Chapter 16

Environmental Emergencies

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

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Common Emergencies

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- 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

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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

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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

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> 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

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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
- 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

Cold-Related Emergencies

- 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

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- > Can often see a line of demarcation, separating frostbitten
 - area from undamaged tissue

Cold-Related Emergencies

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Cold-Related Emergencies

Local cold emergencies

- Signs and symptoms
 - <u>Superficial</u> 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

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Cold-Related Emergencies

Local cold emergencies

Signs and symptoms

<u>Deep</u> 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

Cold-Related Emergencies

- 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

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 Occurs when illness, alcohol, or aging influences body's ability to retain heat

Cold-Related Emergencies

- Generalized cold emergencies
 - Signs and symptoms-generalized hypothermia
 - Cool/cold skin temperature
 - Shivering
 - Poor judgment
 - Dizziness
 - Stiff or rigid posture
 - Decreasing mental status/motor function

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Cold-Related Emergencies



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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

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- 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-Related Emergencies

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• 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



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

Ingestion

- Signs and symptoms
 - Nausea
 - Vomiting
 - > Diarrhea
 - Abdominal pain
 - > Discoloration, burning, swelling in mouth

Poisonings

Inhalation

- Brought into body through lungs during breathing
- · Examples of inhaled poison:
 - Carbon monoxide
 - > Cyanide > Drugs
 - > Fumes from household cleaners

Signs and symptoms

- > Headache
- Nausea
- Coughing
- > Difficulty breathing
- Altered mental status > LOC

Poisonings

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

Signs and symptoms

- Itching
- > Rashes
- Burning
- > Redness of skin
- > Shock
- Nausea
- Vomiting

Poisonings

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
 - BitesStings
- 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 Poison Control Center
 - 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 <u>history</u>
 - Determine what has occurred
 - What type of poison the patient may have contacted
 - When poison may have been takenHow much may have been taken

Poisonings

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

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Allergic Reactions

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

Allergic Reactions

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

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Allergic Reactions

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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

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Water-Related Emergencies

Water-related emergencies

- Decompression sickness (dysbarism)
 - Altitude-related illnesses arise with decreases in atmospheric pressure

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- Increases in pressure can also cause problems
 Most often occurs when a person goes scuba diving
- wost often occurs when a person goes scuba diving

Water-Related Emergencies

- 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
 - 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

Water-Related Emergencies

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Drowning

- 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

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Water-Related Emergencies

Drowning

- 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

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

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Lightening and Electrocution

- 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

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Emergencies in the Wilderness

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• 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

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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

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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

Emergencies in the Wilderness

- 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

Emergencies in the Wilderness

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

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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

Emergencies in the Wilderness

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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

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Emergencies in the Wilderness

Altitude

- HAPE and HACE may result if AMS is not treated
- or if patients ascends 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

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Emergencies in the Wilderness

- 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

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Emergencies in the Wilderness

- 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

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The oil's binding to skin can be prevented through use of several blocking agents that are commercially available

Bites and Stings

 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

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Bites and Stings

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

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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

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