Chapter 30

Environmental Emergencies

Chapter Goal

- Use assessment findings to formulate field impression & implement treatment plan for patients with environmentally induced or exacerbated emergencies

Learning Objectives

- Define \textit{environmental emergency}
- Identify risk factors predisposing persons to environmental emergencies
- Identify environmental factors that may cause illness or exacerbate preexisting illness
- Identify environmental factors that may complicate treatment or transport decisions
- List principal types of environmental illnesses
Learning Objectives

- Identify normal, critically high, & critically low body temperatures
- Describe several methods of temperature monitoring
- Describe body's compensatory process for overheating
- Describe body's compensatory process for excess heat loss
- List common forms of heat & cold disorders

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Learning Objectives

- List common predisposing factors associated with heat & cold disorders
- List common preventive measures associated with heat & cold disorders
- Define heat illness
- Identify signs & symptoms of heat illness

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Learning Objectives

- List predisposing factors for heat illness
- List measures to prevent heat illness
- Relate symptomatic findings to commonly used terms: heat cramps, heat exhaustion, & heat stroke
- Discuss how to differentiate between fever & heat stroke
- Discuss role of fluid therapy in treatment of heat disorders
Learning Objectives

- Differentiate among various treatments & interventions in management of heat disorders
- Integrate pathophysiological principles & assessment findings to formulate field impression & implement treatment plan for patients who have dehydration, heat exhaustion, or heat stroke
- Define hypothermia
- List predisposing factors for hypothermia

Learning Objectives

- List measures to prevent hypothermia
- Identify differences between mild & severe hypothermia
- Describe differences between chronic & acute hypothermia
- List signs & symptoms of hypothermia
- Correlate abnormal assessment findings with their clinical significance in patients with hypothermia

Learning Objectives

- Discuss impact of severe hypothermia on standard BLS & ACLS algorithms & transport considerations
- Integrate pathophysiological principles & assessment findings to formulate field impression & implement treatment plan for patients who have either mild or severe hypothermia
- Define near-drowning
- List signs & symptoms of near-drowning
Learning Objectives

- Discuss complications & protective role of hypothermia in context of near-drowning
- Correlate abnormal assessment findings with clinical significance in victim of near-drowning
- Differentiate among various treatments & interventions in management of near-drowning

Learning Objectives

- Integrate pathophysiological principles & assessment findings to formulate field impression & implement treatment plan for victims of near-drowning
- Integrate pathophysiological principles regarding patient affected by environmental emergencies
- Differentiate between environmental emergencies on basis of assessment findings
- Correlate abnormal findings in assessment with clinical significance in patients affected by environmental emergencies

Learning Objectives

- Develop patient management plan based on field impression of patient affected by an environmental emergency
- Recall & integrate into practice-specific patient assessment & management techniques for particular locale-specific emergencies (e.g., diving accidents, altitude emergencies)
Introduction

- Environmental emergency
  - Medical condition caused or exacerbated by weather, terrain, atmospheric pressure, or other local factors
  - May be life threatening

- Risk factors
  - Age
  - General health
  - Fatigue
  - Predisposing medical conditions
  - Medications

Introduction

- Environmental factors
  - Climate
  - Season
  - Weather
  - Atmosphere
  - Terrain
  - Other conditions complicated by environmental conditions

- Types of environmental illnesses
  - Systemic
  - Localized

Pathophysiology

- Homeostasis
  - Body temperature
  - Core body temperature measured
  - Tactile measurement

- Thermolysis
  - Radiation
  - Conduction
  - Convection
  - Evaporation
Heat Disorders

- General concepts
  - Signs of thermolysis
    - Diaphoresis
    - ↑ Skin temperature
    - Flushing
  - Signs of thermolytic inadequacy
    - Altered LOC
  - Extremes of age
    - ↑ Sensitivity to heat & cold
    - Diabetes
    - Medications

- Relative contributing factors
  - Length & intensity of exposure
  - Ambient environmental conditions
- Acclimatization
  - Requires at least 1 wk of gradually increasing heat exposure

Heat Disorders

- Heat cramps
  - Cause
    - Dehydration
    - Overexertion
    - ↑ Loss of salt & water
  - Signs & symptoms
    - Muscle twiching, painful spasms
    - Nausea, vomiting
    - Weakness
    - Diaphoresis
Heat Disorders

- Heat exhaustion
  - High incidence
    - Young children
    - Persons taking diuretics
    - People unable to maintain adequate fluid intake
    - Prolonged diarrhea
  - Signs & symptoms
    - Pallor
    - Profuse sweating
    - Hypotension
    - Headache
    - Thirst
    - Normal, slightly ↑ temperature

- Heat stroke
  - Signs & symptoms
    - Altered LOC
    - ↑ Body temperature
    - Minimal, no sweating
    - Collapse
    - Shock
    - Nausea, vomiting
    - Shortness of breath

- Care
  - Move patient to cool environment
  - Remove some clothing, fan patient
  - Give high-concentration O₂
  - Oral fluids
  - Start IV per local protocols
  - Monitor ECG
  - Transport ASAP
Heat Disorders

- Heat stroke
  - Care
    * Rapid cooling
    * Move patient to cool environment
    * Remove clothing
    * Cool patient with tepid water & fanning
    * Give high-concentration O₂
    * Start IV per local protocol
    * Monitor ECG
    * Transport ASAP

Cold Disorders: Hypothermia

- Causes & predisposing factors
  - Primary causes
    * Cold water immersion
    * Cold weather exposure
    * Urban hypothermia
  - Conditions that may contribute to hypothermia:
    * Alcohol
    * CNS depressants
    * Infections
    * Endocrine system disease
    * Brain dysfunction
    * Burns
  - Predisposing factors
    * Elderly person living alone
    * Alcohol intoxication
    * Children <1 yr old
    * Submersion injury
    * Head trauma
    * Trauma with subsequent blood loss
    * Person lost or immobilized in cold weather
Cold Disorders: Hypothermia

- Causes & predisposing factors
  - Medications that interfere with thermogenesis
    - Narcotics, phenothiazines, alcohol, barbiturates
    - Antiseizure medications
    - Antihistamines & other allergy medications
    - Antipsychotics, sedatives, antidepressants
    - Various pain medications

Cold Disorders: Hypothermia

- Classification of hypothermia
  - Mild
    - CBT >34° C (93.2 ° F)
  - Moderate
    - CBT 30 ° C to 34 ° C (86 ° F to 93.2 ° F)
  - Severe
    - CBT <30 ° C (86 ° F)
  - Compensated
    - Signs & symptoms with normal CBT
  - Onset
    - Acute—occurs rapidly, little chance for survival if no immediate rescue
    - Subacute—occurs over minutes to hours
    - Chronic—occurs hours to days

Cold Disorders: Hypothermia

- Signs & symptoms
  - ↓ Coordination, psychomotor function
  - Altered LOC
  - Cardiac irritability
Cold Disorders: Hypothermia

Treatment
- ABCs
- Stop ongoing heat loss
- Handle patient gently; maintain horizontal position
- Give high-concentration O2 or assist ventilations
- Give warm fluids
- Start IV line
- Care for other life-threatening injuries
- Follow local protocols for rewarming

Cold Disorders: Hypothermia

Resuscitation considerations
- BLS
  - Cardiac arrest—check pulse for 3-45 sec before starting chest compressions
  - Use warmed humidified O2 if available
  - Apply AED if VF present; deliver 1 shock; resume CPR for 2 min before rechecking pulse
  - Withhold subsequent shocks until patient rewarmed to at least 30° C (86 °F)
  - Continue CPR, rewarming, transport rapidly

Cold Disorders: Hypothermia

Resuscitation considerations
- ALS
  - VF/pulseless VT
    - No medications if body temperature <30° C (86 °F)
    - If patient down >4-5 min, perform 2 min of CPR
    - Defibrillate
    - CPR for 2 min,
    - Check pulse
    - Follow ACLS guidelines per local protocol
- Transport
  - Gentle transport mandatory
Local Injuries: Frostbite

- Frostbite
  - Trench foot

- Patient assessment
  - Initially, extremity waxy, yellowish white, or bluish white
  - Area may be soft or firm
  - With rewarming, area becomes flushed with red to purple-burgundy color
  - Edema within hours of thawing
  - Following thawing, blisters may form
  - After 9-15 days, black, hard scar
  - If tissue death occurs, area will be moist & weep with pus

Local Injuries: Frostbite

Edema & blister formation 24 hrs after injury

Gangrenous necrosis 6 wks post-injury

Local Injuries: Frostbite

- Treatment
  - Check for other injuries
  - Treat hypothermia first
  - Remove jewelry
  - Dry, sterile dressing between affected digits
  - Elevate & immobilize
  - DO NOT:
    - Break blisters
    - Allow smoking
    - Allow alcohol
    - Rewarm in field
    - Rub

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Near-Drowning

- Drowning vs. near-drowning

- Causes
  - Swimmer exhaustion
  - Lack of skill
  - Panic
  - Acute medical condition while swimming
  - Suicide attempts

Near-Drowning

- Epidemiology
  - Types of drowning:
    - "Dry" drowning
    - "Wet" drowning
    - Secondary drowning

- Special considerations
  - Hypothermia

Seawater vs. freshwater drowning
Near-Drowning

- Patient assessment
  - May appear normal initially
  - Progressive dyspnea
  - Wheezing, other lung sounds
  - Tachycardia
  - Cyanosis
  - Chest pains, mental confusion
  - Coma, respiratory or cardiac arrest

Near-Drowning

- Treatment
  - Remove from water
    - If neck injury suspected, place on long backboard, stabilize neck, then remove from water
  - Maintain airway
  - Give high-concentration O₂ or ventilate as appropriate
  - Monitor ECG
  - Start IV TKO
  - Defibrillate if appropriate
  - Follow ACLS protocols if normothermic

Near-Drowning

- Complications
  - Persistent hypoxemia
  - Infection
  - Renal failure
  - Persistent neurological deficit

- Pearls
  - Be prepared for vomiting
  - Transport all submersion victims
  - Beware of neck injuries
  - Hypothermic patients
Locale-Specific Problems: Scuba Diving Emergencies

- Diving physiology
- Barotrauma

General principles
- Take adequate history
  - Number of dives
  - Depth of each dive
  - Bottom time
  - Type of equipment used
  - Environmental factors
  - Diving with companion
  - Type of gas mixture
  - Was in-water recompression attempted?
  - Did diver fly or jog before developing symptoms?

Air embolism
- Presence of air bubbles in central circulation
- Cause—holding breath on ascent
- Signs & symptoms
  - Chest tightness
  - Shortness of breath
  - Pink, frothy sputum
  - Vertigo
  - Paresthesia, paralysis
  - Seizures
  - Loss of consciousness
  - Signs/symptoms of tension pneumothorax
Locale-Specific Problems: Scuba Diving Emergencies

- Air embolism
  - Treatment
    - High-concentration O₂
    - Needle thoracostomy, if tension pneumothorax present
    - Left lateral decubitus position
    - Serial vital signs
    - IV fluids TKO
    - Recompression

Locale-Specific Problems: Scuba Diving Emergencies

- Nitrogen narcosis
  - Apathetic, slightly euphoric mental state
  - Patient assessment
    - Drowsiness
    - ↓ Mental function
    - ↓ Strength, coordination
    - Unconsciousness, death
  - Treatment
    - Gradual ascent

Locale-Specific Problems: Scuba Diving Emergencies

- Decompression sickness
  - The “bends”
  - Pathophysiology
    - ↓ Tissue perfusion, ischemia
    - Interstitial edema
  - Patient assessment
    - Blotchy, red torso
    - Pain
    - Dizziness, “staggerers”
    - Shortness of breath, “choke”
Locale-Specific Problems: Scuba Diving Emergencies

- Decompression sickness
  - Treatment
    - Follow local protocols
  - Pearls
    - Suspect if joint soreness 24–48 hrs after dive
    - Can occur <33 ft depth
    - Not advisable to fly in unpressurized aircraft within 24 hrs
    - With paralysis, suspect decompression trauma, spinal cord syndrome

Locale-Specific Problems: High-Altitude Illness

- Activities
  - Mountain climbing
  - Snow skiing
  - Travel to higher elevations
  - Flying in unpressurized cabins

- Most common altitude syndromes
  - Acute mountain sickness
  - High-altitude pulmonary edema
  - High-altitude cerebral edema

Locale-Specific Problems: High-Altitude Illness

- Emergency care
  - Maintain ABCs
  - Descent to lower altitude
  - Appropriate transport to definitive care facility
Locale-Specific Problems: High-Altitude Illness

- Acute mountain sickness
  - Occurs after rapid ascent to altitudes >8000 ft
  - Symptoms
    * Dizziness
    * Headache
    * Irritability
    * Breathlessness
    * Euphoria
    * Difficulty sleeping
    * Nausea
  - Elderly: Pulmonary edema, heart failure
  - Severe: Altered LOC, coma

Locale-Specific Problems: High-Altitude Illness

- High-altitude pulmonary edema
  - Symptoms
    * Shortness of breath
    * Tachypnea
    * Cyanosis

- High-altitude cerebral edema
  - Most severe form of altitude illness
  - ↓ LOC
  - Transport ASAP

Summary

- Environment has significant impact on human body & its metabolism

- Features common to different environmental emergencies include:
  - Abnormal core body temperatures
  - Signs of metabolic decompensation
  - Development of shock in late disease
Summary

- Management primarily aimed at stabilization of patient:
  - Removal of abnormal environmental influence
  - Support of metabolic decompensation
  - Transport to treatment facility

Questions?