(1) Acid burn injury management according to local protocol
(2) Alkali burn injury management according to local protocol
(3) Chemical burn injury according to local protocol
(4) Dry chemical burn injury according to local protocol
e. Transport considerations
(1) Appropriate mode

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(2) Appropriate facility
f. Psychological support/ communication strategies

D. Chemical burn injury of the eye
1. Epidemiology
a. Incidence
(1) Supportive statistics
b. Morbidity/ mortality
(1) Supportive statistics
c. Risk factors
d. Prevention strategies
2. Anatomy and physiology review of the eye
3. Pathophysiology
a. Types of chemicals which cause chemical burn injuries to the eye
(1) Acids
(2) Bases (alkali)
(a) Cement
(3) Dry chemicals
(4) Phenols
(5) Mace/ pepper spray
4. Assessment
a. Mechanism of injury
(1) Industrial accidents most frequent
b. Severity
c. Criteria for determining severity of a eye injury
d. Considerations which impact care and prognosis of a chemical injury to the eye
5. Management
a. Airway and ventilatory support
b. Circulatory support
c. Pharmacological interventions
d. Non-pharmacological interventions
e. Transport considerations
(1) Appropriate mode
(2) Appropriate facility
f. Psychological support/ communication strategies

E. Electrical burn injuries
1. Epidemiology
a. Incidence
(1) Supportive statistics
b. Morbidity/ mortality
(1) Supportive statistics
c. Risk factors
d. Prevention strategies
2. Anatomy and physiology review
3. Review of the characteristics of electrical current
4. Pathophysiology
a. External burn injuries
b. Internal burn injuries

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c. Musculoskeletal injuries
d. Cardiovascular injuries
e. Respiratory injuries
f. Neurological injuries
g. Myoglobin release and renal involvement

5. Assessment
   a. Mechanism of injury
      (1) Contact burn injuries
      (2) Arc injuries
      (3) Flame or flash burn injuries
         (a) Welder's flash
      (4) Lightning injuries
         (a) Direct stroke
         (b) Side flash (splash)
         (c) Step voltage
   b. Depth classification
   c. Severity
   d. Criteria for determining severity of an electrical burn injury
      (1) The adult patient
      (2) The pediatric patient
   e. Considerations which impact care and prognosis of an electrical burn injured patient
6. Management
   a. Airway and ventilatory support
   b. Circulatory support
   c. Pharmacological interventions
   d. Non-pharmacological interventions
      (1) Electrical burn injury management according to local protocol
   e. Transport considerations
      (1) Appropriate mode
      (2) Appropriate facility
   f. Psychological support/ communication strategies

F. Radiation exposure
1. Epidemiology
   a. Incidence
      (1) Supportive statistics
   b. Morbidity/ mortality
      (1) Supportive statistics
   c. Risk factors
      (1) Accidents associated with the improper handling of radiological materials
   d. Prevention strategies
2. Anatomy and physiology review
3. Types of radiation which cause burn injury
   a. Alpha radiation
   b. Beta radiation
   c. Gamma radiation

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4. Characteristics of ionizing radiation
    a. Alpha radiation
    b. Beta radiation
    c. Gamma radiation
5. Aspects of exposure
    a. Duration of exposure
    b. Distance from the source
    c. Shielding
6. Other considerations of exposure
    a. Direct exposure to ionizing radiation
    b. Exposure to contaminants containing small particles of active material
7. Assessment
    a. Mechanism of injury
    b. Depth classifications
        (1) Immediate versus delayed injuries and effects
    c. Severity
        (1) Immediate versus delayed injuries and effects
    d. Criteria for determining severity of a radiation exposure and associated burn injury
        (1) The adult patient
        (2) The pediatric patient
    e. Considerations which impact care and prognosis of a radiation exposure and burn injuries
8. Management
    a. Scene safety
    b. Airway and ventilatory support
    c. Circulatory support
    d. Pharmacological interventions
    e. Non-pharmacological interventions
        (1) Injury management according to local protocol
        (2) Management of a radiation accident scene
    f. Transport considerations
        (1) Appropriate mode
        (2) Appropriate facility
    g. Psychological support/ communication strategies

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