Chapter 16
Environmental Emergencies

Learning Objectives

- Describe heat loss
- List the signs and symptoms of cold exposure
- Describe assistance that can be given to victims of cold exposure
- List the signs and symptoms of exposure to heat

Learning Objectives

- Describe assistance that can be given to victims of heat exposure
- List signs and symptoms of drowning and near-drowning
- Describe assistance that may be given to victims of drowning/near-drowning
Learning Objectives

- Describe types of bites and stings that may cause illness in patients
- Describe assistance that can be given to victims of bites and stings

Introduction

- Environmental emergencies are situations in which the external environment surrounding a person makes the person ill
  - Exposure usually results in illness/injury but can cause death in extreme cases

Communication

- Two common examples of environmental emergencies are those caused by heat and cold
  - Individuals exposed to extremes of heat/cold can have mild to severe effects
  - Even relatively short periods of lighter exposure can cause harm to patients who are otherwise compromised by illness/injury
Thermoregulation

- Refers to way the body creates and releases heat.
  - Knowledge of process helps you understand how people respond to extreme changes in temperature.
  - Body creates heat through cellular metabolism:
    - As fuel and O₂ enter cells of the body, CO₂ waste and heat are generated.
    - Heat generated is usually sufficient to keep body's temperature in optimal range.
    - If heat generated is more than or less than what the body requires, it is either released from or absorbed into the body.

Thermoregulation

- Heat transfer
  - Is the way that needed heat is moved into the body and how excess heat is released from the body.
  - Transfer is accomplished through the following mechanisms:
    - Conduction
    - Convection
    - Evaporation
    - Respiration
    - Radiation
Thermoregulation

- Heat transfer
  - Conduction
    - Direct transfer of heat from a warmer object to cooler object
    - You lose body heat when you sit/lie on a surface cooler than your body temperature
    - Certain materials conduct heat better than others

Thermoregulation

- Heat transfer
  - Convection
    - Heat loss through heating of cooler water or air as it passes over warmer surface
    - Body will lose heat 25 times faster in water than in air

Thermoregulation

- Heat transfer
  - Evaporation
    - Loss of heat that occurs when water/moisture from perspiration on skin is converted to water vapor
    - Can be the cause of large amounts of body heat loss
Thermoregulation

• Heat transfer
  ➢ Radiation
    • Direct transfer of energy without external medium such as wind/water
    • Any object warmer than the external environment gives off heat in the form of infrared radiation
    • Keeping skin covered helps prevent loss of body heat from radiation

Thermoregulation

• Heat transfer
  ➢ Respirations
    • Can be a source of heat loss if external air is cooler than body temperature
      ➢ Cooler outside air is inhaled and then warmed to body’s internal temperature
      ➢ Once warmed air is exhaled it takes increased heat with it, causing decrease in body’s temperature

Cold-Related Emergencies

• Frostbite
  ➢ Localized cold emergency

• Hypothermia
  ➢ Generalized cold emergency
Cold-Related Emergencies

- When exposed to cold
  - Keep yourself and patient dry
  - Avoid direct contact with items colder than yourself
  - Dress in layers that will trap dry air
  - Wear a hat to prevent heat loss from your head

- Once on scene, spend the first minute layering up with extra clothing
  - As you get involved with patient care and cool off, you will remain warm
    - This can be done while surveying scene for safety and mechanism of injury
    - Proper nutrition gives you a better chance at conserving heat

Cold-Related Emergencies

- Local cold emergencies
  - Frostbite
    - Freezing or near-freezing of a body part
  - Can be classified as:
    - Superficial
    - Deep
  - Can occur with/without hypothermia
  - Typically occurs in exposed extremities
  - Can often see a line of demarcation, separating frostbitten area from undamaged tissue
Cold-Related Emergencies

• Local cold emergencies
  ▶ Signs and symptoms
    ◦ Superficial frostbite
      ▶ Blanching (whitening) of skin
      ▶ Loss of sensation in injured area
      ▶ Skin that is soft to touch
      ▶ If area is rewarmed, complaints of tingling sensation

• Local cold emergencies
  ▶ Signs and symptoms
    ◦ Deep frostbite
      ▶ White, waxy skin
      ▶ Skin that is firm or feels frozen to touch
      ▶ Swelling
      ▶ Blisters
      ▶ If thawed/partially thawed, skin may appear flushed with areas of purple and blanching, may be mottled and bluish
Cold-Related Emergencies

- **Local cold emergencies**
  - Management of local cold emergencies
    - Focus on getting patient out of cold environment
    - Follow usual sequence of assessment
    - Frostbitten part should be warmed quickly
    - Comfort, calm, and reassure patient until ambulance arrives

- **Generalized cold emergencies**
  - **Hypothermia**
    - Generalized cold emergency occurs when a patient’s body temperature drops from normal 98.6°F to <95°F
    - Primary hypothermia
      - Body’s core temperature dropping below 95°F (35°C) because of environmental exposure
    - Secondary hypothermia
      - Occurs when illness, alcohol, or aging influences body’s ability to retain heat

- **Signs and symptoms—generalized hypothermia**
  - Cool/cold skin temperature
  - Shivering
  - Poor judgment
  - Dizziness
  - Stiff or rigid posture
  - Decreasing mental status/motor function
Cold-Related Emergencies

- Generalized cold emergencies
  - Management of generalized cold emergency
    - Scene size-up
    - Initial assessment
    - As patient's body temperature decreases, the respiratory rate and pulse rate will slow and eventually stop
    - Warm gently through passive means
    - Never give patient anything by mouth

Heat-Related Emergencies

- Patients external environment and level of physical activity are primary factors that lead to heat-related emergencies
  - Normally the body tries to maintain a temperature of 98.6°F
  - If body temperature starts to rise the body uses thermoregulation methods to get rid of excess heat
Heat-Related Emergencies

- In addition to exposure to heat, other factors that may predispose a patient to heat-related emergencies:
  - Patient’s age (very old and very young are at higher risk)
  - Preexisting illness/medical condition
  - Use of certain medications/abuse of some drugs

Heat-Related Emergencies

- Heat cramps
  - Are muscle cramps that are usually limited to patient’s legs and abdomen
  - Result of fluid and salts being lost from body through heating
  - Patient may complain of:
    - Exhaustion
    - Dizziness
    - Periods of faintness

Heat-Related Emergencies

- Heat exhaustion
  - Term used when circulatory system fails to adequately maintain its normal function because of excessive loss of fluids and salts from the body
  - Signs and symptoms
    - Rapid, shallow breathing
    - Excessive sweating
    - Total body weakness
    - Dizziness
Heat-Related Emergencies

- Heat stroke
  - True life-threatening emergency
  - Result of body’s inability to cool itself
    - This causes body’s core temperature to rise (hyperthermia)
    - Body’s temperature can increase so much that brain damage can occur

- Heat stroke
  - Signs and symptoms
    - Deep breathing followed by period of shallow breathing
    - Rapid, strong pulses followed by rapid, weak pulses
    - Dry, hot skin
    - Dilated pupils
    - Loss of consciousness
    - Muscle twitching/seizures
Heat-Related Emergencies

Poisonings

Poison—Any substance that can be potentially harmful to the body
- Poison can enter body through four main routes:
  - Ingestion
  - Inhalation
  - Absorption
  - Injection
- Can also be the result of food poisoning
Poisonings

- Poison can enter the body through four routes:
  - Ingestion
    - Signs and symptoms
      - Nausea
      - Vomiting
      - Diarrhea
      - Abdominal pain
      - Discoloration, burning, swelling in mouth
  - Inhalation
    - Brought into body through lungs during breathing
    - Examples of inhaled poison:
      - Carbon monoxide
      - Cyanide
      - Drugs
      - Fumes from household cleaners

- Poison can enter the body through four routes:
  - Inhalation
    - Signs and symptoms
      - Headache
      - Nausea
      - Coughing
      - Difficulty breathing
      - Altered mental status
      - LOC
Poisonings

Poison can enter the body through four routes:

- **Absorption**
  - Poisons that can be absorbed through skin:
    - Insecticides
    - Toxins from poisonous plants (such as poison ivy)
  - Signs and symptoms can be local to affected area/have a more generalized effect on the body

- **Injection**
  - Poison can be injected through the skin, causing a local reaction, and it can enter the circulatory system
  - Examples of this type of poisoning:
    - Intravenous (IV) drug
    - Bites
    - Stings

- **Inhalation**
  - Poison inhaled into the lungs

- **Intake**
  - Poison ingested into the body
Poisonings

- Poison can enter the body through four routes:
  - Injection
    - Signs and symptoms
      - Obvious puncture site where substance bypassed skin
      - Redness
      - Itching
      - Tenderness
      - Swelling
      - Pain at injection site

Poisonings

- Management of poisoning
  - No matter what the cause of the poisoning, always call 9-1-1 and PCC
    - If you are part of the 9-1-1 response and transport is available, PCC can be contacted while the patient is en route to the hospital by EMS/receiving hospital staff

Poisonings

- Management of poisoning
  - Assessment should include a thorough SAMPLE history
    - Determine what has occurred
    - What type of poison the patient may have contacted
    - When poison may have been taken
    - How much may have been taken
Poisonings

- Management of poisoning
  - Do a scene size-up
    - Ensure patient is moved to safe area, if needed
    - Initial assessment should be done and any life-threatening conditions treated
    - Watch for signs and symptoms of shock and treat accordingly
    - Always try to identify poisonous substance without delaying transport
    - Save any materials that patient vomits
    - All material should be transported with patient to hospital without compromising the safety of individuals providing transportation

Allergic Reactions

- Is the response body makes to foreign substance such as:
  - Insect venom
  - Food
  - Medication
  - Animal dander
  - Pollen

- Typical allergic reaction involves:
  - Hives
  - Reddened itchy skin
  - Airways swell and constrict resulting in an asthma-like response
  - When airway is involved the patient will present with wheezing and difficulty breathing
Allergic Reactions

- Anaphylaxis
  - Most severe allergic reaction
  - Occurs when patient's body is overwhelmed by allergic substance and the reaction intensifies into shock
  - Life-threatening emergency that requires medical attention as soon as possible
  - Provide supportive care by maintaining airway and breathing assistance while waiting for EMS to arrive

Water-Related Emergencies

- Water-related emergencies
  - Decompression sickness (dysbarism)
    - Altitude-related illnesses arise with decreases in atmospheric pressure
    - Increased in pressure can also cause problems
    - Most often occurs when a person goes scuba diving

- Management of decompression sickness
  - Administer high-flow O₂ with a nonrebreather mask
  - Gather history of dive
  - Definitive care involves:
    - Treating patient in hyperbaric chamber
Water-Related Emergencies

Drowning

- Suffocation that occurs from submersion in liquid
  - Important to ensure rescuer safety in water incidents
    - EMS personnel as well as bystanders may also become victims if they are not well trained in water rescue and protected by PFDs
    - If rescue is to be attempted, every effort must be made for rescuer to stay out of water or away from struggling, awake victim

- The following rule is important: Reach, throw, row, and only then go
  - Rescue should be first attempted by extending your reach to victim using a pole, branch, article of clothing
  - If victim cannot be reached safely, throw an item that will float and can support the individual
  - If the individual is too far from shore for these measures, boat-based rescue is preferred to a swimming rescue

- Survival after submersion is primarily related to the duration of submersion
  - Longer patient is without O₂, less chance of survival
  - Sooner ventilation can be started, the better
  - It is recommended that chest compressions are started after victim is on firm surface

- Another factor that affects survival is the purity of the water
  - More polluted the liquid, the worse the potential outcome
Water-Related Emergencies

Lightening and Electrocution

- Lightening kills about 200 people per year
  - Many more people are struck every year and not killed
  - Only 20%-30% of those struck are killed

- Lightening is a hazard to responders on search and rescues
  - Many stray sources of electricity in the aftermath of a disaster that can pose a danger
  - Most dangerous time for lightning strike is before the storm hits
  - Lightening can travel horizontally in front of a storm as far as 6 miles
Lightening and Electrocution

- Patients struck by lightning:
  - Are not burned to a crisp when struck
  - Lightning travels mostly over (not through) the body
  - Flow of lightning may blow clothing right off patient
  - There is often internal damage of high-voltage electrocution without external burns
  - Lightening strike patients may pass in and out of cardiac or respiratory arrest repeatedly and must be watched closely
  - Patients are not electrified and may be touched safely

Emergencies in the Wilderness

- Can be challenging
  - Rescuers must protect themselves and be prepared for injuries and illness common to the particular environment
  - There are standards of care for these types of emergencies

Emergencies in the Wilderness

- Special protocols
  - The Wilderness Medical Society & National Association of Emergency Medical Services Physicians have each published papers detailing care of patients in extended care situations for the following areas:
    - Discontinuation of CPR
    - Spinal immobilization
    - Wound care
Emergencies in the Wilderness

- Special protocols
  - Discontinuing of CPR
    - Emergency Cardiovascular Care Guidelines for starting and stopping CPR assume a traditional progression of bystander CPR within 4-6 minutes
    - Defibrillation and ALS within 8 minutes
    - After 30 minutes without effect, efforts should be discontinued

- Special protocols
  - Spinal immobilization
    - It is difficult to improvise a spinal immobilization device that actually works
    - Therefore, if a small group believes patient might have spinal injury, they must send for a litter team

- Special protocols
  - Wound care
    - High-risk wounds that must be treated with particular care
    - Human/animal bites
    - Open fractures
    - Exposed tendons/ligaments
    - Large/ragged wound
    - Contaminated wounds
    - Wounds with dead tissues
    - Wounds entering into body cavity
Emergencies in the Wilderness

- **Special protocols**
  - **Wound care**
    - After stopping bleeding with direct pressure, next concerns with soft tissue wounds are function of the affected part, infection, and cosmetic result.
    - Because of pain, swelling, and stiffness, soft tissue wounds can incapacitate a patient, preventing him from helping with evacuation.

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Emergencies in the Wilderness

- **Altitude**
  - As you travel up from sea level, weight of blanket of air gets thinner and thinner as barometric pressure decreases.
    - The percentage of O₂ in the air remains the same (21%), but as the overall weight of air decreases, partial pressure of O₂ also decreases.
    - This means the pressures pushing O₂ out of the lungs and into the blood are only 2/3 and ½, respectively, of those at sea level.

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Emergencies in the Wilderness

- **Altitude**
  - Acute mountain sickness (AMS)
    - Signs of AMS:
      - Headache
      - Apathy
      - Insomnia
      - Lightheadedness
      - Loss of appetite
      - Nausea
      - Vomiting
      - Shortness of breath on exertion
Emergencies in the Wilderness

- Altitude
  - HAPE and HACE may result if AMS is not treated or if patients ascend even higher
  - Life-threatening and require immediate treatment
  - HAPE is characterized by:
    - Cough
    - Increasing distress
    - Chest pain
    - Fluid in lungs
  - HACE is characterized by:
    - Altered mental status
    - Lack of coordination

- Blisters
  - May seem like a minor annoyance, but they can stop a SAR team or interrupt a wild-land response
  - Prevention with well-fitting double layer socks and properly fitted, broken in boots is preferable to treatment
  - It is also better to treat hot spots caused by chaffing than to let them develop into blisters
  - Once a blister develops but is not yet broken, it should be protected intact

- Poison ivy
  - Causes an allergic reaction spread by an oil in stems, leaves, roots of plant
  - Leading reason for workers compensation in the forest service
  - In smoke, it can be life threatening if inhaled
  - The oil’s binding to skin can be prevented through use of several blocking agents that are commercially available
Patients that are bitten/stung can become ill because of an allergic response/because the animal secretes/inject toxins into the wound
- Are prone to infection
- Insects
  - Bees, wasps, and spiders can cause reactions whether or not they inject toxins.
  - Bee sting allergies are common and allergic patients should carry antidote kits that keep reaction from becoming fatal.
  - Bee and wasp stings cause the majority of serious reactions

Bites and Stings

Mammals
- Dog and cat bites are common and the injury can be severe with damage to soft tissues and muscles.

Snakes
- Uncommon and envenomation rarely occurs

Marine animals
- Jellyfish sting most common poisoning
Bites and Stings

- Management of bites and stings
  - Treatment of bites is supportive
  - Cleanse wound
  - Apply cold compresses
  - Scrape stinger of bees from skin
  - Immobilize snake bitten extremities
  - Monitor patients level of consciousness
  - Maintain airway and ventilations with O₂

Questions?