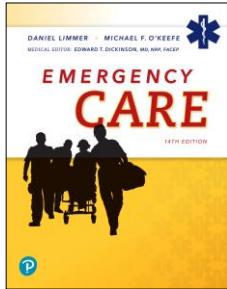


## Emergency Care

Fourteenth Edition



### Chapter 35

#### Environmental Emergencies

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## Topics

- [Exposure to Cold](#)
- [Exposure to Heat](#)
- [Water-Related Emergencies](#)
- [High-Altitude Emergencies](#)
- [Bites and Stings](#)

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## Exposure to Cold

[Back to Topics](#)

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## Environmental Emergencies

- Occur in any setting
  - Wilderness
  - Rural
  - Suburban
  - Urban
- Exposure may not be only danger.
  - Environmental emergencies can involve preexisting—or cause additional—medical problems and injuries.

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## How the Body Loses Heat (1 of 3)

- Conduction
  - Direct contact
  - Water chill
- Convection
  - Air or water carry away heat.
  - Wind chill
- Radiation
  - Heat is “picked up” by surrounding air or water.

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## How the Body Loses Heat (2 of 3)

- Evaporation
  - Occurs when the body perspires or gets wet
- Respiration
  - Loss of body heat through exhaled air

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## How the Body Loses Heat (3 of 3)



[For long description, see slide 87: Appendix 1](#)

Mechanisms of heat loss.



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## Generalized Hypothermia (1 of 2)

- Exposure to cold reduces body heat.
- Body is unable to maintain proper core temperature.
- May lead to death
- Predisposing factors
  - Shock
  - Injuries, infection, and/or immobility
  - Diabetes with hypoglycemia
  - Influence of drug or alcohol use



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## Generalized Hypothermia (2 of 2)

- Obvious and subtle exposure
  - Ethanol (alcohol) ingestion
  - Underlying illness
  - Overdose or poisoning
  - Major trauma
  - Outdoor resuscitation
  - Decreased ambient temperature



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## Geriatric Note

- The effects of cold temperature on older adults are immediate.
- During winter months, many older citizens on small, fixed incomes live in unheated rooms or rooms that are kept too cool.
  - This environment plus slowing body systems and lack of activity can lead to hypothermia.



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## Pediatric Note

- Because infants and young children are small with large skin surface areas in relation to their total body mass and have little body fat, they are especially prone to hypothermia.
  - Unable to shiver much due to small muscle mass



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## Assessment of Patient with Hypothermia (1 of 2)

- Shivering, in early stages
- Numbness or reduced or lost sense of touch
- Stiff or rigid posture
- Drowsiness
- Rapid breathing and pulse; slow or absent breathing/pulse in prolonged cases



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## Assessment of Patient with Hypothermia (2 of 2)

- Loss of motor coordination
- Joint/muscle stiffness, or muscular rigidity
- Decreased level of consciousness or unconsciousness
- Cool abdominal skin temperature
- Red skin; pale or cyanotic skin in prolonged cases



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## Passive and Active Rewarming

- Passive
  - Cover patient.
  - Remove wet clothing.
- Active
  - Apply external heat source.



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## Care of Hypothermic Patient Who Is Alert and Responding Appropriately

- Remove all wet clothing.
- Actively rewarm patient during transport.
- Provide care for shock.
- If alert, give patient warm liquids at slow rate.
- Transport patient, unless mild case.



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## Rewarming



Rewarming the frozen part.



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## Extreme Hypothermia

- Patient unconscious, no discernible vital signs
  - Heart rate can slow to 10 beats/minute.
  - Very cold to touch
- If no pulse, start CPR with AED.
- If pulse is present, care as for any patient who is unresponsive or not responding appropriately.
- **“You’re not dead until you’re warm and dead.”**



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## Care of Hypothermic Patient Who Is Unresponsive/Responding Inappropriately

- If patient is unresponsive or not responding appropriately.
  - Ensure open airway.
  - Provide high-concentration oxygen that has (if possible) been passed through a warm-water humidifier.
  - Wrap patient in blankets.
  - Transport immediately.



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## Local Cold Injuries and Frostbite (1 of 2)

- Most commonly affects ears, nose, face, hands, fingers, and feet and toes
  - Blood flow limited by constriction of blood vessels
  - Tissues freeze, may form ice crystals.
- Early/superficial (frostnip)
  - Remove from cold and cover.
- Late/deep (frostbite)
  - Oxygen
  - Cover frostbitten part and handle gently.



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## Local Cold Injuries and Frostbite (2 of 2)



Local cold injuries. © Edward T. Dickinson, MD



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## Active Rapid Rewarming of Frozen Parts (1 of 3)

- Seldom recommended
  - Chance of permanent injury
  - Only if local protocols recommend it, medical direction instructs you, or transport will be severely delayed and you cannot reach medical direction
- Warm water and a container in which you can immerse entire site of injury without touching sides or bottom



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## Active Rapid Rewarming of Frozen Parts (2 of 3)

- Steps
  - Heat water to between 100°F and 105°F.
  - Fill the container with heated water.
    - Remove clothing, jewelry, bands, or straps.
  - Fully immerse the injured part.
    - Do not allow area to touch sides or bottom of container.



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## Active Rapid Rewarming of Frozen Parts (3 of 3)

- Continuously stir water.
- If you complete rewarming, gently dry the affected area and apply a dry, sterile dressing.
- Keep the patient at rest.
- Make certain to keep the entire patient as warm as possible.
- Continue to monitor the patient.
- Do not allow the limb to refreeze.
- Transport as soon as possible with the affected limb slightly elevated.



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## Exposure to Heat

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### Effects of Heat on Body

- Heat that is not needed for temperature maintenance, and not lost, creates hyperthermia.
- Left unchecked, leads to death
- Heat cramps and heat exhaustion
  - Moist, pale, normal-to-cool skin
- Heat stroke
  - Hot, dry, or possibly moist skin



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### Patient with Moist, Pale, and Normal or Cool Skin

- Condition known as heat exhaustion
- As sweating continues, the body loses salts, bringing on painful muscle (heat) cramps.
- Healthy individuals may experience a form of shock brought about by fluid and salt loss.
  - Often occurs before people have been acclimatized to summer heat



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### Assessment of Patient with Moist, Pale, and Normal or Cool Skin

- Muscular cramps
- Weakness or exhaustion
- Rapid, shallow breathing
- Weak pulse
- Heavy perspiration
- Loss of consciousness possible but usually brief



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### Care of Patient with Moist, Pale, and Normal or Cool Skin

- Remove patient from hot environment.
- Administer oxygen if there are signs of hypoxia or the potential for shock.
- Loosen or remove clothing.
- Put patient in supine position.
- Give patient small sips of water.
- Apply moist towels over cramped muscles.
- Transport the patient.



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### Patient with Hot Skin, Whether Dry or Moist

- Heat stroke is a true emergency.
  - Temperature-regulating mechanisms fail.
  - The body cannot rid itself of excessive heat.
- Patients who stop sweating cannot lose heat through evaporation.



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### Assessment of Patient with Hot Skin, Whether Dry or Moist

- Loss of consciousness or altered mental status
- Rapid, shallow breathing
- Full, rapid pulse
- Generalized weakness
- Little or no perspiration
- Dilated pupils
- Potential seizures; no muscle cramps



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## Care of Patient with Hot Skin, Whether Dry or Moist

- Remove the patient from the hot environment.
- Remove the patient's clothing.
- Apply cool packs to the neck, groin, and armpits.
- For infants or young children, cooling is started using tepid (lukewarm) water.
- Administer high-concentration oxygen.
- Transport immediately.



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## The Dangers of Extreme Body Temperature

- As body temperature decreases:
  - Muscles shiver
  - Heart is prone to dysrhythmias
  - Central nervous system becomes sluggish
- As body temperature increases:
  - Sweating leads to evaporation and cool skin
  - If excess heat builds up, skin becomes hot



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## Water-Related Emergencies

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## Water-Related Accidents

- Boating
- Water-skiing
- Wind-surfing
- Jet-skiing
- Diving
- Scuba-diving



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## Assessment of Patients in Water-Related Accidents

- Airway obstruction
- Cardiac arrest
- Signs of heart attack
- Injuries to head and neck
- Internal injuries
- Generalized cooling, or hypothermia
- Substance abuse
- Drowning



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## Drowning (1 of 3)

- According to World Health Organization
  - Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid.
  - Outcomes
    - Death
    - Morbidity
    - No morbidity



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## Drowning (2 of 3)

- Often begins as person struggles to keep afloat
- When they start to submerge, they try to take one more deep breath.
- Water may enter airway, followed by coughing and swallowing, and involuntary swallowing of more water.



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## Drowning (3 of 3)

- Reflex spasm of larynx is triggered, sealing airway.
  - Unconsciousness results from hypoxia.
- Some who die from drowning die just from lack of air.
- Most attempt a final breath (or are unconscious) and water enters lungs.



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## Rescue Breathing in or out of the Water

- Do not delay transport.
- Begin rescue breathing without delay.
- If you reach a non-breathing patient in water, support patient in semi-supine position and provide ventilations.
- May encounter airway resistance; will probably have to ventilate more forcefully than other patients.



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## Care for Possible Spinal Injuries in the Water (1 of 2)

- Assume unconscious patient or patient with head injuries has neck and spinal injuries as well.
- Resuscitation should be started before you immobilize neck and spine.
- May not be able to complete assessment for spinal injuries while patient is in the water.



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## Care for Possible Spinal Injuries in the Water (2 of 2)

- Take care to avoid aggravating spinal injuries, but do not delay basic life support.
- When possible, keep patient's neck supported and in a straight line with the body's midline.
- Information supplied to dispatcher or hospital from the scene and during transport is critical.



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## Diving Accidents

- Most involve head and neck, but many also involve spine, hands, feet, and ribs.
- Emergency care is the same as for any accident patient out of water.



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## Scuba-Diving Accidents (1 of 6)

- Arterial gas embolism (gas bubbles in bloodstream)
  - Diver holding breath
  - May be due to inadequate training, equipment failure, underwater emergency, or trying to conserve air



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## Scuba-Diving Accidents (2 of 6)

- Decompression sickness
  - Diver surfacing too quickly from deep, prolonged dive
  - Takes 1–48 hours to appear
- Signs and symptoms
  - Air embolism
    - Altered mental status
    - Rapid loss of consciousness
    - Blurred vision
    - Seizures



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## Scuba-Diving Accidents (3 of 6)

- Signs and symptoms
  - Air embolism
    - Paralysis or paresthesia in the extremities
    - Stroke
    - Numbness or tingling sensations in the extremities
    - Generalized or specific weakness
    - Frothy blood in the mouth or nose
    - Incontinence
    - Chest pain
    - Stroke-like symptoms



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## Scuba-Diving Accidents (4 of 6)

- Signs and symptoms
  - Air embolism
    - Myocardial infarction
    - Respiratory arrest and cardiac arrest
  - Decompression sickness
    - Altered mental status and related symptoms
    - Fatigue
    - Pain in the muscles and joints (the “bends”)
    - Itchy blotches or mottling of the skin



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## Scuba-Diving Accidents (5 of 6)

- Signs and symptoms
  - Decompression sickness
    - Numbness or paralysis
    - Choking, coughing, dyspnea, substernal pleuritic chest pain
    - Coughing
    - Peripheral edema and swelling



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## Scuba-Diving Accidents (6 of 6)

- Same emergency care steps
  - Maintain an open airway.
  - Administer oxygen.
  - Keep the patient warm.
  - Position the patient either supine or on either side. Continue to monitor the patient. You may have to reposition the patient to ensure an open airway.
  - Contact medical direction for specific transport instructions.
  - Promptly transport the patient.



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## Water Rescues

- Reach
  - Hold object for patient to grab.
- Throw and tow
  - Throw object that will float.
- Row
  - Row boat to patient.
- Go
  - Swim to patient (last resort).



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## Water Rescue



[For long description, see slide 88: Appendix 2](#)

First try to reach and pull the patient from the water. If that fails, throw him anything that will float to use as a way to tow the person from the water. If that fails, row to the patient.



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## Ice Rescues (1 of 2)

- Number-one rule is to protect yourself.
- Ways to reach patient
  - Throw flotation device to patient.
  - Toss rope with loop.
  - Push out flat bottomed aluminum boat.
  - Lay ladder flat on ice.



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## Ice Rescues (2 of 2)

- Treat patient for hypothermia.
  - Remember that the patient may not be able to do much to help the rescue process.
- Always transport.
- Do not work alone.
- Do not walk out onto the ice.



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## High-Altitude Emergencies

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## High-Altitude Illness (1 of 6)

- Differences at higher altitudes
  - Less air to breathe
  - Decreased air pressure
- Normal, healthy people who have adjusted to high altitudes have a lower oxygen saturation than do those at sea level because there is less oxygen to breathe.
- Acute mountain sickness



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## High-Altitude Illness (2 of 6)

- Acute mountain sickness
  - Less serious case of a person experiencing problems adjusting to thinner air
  - In mild cases, all that may be needed to overcome acute mountain sickness is rest and rehydration at altitude.
  - In more severe cases, supplemental oxygen and immediate descent should lead to improvement.



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## High-Altitude Illness (3 of 6)

- High-altitude cerebral edema (HACE) is the worse form of acute mountain sickness.
  - Signs and symptoms
    - Headache that worsens over time
    - Loss of balance and coordination
    - Severe fatigue
    - Seizure
    - Altered mental status
    - Loss of consciousness



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## High-Altitude Illness (4 of 6)

- High-altitude cerebral edema (HACE) is the worse form of acute mountain sickness.
  - Patient care
    - Arrange for immediate descent. All other treatments are secondary to this.
    - Administer high-concentration oxygen.
    - Provide supportive treatment.



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## High-Altitude Illness (5 of 6)

- High-altitude cerebral edema (HACE) is even more serious than HAPE.
  - Signs and symptoms
    - Shortness of breath
    - Dry cough that progresses to coughing up blood
    - Tachypnea and tachycardia
    - Mild fever up to 100.4°F (38.0°C)
    - Oxygen saturation lower than other asymptomatic people in the same environment
    - Respiratory failure and arrest



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## High-Altitude Illness (6 of 6)

- High-altitude cerebral edema (HACE) is even more serious than HAPE.
  - Patient care
    - Arrange for immediate descent.
    - Administer high-concentration oxygen.
    - Minimize physical activity.
    - Provide supportive treatment.



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## Bites and Stings

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## Insect Bites and Stings (1 of 2)

- All spiders are venomous.
- Insect stings and bites are rarely dangerous.
- Anaphylactic shock is a major concern.
- Remove stinger quickly.



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## Insect Bites and Stings (2 of 2)



Brown recluse spider bite.  
Centers for Disease Control and Prevention



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## Assessment of a Patient with an Insect Bite or Sting (1 of 3)

- Signs and symptoms
  - Altered mental status
  - Noticeable stings or bites on the skin
  - Puncture marks (especially note the fingers, forearms, toes, and legs)
  - Blotchy (mottled) skin
  - Localized pain or itching
  - Numbness in a limb or body part



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## Assessment of a Patient with an Insect Bite or Sting (2 of 3)

- Signs and symptoms
  - Burning sensations at the site followed by pain spreading throughout the limb
  - Redness
  - Swelling or blistering at the site
  - Weakness or collapse
  - Difficult breathing and abnormal pulse rate
  - Headache and dizziness



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## Assessment of a Patient with an Insect Bite or Sting (3 of 3)

- Signs and symptoms
  - Chills
  - Fever
  - Nausea and vomiting
  - Muscle cramps, chest tightening, joint pain
  - Excessive saliva formation, profuse sweating
  - Anaphylaxis



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## Care of a Patient with an Insect Bite or Sting (1 of 2)

- Emergency care
  - Treat for shock.
  - Call medical direction if your EMS system does not have a specific protocol for care.
  - Remove stinger or venom sac.



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## Care of a Patient with an Insect Bite or Sting (2 of 2)

- Emergency care
  - Remove jewelry from affected limb.
  - Place constricting bands above and below sting or bite site if on an extremity and not over a joint, if local protocols permit.
  - Keep limb immobilized.



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## Snakebites

- Require special care but are not usually life-threatening.
- Death is not sudden unless anaphylactic shock develops.
- Stay calm.
- Keep patient calm and at rest.
- A pressure immobilization bandage may be the most effective technique to slow venom spread.



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## Assessment of a Patient with a Snakebite (1 of 2)

- Signs and symptoms
  - Noticeable bite on the skin, which may appear as nothing more than a discoloration
  - Pain and swelling in the area of the bite, which may be slow to develop, taking from 30 minutes to several hours
  - Rapid pulse and labored breathing



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## Assessment of a Patient with a Snakebite (2 of 2)

- Signs and symptoms
  - Progressive general weakness
  - Vision problems (dim or blurred)
  - Nausea and vomiting
  - Seizures
  - Drowsiness or unconsciousness



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## Care of a Patient with a Snakebite

- Emergency Care
  - Call medical direction.
  - Treat for shock, conserving body heat.
  - Keep patient calm.
  - Locate fang marks.
  - Remove any jewelry on extremity.
  - Keep any bitten extremities immobilized.
  - Transport patient.



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## Poisoning from Marine Life

- Can occur in variety of ways
  - Eating improperly prepared seafood or poisonous organisms
  - Stings and punctures
- Fresh water activates toxins on skin, increasing pain.
  - Use salt water to rinse affected area



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## Chapter Review

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## Chapter Review (1 of 6)

- Patients suffering from exposure to heat or cold must be removed from the harmful environment as quickly and as safely as possible.



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## Chapter Review (2 of 6)

- Generalized cold injuries involve cooling the entire body, also referred to as hypothermia. Treatment decisions are based on whether the patient has normal or altered mental status.
- Patients who have hypothermia with altered mental status are considered to have severe hypothermia; this indicates a life-threatening emergency.



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## Chapter Review (3 of 6)

- Local cold injury involves an isolated part or parts of the body (frostbite). Early local injury sites may be rewarmed gently. Late local cold injury involves freezing of tissue.



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## Chapter Review (4 of 6)

- Hyperthermia is a heat emergency. Its severity is determined by skin temperature. Skin that is normal to cool (heat exhaustion) is considered less severe than skin that is hot to the touch (heat stroke). All heat-emergency patients should be removed from the heat and cooled. Altered mental status in the setting of hyperthermia indicates a life-threatening emergency.



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## Chapter Review (5 of 6)

- Follow local protocols in reference to rewarming or cooling procedures.
- Immediate resuscitation of a water-related emergency patient may require quick and persistent intervention. Always ensure your own safety before attempting any sort of rescue.



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## Chapter Review (6 of 6)

- For injection or ingestion of the venoms of insects, spiders, snakes, and marine life, call medical direction and follow your local protocols.



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## Remember (1 of 4)

- Heat is lost and gained through convection, conduction, evaporation, respiration, and radiation. Certain illnesses, medications, and underlying conditions make patients more susceptible to heat and cold injuries.



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## Remember (2 of 4)

- Actively rewarm alert and responsive hypothermia patients. Passively rewarm hypothermic patients with an altered level of consciousness.
- In a patient with signs of heat exhaustion and altered mental status, the EMT must assume heat stroke is present. Active cooling is essential.



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## Remember (3 of 4)

- Providers never should attempt a water rescue unless they have been properly trained to do so.
- The two special problems seen in scuba-diving accidents are arterial gas emboli and decompression sickness.



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## Remember (4 of 4)

- When treating a scuba-related injury, EMTs should contact medical control to determine the most appropriate destination.
- Certain species of spiders, scorpions, and snakes can be dangerous to humans.



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## Questions to Consider

- Is the scene safe from heat, cold, or venomous creatures?
- How can I get the patient from the water safely?
- Hypothermia: Does the patient have an altered mental status?
- Hyperthermia: Is the patient's skin temperature cool to normal, or hot?



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## Critical Thinking

- You are with your family at a local lake. You observe a boat capsize near the middle of the lake. Screams can be heard from the scene. You are a marginal swimmer. Several civilians begin swimming out to the site. Apply the concepts learned in scene size-up to this scene.



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## Appendix 1

A man sits on the ground and waves are drawn to show heat escaping from his body. Five methods of heat loss are identified. Radiation: Body heat is lost to the atmosphere or nearby objects without physically touching them. Convection: Body heat is lost to surrounding air, which becomes warmer, rises, and is replaced with cooler air. Respiration: Heat is lost through exhalation of warm air and inhalation of cold air. Evaporation: Perspiration or wet skin results in body heat lost when the liquid evaporates. Conduction: Body heat is lost to nearby objects through direct physical touch.

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## Appendix 2

The examples are as follows. 1. A rescuer on a dock extends a long branch to a swimmer in the water. 2. A rescuer on a dock throws a rope to a swimmer in the water. 3. A rescuer in a boat rows towards a swimmer in the water.

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