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UNIT TERMINAL OBJECTIVE

5-8 At the completion of this unit, the EMT-Intermediate student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the patient with an environmentally-induced or exacerbated emergency.

COGNITIVE OBJECTIVES

At the completion of this unit, the EMT-Intermediate student will be able to:

5-8.1 Define "environmental emergency." (C-1)
5-8.2 Identify risk factors most predisposing to environmental emergencies. (C-1)
5-8.3 Identify environmental factors that may cause illness or exacerbate a pre-existing illness. (C-1)
5-8.4 Identify environmental factors that may complicate treatment or transport decisions. (C-1)
5-8.5 List the principal types of environmental illnesses. (C-1)
5-8.6 Identify normal, critically high and critically low body temperatures. (C-1)
5-8.7 Describe several methods of temperature monitoring. (C-1)
5-8.8 Describe the body's compensatory process for over heating. (C-1)
5-8.9 Describe the body's compensatory process for excess heat loss. (C-1)
5-8.10 List the common forms of heat and cold disorders. (C-1)
5-8.11 List the common predisposing factors associated with heat and cold disorders. (C-1)
5-8.12 List the common preventative measures associated with heat and cold disorders. (C-1)
5-8.13 Define heat illness. (C-1)
5-8.14 Identify signs and symptoms of heat illness. (C-1)
5-8.15 List the predisposing factors for heat illness. (C-1)
5-8.16 List measures to prevent heat illness. (C-1)
5-8.17 Relate symptomatic findings to the commonly used terms: heat cramps, heat exhaustion, and heat stroke. (C-3)
5-8.18 Discuss how one may differentiate between fever and heat stroke. (C-1)
5-8.19 Discuss the role of fluid therapy in the treatment of heat disorders. (C-1)
5-8.20 Differentiate among the various treatments and interventions in the management of heat disorders. (C-3)
5-8.21 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient who has dehydration, heat exhaustion, or heat stroke. (C-3)
5-8.22 Define hypothermia. (C-1)
5-8.23 List predisposing factors for hypothermia. (C-1)
5-8.24 List measures to prevent hypothermia. (C-1)
5-8.25 Identify differences between mild and severe hypothermia. (C-1)
5-8.26 Describe differences between chronic and acute hypothermia. (C-1)
5-8.27 List signs and symptoms of hypothermia. (C-1)
5-8.28 Correlate abnormal findings in assessment with their clinical significance in the patient with hypothermia. (C-3)
5-8.29 Discuss the impact of severe hypothermia on standard BCLS and ACLS algorithms and transport considerations. (C-1)
5-8.30 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient who has either mild or severe hypothermia. (C-3)
5-8.31 Define near-drowning. (C-1)
5-8.32 List signs and symptoms of near-drowning. (C-1)
5-8.33 Discuss the complications and protective role of hypothermia in the context of near-drowning. (C-1)
5-8.34 Correlate the abnormal findings in assessment with the clinical significance in the patient with near-drowning. (C-3)

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5-8.35 Differentiate among the various treatments and interventions in the management of near-drowning. (C-3)
5-8.36 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the near-drowning patient. (C-3)
5-8.37 Integrate pathophysiological principles of the patient affected by an environmental emergency. (C-3)
5-8.38 Differentiate between environmental emergencies based on assessment findings. (C-3)
5-8.39 Correlate abnormal findings in the assessment with the clinical significance in the patient affected by an environmental emergency. (C-3)
5-8.40 Develop a patient management plan based on the field impression the patient affected by an environmental emergency. (C-3)

AFFECTIVE OBJECTIVES

None identified for this unit.

PSYCHOMOTOR OBJECTIVES
None identified for this unit.

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DECLARATIVE

I. Environmental emergency
- A. A medical condition caused or exacerbated by the weather, terrain, atmospheric pressure, or other local factors
  - 1. Instances of environmental emergencies
  - 2. Environmental impact on morbidity and mortality
    - a. Environmental stressors that induce or exacerbate other medical or traumatic conditions
- B. Risk factors
  - 1. Age
  - 2. General health
  - 3. Fatigue
  - 4. Predisposing medical conditions
  - 5. Medications
    - a. Prescription
    - b. Over the counter (OTC)
- C. Environmental factors
  - 1. Climate
  - 2. Season
  - 3. Weather
    - a. Wind
    - b. Rain
    - c. Snow
    - d. Humidity
    - e. Temperature
    - f. Radiation
    - g. Heat
    - h. Cold
  - 4. Atmospheric pressure
  - 5. Terrain
- D. Types of environmental illnesses
  - 1. Heat illness
  - 2. Cold illness
  - 3. Localized injuries
    - a. Frostbite
    - b. Radiation burns, e.g., sunburn

II. General pathophysiology, assessment, and management
- A. Homeostasis
  - 1. "Normal" body temperatures
    - a. Core
    - b. Periphery
  - 2. Evaluation of body temperatures
    - a. Oral
    - b. Axillary
    - c. Tympanic
    - d. Rectal
    - e. Tactile

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B. Thermolysis (Methods of heat loss)
   1. Conduction
   2. Convection
   3. Radiation
   4. Evaporation
   5. Respiration

III. Specific pathology, assessment, and management - heat disorders
   A. Heat illness
      1. Definition
         a. Increased core body temperature (CBT) due to inadequate thermolysis
      2. General signs and symptoms
         a. Signs of thermolysis
            (1) Diaphoresis
            (2) Posture
            (3) Increased skin temperature
            (4) Flushing
         b. Signs of thermolytic inadequacy
            (1) Altered mentation
            (2) Altered level of consciousness
      3. Predisposing factors
         a. Age
            (1) Pediatric
            (2) Geriatric
         b. General health and medications
            (1) Diabetes
               (a) Autonomic neuropathy interferes with vasodilation and perspiration
               (b) Autonomic neuropathy may interfere with thermoregulatory input
            (2) Various medications
            (3) Acclimatization
         c. Length of exposure
         d. Intensity of exposure
         e. Environmental
            (1) Humidity
            (2) Wind
      4. Preventative measures
         a. Maintain adequate fluid intake
            (1) Thirst is an inadequate indicator of dehydration
         b. Acclimatize
            (1) Acclimatization results in more perspiration with lower salt concentration
            (2) Increases fluid volume in body
         c. Limit exposure
      5. Heat cramps
         a. Muscle cramps due to dehydration and overexertion
         b. Not specifically related to heat illness
      6. Heat exhaustion (mild heat illness)
         a. Ill-defined term referring to milder forms of heat illness
         b. Increased CBT with some neurologic deficit

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c. Signs of active thermolysis usually present
d. Symptoms may be due solely to simple dehydration, combined with overexertion
(1) Result is orthostatic hypotension
(2) Symptoms resolve with rest and supine positioning
(a) Fluids and elevation of knees beneficial
e. Symptoms that do not resolve with rest and supine positioning may be due to increased CBT, are predictive of impending heat stroke and must be treated aggressively

7. Heat stroke
a. Increased CBT with significant neurologic deficit
b. Organ damage
(1) Brain
(2) Liver
(3) Kidneys
c. Signs of active thermolysis may be present or absent
(1) Classic
(a) Commonly presents in those with chronic illnesses
(b) Increased CBT due to deficient thermoregulatory function
(c) Predisposing conditions include age, diabetes, and other medical conditions
(d) "Hot, red, dry" skin is common
(2) Exertional
(a) Commonly presents in those who are in good general health
(b) Increased CBT due to overwhelming heat stress
(c) Excessive ambient temperature
(d) Excessive exertion
(e) Prolonged exposure
(f) Poor acclimatization
(g) "Moist, pale" skin is common

B. Treatment
1. Remove from environment
2. Active cooling
a. Misting and fanning
b. Moist wraps
c. Risks of over-cooling
(1) Reflex hypothermia
d. Use of tepid water for cooling
(1) Ice packs and cold water immersion may produce reflex vasoconstriction and shivering due to effect on peripheral thermoreceptors

3. Fluid therapy
a. Oral
(1) Some salt additive is beneficial
(2) Limited need for other electrolytes in oral rehydration
(3) Salt tablets
(a) May cause GI irritation and ulceration
(b) May cause hypernatremia
(c) Should be avoided
b. Intravenous
(1) Normal saline solution preferred

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IV. Specific pathology, assessment, and management - cold disorders
- A. Hypothermia
  - 1. Definition
    - a. Decreased CBT due to
      - (1) Inadequate thermogenesis
      - (2) Excess cold stress
      - (3) A combination of both
- B. Mechanisms of heat loss
  - 1. Physiological
  - 2. Environmental
- C. Predisposing factors
  - 1. Age
    - a. Pediatric
    - b. Geriatric
  - 2. General health and medications
    - a. Hypothyroidism
    - b. Malnutrition
    - c. Hypoglycemia
    - d. Medication may interfere with thermogenesis
  - 3. Fatigue and exhaustion
  - 4. Length of exposure
  - 5. Intensity of exposure
  - 6. Environmental
    - a. Humidity
    - b. Wind
    - c. Temperature
- D. Preventative measures
  - 1. Dress
  - 2. Rest
  - 3. Food
  - 4. Limit exposure
- E. Categories of hypothermia
  - 1. Severity
    - a. Mild
      - (1) Presence of signs and symptoms with a CBT that is greater than 90° F
    - b. Severe
      - (1) Presence of signs and symptoms with a CBT that is less than 90° F
    - c. Compensated
      - (1) Presence of signs and symptoms with a normal CBT
      - (2) CBT being maintained by thermogenesis
      - (3) As energy stores (liver and muscle glycogen) are exhausted, CBT will drop
  - 2. Onset
    - a. Acute (immersion)
    - b. Subacute (exposure)
    - c. Chronic (urban)
  - 3. Primacy
    - a. Primary cause of symptoms
    - b. Secondary presentation of other etiology

F. Principal signs and symptoms
   1. No reliable correlation between signs or symptoms and specific CBT
   2. Signs of thermogenesis effort
   3. Diminished coordination and psychomotor function
   4. Altered mentation
   5. Altered level of consciousness
   6. Cardiac irritability

G. Specific treatment
   1. Stop heat loss
      a. Remove from environment
      b. Dry
      c. Wind/ vapor/ moisture barrier
      d. Insulate
   2. Rewarming
      a. Passive external
         (1) Insulation
         (2) Wind/ vapor/ moisture barrier
      b. Active external
         (1) Heat packs
            (a) Placed over areas of high heat transfer with core
               i) Base of neck
               ii) Axilla
               iii) Groin
            (b) Insulate underneath to prevent burning
         (2) Heat guns
         (3) Lights
         (4) Warm water immersion
            (a) 102° F to 104° F
            (b) Can induce rewarming shock
            (c) Little application in out-of-hospital setting
      c. Active internal
         (1) Warmed (102° F to 104° F) humidified oxygen
         (2) Warmed (102° F to 104° F) intravenous administration
         (3) Role of warmed administration
            (a) Crucial, to prevent further heat loss
         (4) Limitations of warmed administration
            (a) Actual heat transferred is minimal
            (b) Limited contribution to rewarming
   3. Rewarming shock
      a. Active external rewarming causes reflex vasodilation
      b. Requires more heat transference than is possible with methods available in out-of-hospital setting
      c. Easily prevented by IV fluid administration during rewarming
   4. Cold diuresis and the need for fluid resuscitation
      a. Oral
      b. Intravenous
   5. Resuscitation considerations
      a. BCLS considerations
         (1) Increased time to evaluate vital signs

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(2) Use of normal chest compression and ventilation rates
(3) Use of oxygen
(4) AED recommendations
b. ACLS considerations
(1) Effects of cold on cardiac medications
(2) Considerations for airway management
(a) No increased risk of inducing ventricular fibrillation (V-fib) from orotracheal or nasotracheal intubation
(3) AHA recommendations
(4) Risks and management of V-fib
(a) Risks of V-fib related both to depth and duration of hypothermia
(b) Rough handling can induce V-fib
(c) It is generally impossible to electrically defibrillate a hypothermic heart that is colder than 86° F
(d) Lidocaine paradoxically lower fibrillatory threshold in a hypothermic heart and increase resistance to defibrillation
6. Transport considerations
a. Gentle transportation necessary due to myocardial irritability
b. Transport with patient level or head slightly down
c. General rewarming options of destination
d. Availability of cardiac bypass rewarming preferable in destination consideration

V. Specific pathology, assessment, and management - near-drowning
A. Definition
1. Drowning
a. Suffocation due to submersion in water or other fluids
2. Near-drowning
a. Near suffocation due to submersion in water or other fluids with a recovery event that last at least 24 hours
B. Pathophysiology
1. Hypothermic considerations in near-drownings
a. Common concomitant syndrome
b. May be organ protective in cold water near-drownings
c. Always treat hypoxia first
d. Treat all near-drowning patients for hypothermia
C. Treatment
1. Establish airway
a. Conflicting recommendations regarding prophylactic abdominal thrusts
b. Questionable scientific data to support prophylactic abdominal thrusts
2. Ventilation
3. Oxygen
D. Trauma considerations
1. Immersion episode of unknown etiology warrants trauma management
E. Post-resuscitation complications
1. Adult respiratory distress syndrome (ARDS) or renal failure often occur post-resuscitation
2. Symptoms may not appear for 24 hours or more, post-resuscitation
3. All near-drowning patients should be transported for evaluation

VI. Locale-specific environmental emergencies

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A. Diving Emergencies
B. Altitude Illness
C. Local cold injuries
    1. Frostbite
    2. Trenchfoot

VII. Integration
A. Impact of the environment on human metabolism
    1. Heat gain or loss that exceeds the body's capacity to compensate
    2. Pressure changes that exceed the body's capacity to compensate
B. Assessment findings in patients with environmentally-induced illness
    1. Abnormal core body temperatures
    2. Signs of metabolic decompensation
    3. Development of shock state
C. Patient management
    1. Field stabilization
        a. Removal of environmental influence
        b. Support of metabolic compensation
        c. Selection of definitive care location

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