Chapter 52

Environmental Conditions

Learning Objectives

- Define environmental emergency
- Describe the incidence, morbidity, and mortality rates associated with environmental emergencies
- Identify risk factors most predisposing to environmental emergencies

Learning Objectives (Cont'd)

- Identify environmental factors that may cause illness and exacerbate preexisting illness
- Identify environmental factors that complicate treatment and transport decisions
- List the principal types of environmental illnesses
Learning Objectives (Cont'd)
• Define homeostasis and relate the concept to environmental influences
• Identify normal, critically high, and critically low body temperatures
• Describe several methods of temperature monitoring

Learning Objectives (Cont'd)
• Identify components of the body's thermoregulatory mechanism
• Describe the general process of thermal regulation, including substances used and wastes generated
• Describe the body's compensatory process for overheating

Learning Objectives (Cont'd)
• Describe the body's compensatory process for excess heat loss
• List common forms of heat and cold disorders
• List common predisposing factors associated with heat and cold disorders
Learning Objectives (Cont'd)

- List common preventive measures associated with heat and cold disorders
- Integrate pathophysiological principles and complicating factors common to environmental emergencies and discuss differentiating features between emergent and urgent presentations
- Define heat illness

Learning Objectives (Cont'd)

- Describe the pathophysiology of heat illness
- Identify signs and symptoms of heat illness
- List predisposing factors for heat illness
- List measures to prevent heat illness

Learning Objectives (Cont'd)

- Discuss symptomatic variations presented in progressive heat disorders
- Relate symptomatic findings to commonly used terms of heat cramps, heat exhaustion, and heat stroke
- Correlate abnormal findings in assessment with their clinical significance with heat illness
Learning Objectives (Cont’d)

- Describe the contribution of dehydration to the development of heat disorders
- Describe the differences between classic and exertional heat stroke
- Define fever and discuss its pathophysiological mechanism

Learning Objectives (Cont’d)

- Identify the fundamental thermoregulatory difference between fever and heat stroke
- Discuss how to differentiate fever and heat stroke
- Discuss the role of fluid therapy in the treatment of heat disorders

Learning Objectives (Cont’d)

- Differentiate various treatments and interventions in the management of heat disorders
- Integrate pathophysiological principles and assessment findings to formulate a field impression; implement a treatment plan for dehydration, heat exhaustion, and heat stroke
- Define hypothermia
Learning Objectives (Cont'd)

- Describe the pathophysiology of hypothermia
- List predisposing factors for hypothermia
- List measures to prevent hypothermia
- Identify differences between mild and severe hypothermia

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Learning Objectives (Cont'd)

- Describe the differences between chronic and acute hypothermia
- List the signs and symptoms of hypothermia
- Correlate abnormal findings in assessment with their clinical significance in patients with hypothermia

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Learning Objectives (Cont'd)

- Discuss the impact of severe hypothermia on standard basic, advanced life support algorithms, and transport considerations
- Integrate pathophysiological principles and assessment findings to formulate a field impression and to implement a treatment plan for mild or severe hypothermia
Learning Objectives (Cont’d)

- Define frostbite
- Define superficial frostbite (frostnip)
- Differentiate superficial frostbite and deep frostbite
- List the predisposing factors for frostbite

Learning Objectives (Cont’d)

- List measures to prevent frostbite
- Correlate abnormal findings in the assessment with the clinical significance of frostbite
- Differentiate various treatments and interventions in the management of frostbite

Learning Objectives (Cont’d)

- Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with superficial/deep frostbite
- Define drowning
- Describe the pathophysiology of drowning
Learning Objectives (Cont'd)

- List signs and symptoms of drowning
- Describe the lack of significance of freshwater versus saltwater immersion in relation to drowning
- Discuss the incidence of wet versus dry drownings and differences in their management

Learning Objectives (Cont'd)

- Discuss the complications and the protective role of hypothermia in the context of drowning
- Correlate abnormal findings in assessment with clinical significance in a patient with drowning
- Differentiate various treatments and interventions in the management of drowning

Learning Objectives (Cont'd)

- Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for a drowning patient
- Define self-contained underwater breathing apparatus
- Describe laws of gases and relate them to diving emergencies
Learning Objectives (Cont’d)

• Describe the pathophysiology of diving emergencies
• Define decompression illness
• Identify various forms of decompression illness

Learning Objectives (Cont’d)

• Identify various conditions that may result from pulmonary overpressure accidents
• Differentiate various diving emergencies
• List signs and symptoms of diving emergencies

Learning Objectives (Cont’d)

• Correlate abnormal findings in assessment with clinical significance in diving-related illness
• Describe the function of the Divers Alert Network and how members may aid in the management of diving-related illnesses
• Differentiate various treatments and interventions for the management of diving accidents
Learning Objectives (Cont'd)

- Describe the specific function and benefit of hyperbaric oxygen therapy for the management of diving accidents
- Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a management plan for diving accidents
- Define altitude illness

Learning Objectives (Cont'd)

- Describe the application of gas laws to altitude illness
- Describe the etiology and epidemiology of altitude illness
- List predisposing factors for altitude illness
- List measures to prevent altitude illness

Learning Objectives (Cont'd)

- Define acute mountain sickness
- Define high-altitude pulmonary edema
- Define high-altitude cerebral edema
- Discuss symptomatic variations presented in progressive altitude illnesses
Learning Objectives (Cont'd)

- List the signs and symptoms of altitude illnesses
- Correlate abnormal findings in assessment with their clinical significance in a patient with altitude illness
- Discuss the pharmacology appropriate for the treatment of altitude illnesses

Learning Objectives (Cont'd)

- Differentiate various treatments and interventions for the management of altitude illness
- Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for altitude illness

Learning Objectives (Cont'd)

- Integrate pathophysiological principles of the patient affected by an environmental emergency
- Differentiate environmental emergencies on the basis of assessment findings
- Correlate abnormal findings in assessment with clinical significance in a patient affected by an environmental emergency
Learning Objectives (Cont’d)

- Develop a patient management plan based on a field impression of a patient affected by an environmental emergency
- Describe the etiology, signs and symptoms, and management of a patient struck by lightning
- Describe the etiology, signs and symptoms, and management of patients with envenomations

Introduction

- Environmental extremes cause illness/injury
  - Environmental emergencies
  - Environmental illnesses
  - Must know service areas

Wilderness EMS

- Adapted street EMS training to wilderness environments
- Driven by local needs
- Much longer periods of EMS care delivery
Anatomy and Physiology Review

- Homeostasis
  - State of equilibrium

- Homeotherm
  - Body that strives to stay within 1° of norm

Anatomy and Physiology Review (Cont'd)

- Thermoregulation
  - Thermoreceptors
  - Brain
  - Skin
  - Spinal cord
  - Abdominal viscera
  - Great vessels

- Metabolism
  - Increases to generate heat

Anatomy and Physiology Review (Cont'd)

- External mechanisms of heat and cold response
  - Radiation
  - Exchange heat with surroundings
  - Convection
  - Air movement moves heat being radiated
  - Conduction
  - Direct contact with an object
  - Evaporation
  - Heat transfer mechanisms in tandem
Anatomy and Physiology Review (Cont'd)

- External mechanisms of heat and cold response
  - Involuntary responses
    - Perspiration
    - Blood vessels
    - Metabolism
    - Piloerection
  - Voluntary responses
    - Seek shelter from cold or heat
    - Add or remove insulation
  - Outside contributors
    - Wind velocity
    - Humidity

- Predisposing factors
  - Age
  - Health
  - Medical history
  - Shock
  - CNS insult
  - Burns
  - Medications
  - Skin conditions
  - Mental history
Anatomy and Physiology Review (Cont'd)

- Measures to prevent heat and cold injury
  - Cold
    - Avoid long periods of exposure
    - Cover exposed body surfaces
    - Layer clothing
    - Keep clothing and body dry
  - Heat
    - Avoid long periods of exposure
    - Drink plenty of clear fluids
    - Use shade to reduce heat
    - Avoid using diuretics
    - Avoid using amphetamines
    - Limit alcohol intake

Heat Emergencies

- Heat cramps
  - Muscle spasms
  - Poor fluid level
  - Overexertion with fatigue
  - Sodium and electrolyte loss
  - Extended exertion in heat
Heat Emergencies (Cont’d)

- Heat cramps
  - Physical findings
    - Cramps in fingers
    - Arms
    - Legs
    - Abdomen

- Differential diagnosis
  - Tetany
  - Other heat emergency
  - Simple muscle cramps

- Therapeutic interventions
  - Remove from heat
  - Oral hydration of electrolytes
  - IV solutions—NaCl or LR

Heat Emergencies (Cont’d)

- Heat exhaustion
  - Dehydration and compensated hypovolemia
  - Sweating
  - Sodium and electrolyte loss
  - Vasodilation with venous pooling
  - Extended exertion in heat
Heat Emergencies (Cont’d)

- Heat exhaustion
  - Physical findings
    - Rapid shallow breathing
    - Weak rapid pulse
    - Flushed or pale skin
    - Cool clammy skin
    - Heavily sweating
    - Normal core temperature that can rise to 100–105°F
    - May present with dehydration

Heat Emergencies (Cont’d)

- Heat exhaustion
  - Differential diagnosis
    - Uncomplicated dehydration
    - Hypoglycemia
    - Infection
    - Intoxication
    - Fatigue

Heat Emergencies (Cont’d)

- Heat exhaustion
  - Therapeutic interventions
    - Similar to heat cramps
    - Remove from heat
    - Supine
    - Oral hydration of fluids/electrolytes
    - IV solutions–NaCl or LR
    - Manage core temperature
Heat Emergencies (Cont’d)

- Heat stroke
  - Increase in core temperature over 105°F with decreased LOC
  - Hypothalamic temperature regulation lost
  - Chain reaction within tissue
  - Cellular death of brain, kidneys, liver
  - Hallmark is altered mental status
  - Metabolic acidosis
  - Hyperkalemia

Heat Emergencies (Cont’d)

- Heat stroke
  - Classic heat stroke
    - Long periods of heat and humidity exposure
    - Affects very young, very old, diabetics, alcoholism and cardiac history
    - Risks from diuretics, psychotropics, anticholinergics
    - Late sign - hot red dry skin

Heat Emergencies (Cont’d)

- Heat stroke
  - Exertional heat stroke
    - Sudden rise in core temperature during exertion
    - All age groups susceptible
    - Patient not fluid deprived
    - Skin may be sweaty
Heat Emergencies (Cont’d)

- Heat stroke
  - Physical findings
    - Altered LOC—disorientation, combative
    - Unconsciousness
    - Hallucinations
    - Seizures
    - Core temperature above 40.6°C or 105°F
    - Ataxia
    - Tachycardia that slows near death
    - Tachypnea progressing to bradypnea
    - Hypotension often lacking diastolic
  - Differential diagnosis
    - CVA
    - Hypoglycemia
    - Infection
    - Uncomplicated dehydration
    - Intoxication
    - Neuroleptic malignant syndrome

- Therapeutic interventions
  - Goal—cooling core temperature
  - Goal—replenish fluid
  - Airway management
  - Cardiac monitoring
Heat Emergencies (Cont’d)

• Hypothermia
  ➢ Core temperature <35°C (95°F)
  ➢ Exposure to cold
  ➢ Lack of heat production

Heat Emergencies (Cont’d)

• Hypothermia
  ➢ Primary
    • Accidental, homicidal, suicidal
    • Formerly “acute”
  ➢ Secondary
    • Complications of sepsis, trauma, carcinoma
    • Formerly “chronic”

Cold Emergencies

• Hypothermia
  ➢ Compensatory mechanisms
    • Piloerection
    • Shivering
    • Increased muscle tone
    • Peripheral vasoconstriction
    • Increased cardiac output
    • Increased respiratory rate
Cold Emergencies (Cont’d)

● Hypothermia
  ➢ Core temperature drops
  • Failure of compensatory mechanisms
  • Metabolic rate drops
  • Cardiac output drops

Cold Emergencies (Cont’d)

● Hypothermia
  ➢ Mild hypothermia 34–36°C (93.3–96.8°F)
  ➢ Moderate hypothermia 30–34°C (86–93.2°F)
  ➢ Severe hypothermia <30°C (86°F)
  ➢ Poikilothermic

Cold Emergencies (Cont’d)

● Hypothermia
  ➢ Predisposing factors
    • Alcoholism
    • Burns
    • Hypothyroidism
    • Extremes in age
Cold Emergencies (Cont’d)

- Hypothermia
  - Physical findings
    - Assess the environment
    - Core temperature via rectal
    - Stunned peripheral sensation may impair patient’s ability to feel injuries

Cold Emergencies (Cont’d)

- Hypothermia
  - Physical findings
    - Mild hypothermia
      - Normal heart rate
      - Adequate BP
      - Pale, dry or wet skin
      - Slurred speech
      - Shivering
      - Uncoordinated movement
      - Impaired judgment
      - Impaired fine motor skills
      - Sluggishness

Cold Emergencies (Cont’d)

- Hypothermia
  - Physical findings
    - Moderate hypothermia
      - Decreased respiratory rate
      - Normal heart rate or bradycardia, atrial fibrillation, PVCs
      - Adequate BP or hypotension (difficult to obtain)
      - Pale, cyanotic, or mottled skin
      - Confusion to decreased responsiveness
      - Stiffening muscles
      - Decreased shivering
      - Stops below 86–89.6°F
      - Ataxia
Cold Emergencies (Cont’d)

- Hypothermia
  - Physical findings
    - Severe hypothermia
    - Decreased cardiac output, metabolic rate, cerebral blood flow
    - Fixed, dilate pupils
    - Compromised airway
    - Slow, shallow, or absent respirations
    - Pulmonary edema may develop
    - Slowed heart rate
    - Possible Osborne waves on ECG
    - Cyanotic or mottled skin

Cold Emergencies (Cont’d)

- Hypothermia
  - Differential diagnosis
    - Intoxication
    - CVA
    - Head injury
    - Hypothyroidism
Cold Emergencies (Cont’d)

- Hypothermia
  - Therapeutic interventions
    - Prevent further heat loss
    - Remove wet clothing
    - Eliminate wind
    - Insulate patient
    - Passive rewarming
    - Appropriate for all types
    - Move to warm environment
    - Apply warm dry clothing
    - Insulate above and below patient with blankets

Cold Emergencies (Cont’d)

- Hypothermia
  - Therapeutic interventions
    - Active external rewarming
    - Active internal rewarming
    - Allow patient to urinate
    - Begin CPR if apneic and pulseless
    - Defibrillation
    - IV medications

Cold Emergencies (Cont’d)

- Frostbite
  - Clinical characteristics
    - Freezing of body tissue
    - Pulls water from cells to extracellular space
    - Ice crystals expand and destroy surrounding cells
    - Frostnip is more superficial and reversible
    - No extracellular freezing
Cold Emergencies (Cont’d)

- Frostbite
  - Superficial frostbite
    - Superficial
      - Epidermis and subcutaneous tissue
      - Surrounding tissue reddened
      - White or yellowish, firm skin in area
      - Generally painful

- Frostbite
  - Deep frostbite
    - May also be hypothermic
    - Epidermis, subcutaneous tissue, may involve muscles, nerves, tendons, bones
    - Skin white, hard and frozen to touch
    - Loss of sensation
    - Unable to move or bend frozen part
    - Significant pain during rewarming
    - May require amputation of part

- Frostbite
  - Epidemiology and demographics
    - Mountaineers, explorers
    - Tobacco abusers
    - Fatigued or malnourished individuals
    - Soldiers

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Cold Emergencies (Cont’d)

- Frostbite
  - Differential diagnosis
    - Chilblains
    - Pernio
    - Trench foot
    - Cold urticaria
    - Uncomplicated hypothermia
    - Raynaud’s phenomenon
    - Local infection
    - Ischemic injuries
    - Blunt trauma

Cold Emergencies (Cont’d)

- Frostbite
  - Therapeutic interventions
    - Limit further exposure and injury
    - Delay thawing if chance of refreezing exists
    - Minimize movement
    - Do not rub or massage

Cold Emergencies (Cont’d)

- Trench foot
  - Physical findings
    - Similar to those of frostbite
    - Generally above freezing temperatures
    - Injury occurs over days
    - Extremity feels cold and numb
    - Skin appears blanched
Cold Emergencies (Cont’d)

- Trench foot
  - Differential diagnosis
    - Chilblains
    - Pernio
    - Frostbite
    - Frostnip
    - Cold urticaria
    - Raynaud’s phenomenon
    - Local infection
    - Ischemic injuries
    - Blunt trauma

Cold Emergencies (Cont’d)

- Trench foot
  - Therapeutic interventions
    - Dry the area
    - Remove from environment
    - Rewarming area
    - Elevation
    - IV
    - Analgesics if not contraindicated

Submersion Injuries: Drowning and Associated Cautions

- Definition and description
  - Immersion
  - Submersion
  - Drowning
Submersion Injuries: Drowning and Associated Cautions (Cont’d)

- Immersion syndrome
  - Sudden cardiac arrest caused by massive vagal stimulation after sudden exposure to cold water
- Postimmersion syndrome
  - Delayed deterioration of a previous asymptomatic or minimally symptomatic patient

Submersion Injuries: Drowning and Associated Cautions (Cont’d)

- Shallow water blackout
  - Unconsciousness after submersion

Submersion Injuries: Drowning and Associated Cautions (Cont’d)

- Epidemiology and demographics
  - Second leading cause of accidental death in the United States
  - Leading cause of accidental pediatric death
  - Teenagers second major group
  - Elderly third highest group
Submersion Injuries: Drowning and Associated Cautions (Cont’d)

**Etiology**
- Classic sequence starts with panic
  - Victim can no longer hold breath, reflexively takes a breath, and water enters mouth
  - Victim takes several violent intakes of air and water while flailing
- Water intake hits posterior oropharynx
  - Laryngospasm
  - Bronchospasm
  - Severe hypoxia
  - Acidosis
  - Cardiac disturbances
  - CNS anoxia
  - Coma

**Physical findings**
- Often accompanied by trauma
- Cardiac disturbances common
- Hypothermia common
Submersion Injuries: Drowning and Associated Cautions (Cont’d)

• Differential diagnosis
  ➢ Trauma
  ➢ Spinal injury
  ➢ Cardiac disturbances
  ➢ Hypothermia
  ➢ Hypoglycemia
  ➢ CNS disturbances
  ➢ Metabolic abnormalities

Submersion Injuries: Drowning and Associated Cautions (Cont’d)

• Therapeutic interventions
  ➢ Priority is reversing hypoxia
  ➢ If any resuscitation is required, patient must be transported

Submersion Injuries: Drowning and Associated Cautions (Cont’d)

• Complications
  ➢ Sudden respiratory arrest
  ➢ ARDS
  ➢ Release of fluid into alveoli
  ➢ Inflammation of alveoli and lung tissue
  ➢ Loss of surfactant
  ➢ Atelectasis
  ➢ Aspiration pneumonia
  ➢ Pneumothorax
Diving Emergencies

- Physics of diving emergencies
  - Water exerts additional pressure against body
  - Fluids are not compressible
  - Gas-filled organs can be compressed and are affected
  - Boyle's law
  - Dalton's law
  - Henry's law

Diving Emergencies (Cont'd)

- Barotrauma
  - Physical damage to body tissue
  - Caused by changes in pressure between inside of body and air/liquid surrounding body
  - High pressure to low pressure
  - Low pressure to high pressure
  - Most common medical complication of diving

Diving Emergencies (Cont'd)

- Barotrauma
  - Physical findings
    - Descending injuries
      - Inability to equalize pressure between nasopharynx and middle ear
      - Middle ear pain
      - Ringing in ears
      - Dizziness
      - Hearing loss
      - Rupture of eardrum
      - Frontal headache
      - Pain behind eyes
Diving Emergencies (Cont'd)

- Barotrauma
  - Physical findings
    - Ascending injuries
      - Obstructions prevent expanding air from escaping, injures surrounding tissue
      - Obstruction can be holding breath, bronchospasm, or mucus plug

- Barotrauma
  - Physical findings
    - Pulmonary overpressurization syndrome
    - Expansion damages lung tissue
    - Arterial gas embolism
    - Pneumomediastinum
    - Pneumothorax

- Barotrauma
  - Differential diagnosis
    - Infection
    - Decompression sickness
    - Trauma
  - Therapeutic interventions
    - High flow O₂
    - IV access
    - Injury-specific treatments
Diving Emergencies (Cont'd)

- Nitrogen narcosis
  - Diving injury that causes stupor and affects cerebral function
  - Nitrogen becomes more soluble at pressure
  - Produces anesthetic and intoxication effect
  - Physical findings
    - Euphoria
    - Poor thinking

Diving Emergencies (Cont'd)

- Nitrogen narcosis
  - Differential diagnosis
    - Intoxication
    - Hypoglycemia
    - CNS infection
  - Therapeutic interventions
    - Ascent to shallower depth
    - Same treatments as other barotrauma

Diving Emergencies (Cont'd)

- Decompression sickness
  - Formation of nitrogen bubbles in bloodstream and tissue
  - Bubbles occur with too rapid ascent
  - Bubbles cause excessive pressure in body areas
  - Presents in joints, tendons, spinal cord, skin, brain, inner ear
  - Occurs in dives deeper than 33′
Diving Emergencies (Cont’d)

• Decompression sickness
  ➢ Physical findings
    • Generally not visible until diving concludes
    • Complaints involving joints and abdomen
    • Fatigue
    • Paresthesias
    • CNS disturbances
    • Onset may be up to 24 hours after dive

Diving Emergencies (Cont’d)

• Decompression sickness
  ➢ Differential diagnosis
    • Fatigue
    • CVA
    • Intoxication
    • Infection
  ➢ Therapeutic interventions
    • Same as other barotraumas
    • Long-term care may involve recompression

Diving Emergencies (Cont'd)

• Decompression sickness
  ➢ Diving injury prevention
    • Do not hold breath while diving
    • Control breathing under water
    • Avoid long dives at depth
    • Get rest between dives
    • Ensure proper hydration
    • Avoid alcohol when diving
    • Make ascents slowly
Altitude-Related Illness

- Similar to diving emergencies
  - Sustained from decreasing pressure
  - Lowering partial pressure of oxygen
  - Unpressurized aircraft flight, mountain travel
  - Most common in elevation >8000 feet

Altitude-Related Illness (Cont’d)

- Acute mountain sickness
  - Most common altitude illness
  - Etiology
    - Hypoxia from reduced O₂ pressure
    - Fluid redistribution
    - Sympathetic activity
    - Hypoventilation
    - Cerebral edema

Altitude-Related Illness (Cont’d)

- Acute mountain sickness
  - Physical findings
    - Mild
      - Headache
      - Light-headedness and dizziness
      - Difficulty sleeping
      - Loss of appetite
      - Breathlessness
      - Fatigue
      - Nausea and vomiting
Altitude-Related Illness (Cont’d)

• Acute mountain sickness
  ➢ Physical findings
    ➢ Severe
    ➢ Severe weakness
    ➢ Severe, protracted vomiting
    ➢ Decreased urine output
    ➢ Resting dyspnea
    ➢ Altered LOC
    ➢ Cough and congestion
    ➢ Inability to walk straight line/ataxia
    ➢ Pale or changing skin color

Altitude-Related Illness (Cont’d)

• Acute mountain sickness
  ➢ Differential diagnosis
    ➢ Viral infection
    ➢ Dehydration
    ➢ Hypoglycemia
    ➢ Metabolic derangements
    ➢ Intoxication or hangover
    ➢ Fatigue
  ➢ Therapeutic interventions
    ➢ If not relieved by rest, descent necessary

Altitude-Related Illness (Cont’d)

• High-altitude pulmonary edema
  ➢ Fluid buildup in lungs caused by altitude
  ➢ Etiology
    ➢ Fluid buildup prevents oxygen and CO₂ exchange
    ➢ Hypertension
    ➢ Hypoxia
    ➢ Hypoperfusion
    ➢ Impaired cerebral function
    ➢ Death
Altitude-Related Illness (Cont’d)

- High-altitude pulmonary edema
  - Physical findings
    - Persistent wet cough, producing white, watery, frothy fluid
    - Crackles for breath sounds
    - Inability to sleep
    - Inability to lay supine without sensation of suffocation
    - Dyspnea
    - Hyperpnea
    - Lethargy
    - Irritability, confusion, disorientation
    - Coma

Altitude-Related Illness (Cont’d)

- High-altitude pulmonary edema
  - Differential diagnosis
    - Pneumonia
    - Infection
    - Fatigue
    - Cardiogenic and noncardiogenic pulmonary edema
    - Hypoxia
    - Hypoglycemia
    - Metabolic disorders

Altitude-Related Illness (Cont’d)

- High-altitude pulmonary edema
  - Therapeutic interventions
    - Primary treatment is descent
    - O₂
    - Specialized nonstandard EMS medications
    - Nifedipine
Altitude-Related Illness (Cont’d)

- High-altitude cerebral edema
  - Most severe altitude injury causing intracranial pressure from swelling
  - Etiology
    - Excessive fluid leakage and swelling of the brain
    - Increased intracranial pressure
    - Occurs after 1-3 days at altitude
    - Most often occurs at >12,000 ft

Altitude-Related Illness (Cont’d)

- High-altitude cerebral edema
  - Physical findings
    - Disorientation
    - Severe headache
    - Ataxia
    - Decreased LOC
    - Drowsiness not relieved by rest
    - Hallucinations
    - Confusion
    - Stupor
    - Coma

Altitude-Related Illness (Cont’d)

- High-altitude cerebral edema
  - Differential diagnosis
    - CVA
    - Hypoglycemia
    - Other metabolic derangements
    - Intoxication
    - Fatigue
    - AMS
Altitude-Related Illness (Cont’d)

- High-altitude cerebral edema
  - Therapeutic interventions
    - Rapid descent is imperative
    - \( \text{O}_2 \)
    - IV access
    - Dexamethasone

Altitude-Related Illness (Cont’d)

- Prevention of high-altitude illnesses
  - Many strategies
  - Generally, slow ascents with rest periods and acclimation

Lightning Injury

- Injuries from transmission of electricity between sky and ground
- Etiology
  - Direct strike
  - Splash injury
  - Contact injury
  - Step voltage injury
  - Blunt injury
  - Streamer injury
Lightning Injury (Cont’d)

- Physical findings
  - Minor injury
    - Tympanic membrane rupture
    - Confusion
    - Amnesia
    - Brief loss of consciousness
    - Temporary deafness
    - Blindness
    - Paresthesia or dysesthesias in extremities
    - Myalgia

- Physical findings
  - Moderate injury
    - Disorientation
    - Combativeness
    - Coma
    - Motor paralysis
    - Absent pulses due to arterial spasm
    - Sympathetic instability
    - Hypotension
    - Vascular trauma
    - Spinal shock
    - Seizures
    - Burns

- Physical findings
  - Severe injury
    - Cardiac arrhythmia
    - Cardiac arrest
    - Pulmonary edema
    - Pulmonary contusion
Lightning Injury (Cont’d)

- Differential diagnosis
  - High-voltage injury
- Therapeutic interventions
  - Pulseless victims are treated first
  - Symptomatic interventions
  - Prevention

Envenomated Animal Bites

- Snakes
  - Clinical characteristics
    - Venoms are complex toxins
    - Many local and systemic effects
    - Generally only lethal in children and the elderly
  - Physical findings
    - Can cause precipitous deterioration in victims
    - Distal neurovascular status may decrease
    - Localized swelling

Envenomated Animal Bites (Cont’d)

- Snakes
  - Differential diagnosis
    - Nonvenomous bites
  - Nonzoological trauma
  - Therapeutic interventions
    - Immobilize injured area at level lower than heart
    - Keep victim calm
    - Transport
    - IV access
    - Prevention
Envenomated Animal Bites (Cont'd)

- Arachnids
  - Clinical characteristics
    - Scorpion venom is paralytic
    - Brown recluse venom causes skin lesions
    - Black widow venom causes sustained muscle spasms, including abdominal rigidity

Envenomated Animal Bites (Cont'd)

- Arachnids
  - Physical findings
    - Scorpion sting—significant local pain
    - Brown recluse bites—serious ulcerated
    - Cutaneous damage
    - Black widow spider—severe muscle spasms

Envenomated Animal Bites (Cont'd)

- Arachnids
  - Differential diagnosis
    - Nonvenomous bites
    - Dermatitis
  - Therapeutic interventions
    - Keep victim calm
    - Scorpion bite
    - Black widow
    - Brown recluse bite
Chapter Summary

- Management of environmental emergencies requires
  - Integration of pathophysiological principles
  - Understanding of the anatomy, physiology, and metabolic mechanisms the body use to maintain homeostasis

Chapter Summary (Cont’d)

- Differentiation between urgent and emergent conditions may be different in remote or austere areas
  - In remote or rugged environments, conditions that are urgent in urban medicine need to be managed emergently because of difficulties in adequately treating and transporting patients in a timely manner

Chapter Summary (Cont’d)

- As with most injuries and illnesses, many preventive measures can be taken in advance
  - Many victims of environmental injuries do not prepare properly, subsequently they suffer dire consequences
Chapter Summary (Cont’d)

- Basic knowledge of the environmental effects on the body is helpful to a paramedic attempting to reverse events that have occurred within the patient.

Questions?