

Pre-Lecture

I. You Are the EMT

Time: 10 Minutes

Small Group Activity/Discussion

This activity presents the concept of dealing with environmental emergencies.

Purpose

To allow students an opportunity to explore the significance and concerns associated with understanding and treating various environmental emergencies.

Instructor Directions

1. Direct students to read the “You Are the EMT” scenario found in the beginning of Chapter 18.
2. You may wish to assign students to a partner or group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions.
3. You may also use this as an individual activity and ask students to turn in their comments on a separate piece of paper.

Lecture

I. Cold Exposure

Time: 30 Minutes

Slides: 1-16

Lecture/Discussion

DOT Ref 4-7-1

DOT Ref 4-7-III-A

DOT Ref 4-7-III-B

Table 18-1: Characteristics of Systemic Hypothermia

A. Normal body temperature must be maintained within a very narrow range.

B. Cold exposure may cause injury to individual parts of the body or to the body as a whole.

C. There are five ways the body can lose heat.

1. Conduction: Direct transfer of heat to a colder object, as when a warm hand touches cold metal or ice or is immersed in cold water
2. Convection: Transfer of heat to circulating air, as when cool air moves across the body
3. Evaporation: Conversion of any liquid to a gas, the natural mechanism by which sweating cools the body
4. Radiation: Loss of body heat directly into still air in a colder environment
5. Respiration: Loss of body heat during normal breathing, as warm air in the lungs is exhaled and cooler air is inhaled.

D. Heat loss can be modified in three ways.

1. Increase heat production (shivering)
2. Move to an area where heat loss is decreased.

- a. Move out of a cold environment and seek shelter from the wind.
3. Wear insulated clothing.
 - a. Layers of clothing that trap air provide good insulation.
 - b. Also traps perspiration and prevents evaporation
 - c. Covering the head can minimize radiation heat loss by 70%.

E. Hypothermia (“low temperature”)

1. Core temperature of the body falls below 95°F (35°C)
 - a. Body loses the ability to regulate its temperature and to generate body heat.
2. Physiology
 - a. To protect against heat loss, the body constricts blood vessels in the skin, resulting in blue lips and/or fingertips.
 - b. Secondly, the body shivers to generate heat.
 - c. As these mechanisms are overwhelmed, body functions begin to slow down.
 - d. Eventually, key organs such as the heart begin to slow down.
 - e. This can lead to death.
3. Conditions for hypothermia
 - a. Can develop quickly, as with cold water immersion
 - b. Can develop gradually, as with exposure to the cold environment for several hours
 - c. Air temperature does not have to be below freezing for hypothermia to occur.
4. People at risk
 - a. Homeless people and those whose homes lack heating
 - b. Swimmers, even in summer
 - c. It is more common among elderly and ill individuals who are less able to adjust to temperature extremes.
 - d. Also common among the very young
 1. Unable to put on clothes to protect themselves against the cold
 2. Infants and children have a relatively large surface area and less body fat.
 3. Children may not be able to shiver as effectively as adults.
 4. Infants are unable to shiver.
 - e. Patients with injuries or illness
5. Signs and symptoms of hypothermia become progressively more severe as the body’s core temperature falls.
 - a. Four general stages
 1. No clear distinction between stages
 2. Will help to estimate the severity of the problem
 - b. Assess general temperature
 1. Pull back your glove and place the back of your hand between the patient’s clothing and abdomen.
 2. If the abdomen feels cool, the patient is likely experiencing a generalized cold emergency.
 3. You may carry a hypothermia thermometer, which registers lower body temperatures.
 4. Regular thermometers will not register low temperatures.
 - c. Mild hypothermia occurs when the core temperature is between 90° and 95°F (32° and 35°C).
 1. Patient is usually alert and shivering.
 2. Pulse rate and respirations are usually rapid.
 3. Skin may appear red, pale, or cyanotic.
 - d. More severe hypothermia occurs when the core temperature is less than 90°F (32°C).
 1. Shivering stops.
 2. Muscular activity decreases.
 3. Fine muscle activity ceases.
 4. Eventually, all muscle activity stops.
 - e. As the core drops toward 85°F (29°C):
 1. Patient becomes lethargic.
 2. Usually loses interest in fighting the cold
 3. Level of consciousness decreases.

4. Patient may try to undress.
 5. Poor coordination and memory loss follow, along with reduced or complete loss of sensation to touch.
 6. Mood changes occur.
 7. Patient shows impaired judgment.
 8. Patient becomes less communicative.
 9. Experiences joint or muscle stiffness
 10. Trouble speaking
 11. As the muscles eventually become rigid, the patient appears stiff or rigid.
- f. If the body temperature continues to fall to 80°F (27°C):
1. Vital signs slow.
 2. Pulse becomes weaker.
 3. Respirations slow to shallow or become absent.
 4. Cardiac arrhythmias may occur as the blood pressure decreases or disappears.
- g. At a core temperature less than 80°F (27°C):
1. All cardiorespiratory activity may cease.
 2. Pupillary reaction is slow.
 3. Patient may appear dead (or be in a coma).
- h. Never assume that a cold, pulseless patient is dead.
6. Emergency medical care
- a. All patients with hypothermia require immediate transport for evaluation and treatment.
 - b. Management in the field consists of stabilizing the ABCs and preventing further heat loss.
 1. Move the patient from the cold environment.
 2. Do not allow the patient to walk.
 3. Remove wet clothing.
 4. Place dry blankets under and over the patient.
 5. Handle the patient gently.
 6. Do not massage the extremities.
 7. Do not allow the patient to eat, to use any stimulants, or to smoke or chew tobacco.
 8. Give warm, humidified oxygen.
 9. Assess pulse for 30 to 45 seconds, especially before considering CPR.
 10. Begin passive rewarming, wrapping the patient in blankets and turning up the heat in the ambulance.
 11. If the patient is alert and responds appropriately, and the hypothermia is mild, begin active rewarming.
 - a. Wrap the patient in blankets.
 - b. Apply heat packs to the groin, axillary, and cervical regions.
 - c. Turn the heat up high in the ambulance.
 - c. Minimize further loss of body heat, especially if you cannot get to a hospital quickly.
 - d. When the patient has moderate or severe hypothermia, never try to actively rewarm the patient (placing heat on or into the body). Rewarming too quickly may cause a fatal cardiac arrhythmia that requires defibrillation.
 - e. The American Heart Association recommends that CPR be started if the patient has no detectable pulse or breathing, which may require a prolonged pulse check
 - f. Consult medical control.

F. Management of cold exposure in a sick or injured person

1. All patients who are severely injured are at risk for hypothermia.
 - a. Remove wet clothing.
 - b. Prevent conduction heat loss.
 - c. Insulate all exposed body parts.
 - d. Prevent convection heat loss.
 - e. Remove the patient from the cold environment.

G. Local cold injuries

1. Most injuries from cold are confined to exposed parts of the body.
2. The extremities (feet, ears, nose, and face) are vulnerable to cold injury.

- a. If parts of the body are very cold but not frozen, the patient has frostnip, chilblains, or immersion foot (trench foot).
 - b. When parts of the body become frozen, the injury is called frostbite.
3. Assessment
- a. Find out duration of the exposure.
 - b. Find out the temperature to which the body part was exposed.
 - c. Find out the wind velocity during exposure.
 - d. Patients with hypothermia should also be assessed for frostbite or other local cold injury.
4. Underlying factors
- a. Exposure to wet conditions
 - b. Inadequate insulation from cold
 - c. Restricted circulation from tight clothing or shoes or circulatory disease
 - d. Fatigue
 - e. Poor nutrition
 - f. Alcohol or drug abuse
 - g. Hypothermia
 - h. Diabetes
 - i. Cardiovascular disease
 - j. Older age
5. Frostnip and immersion foot
- a. The skin may be freezing while deeper tissues are unaffected.
 - b. Usually not painful; patient often is unaware that cold injury has occurred.
 - c. Immersion foot, also called trench foot, occurs after prolonged exposure to cold water, such as when hikers or hunters stand in a river or lake.
 - d. Signs
 1. With both, the skin is pale (blanched) and cold to the touch.
 2. Normal color does not return after palpation.
 3. Loss of feeling and sensation in the injured area
 - e. Emergency treatment
 1. Remove patient from the cold, wet environment. Rewarm the affected part.
6. Frostbite
- a. Most serious local cold injury; tissues are frozen.
 1. Freezing permanently damages cells.
 2. Exact mechanism is not known.
 3. Ice crystals within the cells may cause physical damage.
 4. Change in the water content in the cells may also cause changes in the concentration of critical electrolytes.
 5. When ice thaws, further chemical changes occur in the cell.
 - a. Gangrene: Permanent damage or cell death
 - b. If gangrene occurs, dead tissues must be surgically removed, sometimes by amputation.
 - c. Following less severe damage, the exposed part will become inflamed, tender to touch, and unable to tolerate exposure to cold.
 - b. Signs
 1. Hard, frozen feel of the affected tissues
 2. Frostbitten parts are hard and waxy and feel firm to frozen.
 3. Blisters and swelling may be present.
 4. Skin may appear red with purple and white areas, or may be mottled and cyanotic.
 - c. Depth of skin damage will vary.
 1. With superficial frostbite, only the skin is frozen.
 2. With deep frostbite, the deeper tissues are frozen.
 3. May not be able to tell in the field
 4. Even an experienced surgeon may not be able to tell until several days have passed.
7. Emergency medical care of local cold injury

- a. Remove the patient from further exposure to the cold.
- b. Handle the injured part gently, and protect it from further injury.
- c. Administer oxygen.
- d. Remove any wet or restrictive clothing over injured part.
- e. Never rub the area, as rubbing causes further damage.
- f. With a late or deep cold injury, such as frostbite, remove any jewelry from the injured part.
- g. Cover loosely with a dry, sterile dressing.
- h. Do not apply heat or rewarm the part or apply something warm or hot.
 1. Rewarming is best accomplished under controlled circumstances in the emergency department.
 2. Further injury to fragile tissues is possible by rewarming a frostbitten part.
- i. Evaluate the patient's general condition for signs or symptoms of systemic hypothermia.
- j. If prompt hospital care is not available, medical control might provide instructions for you to rewarm using a warm-water bath.
 1. Immerse the frostbitten part in water with the temperature between 100°F and 112°F (38°C and 44.5°C).
 2. Check temperature with a thermometer.
 3. Recheck it frequently.
 4. Temperature should never exceed 112°F (44.5°C).
 5. Stir continuously to recirculate.
 6. Keep the frostbitten part in water until it feels warm and sensation has returned.
 7. Dress with dry, sterile dressings, placing them also between injured fingers or toes.
 8. Expect severe pain.
 9. Never attempt rewarming if there is any chance that the part may freeze again.
 10. Some of the most severe consequences have occurred when parts were thawed and then refrozen.
 11. Cover the frostbitten part with soft, padded, sterile cotton dressings.
- k. Do not break blisters.
 1. Provide transport.

H. Cold exposure and you

1. EMT-Bs at risk for hypothermia when working in a cold environment.
2. Be familiar with local conditions.
3. Be aware of existing and potential weather conditions.
4. Make sure proper clothing is available to wear.
5. Vehicle must be properly equipped and maintained.
6. Never allow yourself to become a casualty!

II. Heat Exposure

Time: 20 Minutes

Slides: 17-24

Lecture/Discussion

DOT Ref 4-7-IV

A. Normal condition

1. Body temperature is 98.6°F (37°C).
2. Regulatory mechanisms keep this internal temperature constant, regardless of the ambient temperature.
3. Body tries to rid itself of excess heat.
 - a. Sweating (and evaporation of the sweat)
 - b. Dilation of skin blood vessels
 - c. Both methods increase the rate of heat radiation.

B. Treatment

1. Remove clothing.
2. Find a cooler environment.

C. Conditions of heat exposure

1. Body is exposed to more heat energy than it loses
 - a. Hyperthermia is the result.
 1. High core temperature is usually 101°F (38.3°C) or more.
 2. Mechanisms to decrease heat are overwhelmed and body is unable to tolerate the excessive heat.
 - b. Illness develops
 1. High air temperature can reduce the body's ability to lose heat by radiation.
 2. High humidity reduces the ability to lose heat through evaporation.
 3. Vigorous exercise can cause the body to lose more than 1 L of sweat an hour, causing a loss of fluids and electrolytes.
 4. Three types of heat exposure illnesses
 - a. Heat cramps
 - b. Heat exhaustion
 - c. Heatstroke

D. People at greatest risk for heat illness

1. Newborns, infants, and children who exhibit poor thermoregulation
2. The elderly, who also exhibit poor thermoregulation
3. Patients with heart disease, COPD, diabetes, and dehydration, and those who are obese
4. Those with limited mobility
5. Those who drink alcohol and use certain drugs

E. Heat cramps

1. Painful muscle spasms that occur after vigorous exercise
2. Occurs in situations in addition to when it is hot outdoors
3. Exact cause not well understood
4. Causes a change in the body's electrolyte, or salt, balance
5. May be a loss of essential electrolytes from the cells
6. Dehydration may also play a role.
7. Loss of water may affect muscles that are being stressed and cause them to go into spasm.
8. Usually occur in the leg or abdominal muscles
 - a. Abdominal muscle spasms may be so severe that the patient appears to have an acute abdomen problem.
9. Treatment
 - a. Remove the patient from the hot environment.
 - b. Loosen any tight clothing.
 - c. Rest the cramping muscles.
 - d. Replace fluids by mouth.
 1. Water or a diluted (half-strength) balanced electrolyte solution
 2. Do not give salt tablets or solutions that have a high salt concentration.
 - e. If cramps persist, transport to the hospital.
 - f. Once the cramps are gone, the patient may resume activity.

F. Heat exhaustion

1. Most common serious illness caused by heat
2. The body sweats heavily.
 - a. Body loses a significant amount of water and many electrolytes.

- b. Hypovolemia (fluid depletion) occurs.
- c. For sweating to cool the body, the sweat must be evaporated.
- 3. People particularly prone to heat exhaustion
 - a. Those who work or exercise vigorously
 - b. Those who wear heavy clothing in a warm, humid, or poorly ventilated environment.
- 4. Signs and symptoms
 - a. Onset
 - 1. While working hard or exercising in a hot, humid, or poorly ventilated environment and sweating heavily
 - 2. During rest, in the elderly and infant age groups in hot, humid, and poorly ventilated environments or extended time in hot, humid environments
 - b. Cold, clammy skin with ashen pallor
 - c. Dry tongue and thirst
 - d. Dizziness, weakness, or faintness, with accompanying nausea or headache
 - e. Normal vital signs, although pulse is often rapid and diastolic blood pressure may be low
 - f. Normal or slightly elevated body temperature
- 5. Treatment
 - a. Remove extra clothing.
 - b. Move the patient promptly from the hot environment, preferably to the back of an air-conditioned ambulance.
 - c. Give the patient oxygen.
 - d. Encourage the patient to lie down and elevate the legs.
 - e. If the patient is fully alert, encourage slow drinking of up to a liter of water, as long as nausea does not develop.
 - f. Never force fluids by mouth on a patient who is not fully alert.
 - g. In most cases, the patient feels better within 30 minutes.
 - h. Be prepared to transport to the hospital for more aggressive treatment, especially in the following circumstances:
 - 1. The symptoms do not clear up promptly.
 - 2. The level of consciousness decreases.
 - 3. The temperature remains elevated.
 - 4. The person is young, elderly, or has an underlying medical condition.
 - i. Transport the patient on his or her side.

G. Heatstroke

- 1. Least common heat illness, but also the most serious
- 2. Normal mechanisms are overwhelmed.
- 3. Body temperature rises rapidly to the level at which tissues are destroyed.
- 4. Untreated heatstroke always results in death.
- 5. People at risk
 - a. Persons engaged in vigorous physical activity when outdoors
 - b. Persons in a closed, poorly ventilated, humid space
 - c. During heat waves, among individuals (particularly elderly) who live with no air conditioning or poor ventilation
 - d. Children who are left unattended in a locked car on a hot day
- 6. Signs and symptoms
 - a. Many patients have hot, dry, flushed skin because their sweating mechanism has been overwhelmed.
 - b. Early in the course, the skin may be moist or wet.
 - 1. Keep in mind that a patient can have heatstroke even if he or she is still sweating.
 - c. Body temperature rises rapidly to 106°F (41°C) or more.
 - 1. As core temperature rises, the level of consciousness falls.
 - d. Often, the first sign of heatstroke is a change in behavior.
 - e. Patient becomes unresponsive very quickly.
 - f. The pulse is usually rapid and strong, but becomes weaker and the blood pressure falls.
 - g. Blood pressure drops.
 - h. Death can occur if patient is not treated.

7. Recovery
 - a. Depends on the speed with which treatment is administered
 1. Identify the patient quickly.
 2. Death of patient can occur if not treated rapidly.
 - b. Treatment has one object: reduce the body temperature.
8. Treatment
 - a. Move the patient out of the hot environment and into the ambulance.
 - b. Set air conditioning to maximum cooling.
 - c. Remove the patient's clothing.
 - d. Give oxygen.
 - e. Apply cool packs to the neck, groin, and armpits.
 - f. Cover with wet towels or spray with cool water and fan quickly.
 - g. Aggressively and repeatedly fan the patient.
 - h. Provide immediate transport.
 - i. Notify the hospital as soon as possible.

III. Drowning and Near Drowning

Time: 20 Minutes

Slides: 25-30

Lecture/Discussion

DOT Ref 4-7-V

A. Drowning

1. Death from suffocation after submersion in water
2. If left unattended, small children can drown in only a few inches of water.

B. Near drowning

1. Survival, at least temporarily, after suffocation in water

C. Drowning process

1. Something goes wrong.
 - a. Swallowing of water
 - b. Fatigue
 - c. Currents
 - d. Injuries
 - e. Cold
 - f. Tangled in kelp
 - g. Loss of orientation
 - h. Nitrogen narcosis
2. Patient panics and loses control.
3. Patient undergoes inefficient breathing.
 - a. Carbon dioxide retention
 - b. Oxygen deprivation
4. Patient has decreased buoyancy.
5. Patient is exhausted.
6. Patient experiences cardiac or respiratory arrest.
7. Inhaling very small amounts of water can severely irritate the larynx, sending the muscles into spasm, called laryngospasm.

- a. Prevents more water from entering the lungs
- b. Patient's lungs cannot be ventilated when significant laryngospasm is present.
- c. Hypoxia occurs until the patient becomes unconscious.
- d. At this point, the spasm relaxes, making rescue breathing possible.
- e. In 85% to 90% of cases, significant amounts of water enter the lungs of the drowning victim.

D. Emergency medical care

1. Treatment begins with rescue and removal from the water.
2. Begin rescue breathing as soon as possible.
3. When necessary, artificial ventilation should begin while the patient is in the water.
4. Stabilize and protect the patient's spine when a long fall or dive has occurred.
 - a. Cervical spine injuries are possible.
5. If patient does not have possible spinal injury, turn patient quickly to the left side to allow draining of the upper airway.
6. Perform appropriate BLS airway and resuscitation maneuvers.
 - a. If air does not enter the patient's lungs, treat for obstructed airway.
 - b. Administer oxygen either by mask or via BVM device.
7. Check for pulse immediately after the patient emerges from the water.
 - a. May be difficult to find a pulse.
 - b. Start CPR if patient is unresponsive.
8. Even if resuscitation in the field appears completely successful, you must always transport near-drowning patients to the hospital.
 - a. Inhalation of any amount of fluid can lead to delayed complications lasting for days or weeks.
9. Keep warm and protect from the environment.
10. Transport.

E. EMT-B safety

1. Ensure the safety of rescue personnel before a water rescue can begin.
2. "Reach, throw and row, and only then go."
3. When working near lakes, rivers, or the ocean, have a prearranged plan for water rescue.

F. Spinal injuries in submersion incidents

1. Submersion incidents may be complicated by spinal cord injuries.
2. Assume that spinal injury exists with the following conditions:
 - a. Diving mishap or long fall
 - b. Patient is unconscious and no information is available.
 - c. Patient is conscious but complains of weakness, paralysis, or numbness in the arms or legs.
 - d. Witnesses who say they think no spinal injury exists
3. Most spinal injuries in diving incidents affect the cervical spine.
4. Stabilize the suspected injury while the patient is still in the water.
 - a. Turn the patient supine.
 - b. Restore the airway and begin ventilation.
 - c. Float a buoyant backboard under the patient.
 - d. Secure the head and trunk to the board.
 - e. Remove the patient from the water, on the board.
 - f. Cover the patient with a blanket.

G. Recovery techniques

1. Drowning incidents where patient is not floating or visible in the water
2. Organized rescue efforts in these circumstances call for personnel who are experienced with recovery techniques and equipment.

H. Resuscitation efforts

1. Never give up resuscitating a cold-water drowning victim.
 - a. Documented case of a survivor of a 66-minute cold water submersion
 - b. Hypothermia can protect vital organs from the lack of oxygen.
 - c. Exposure to cold water will occasionally activate certain primitive reflexes, which may preserve basic body functions.
2. Whenever a person dives or jumps into very cold water, the diving reflex—slowing of the heart rate caused by submersion in cold water—may cause immediate bradycardia, a slow heart rhythm.
 - a. Loss of consciousness and drowning may result.
 - b. The person may be able to survive for an extended period of time under water, due to a lowering of the metabolic rate associated with hypothermia.
 - c. Continue full resuscitation efforts no matter how long the patient has been submerged.

IV. Diving Problems

Time: 20 Minutes

Slides: 31-35

Lecture/Discussion

A. Descent problems

1. Usually due to the sudden increase in pressure on the body as the person dives deeper into the water
 - a. Some body cavities cannot adjust to changes in pressure.
 - b. Typical areas affected are:
 1. Lungs
 2. Sinus cavities
 3. Middle ear
 4. Teeth
 5. Area of the face surrounded by the diving mask.
 - c. Results in severe pain
 1. The pain usually forces the diver to return to the surface to equalize the pressure.
 2. Problem clears up
 3. Diver who continues to complain of pain, particularly in the ear, after returning to the surface should be transported to the hospital.
 4. Person with a perforated tympanic membrane (ruptured eardrum) may develop a special problem while diving.
 - a. If cold water enters the middle ear through a ruptured eardrum, the diver may lose his or her balance and orientation.
 - b. Diver may then shoot to the surface and experience ascent problems.

B. Problems at the bottom

1. Rare problem
2. Examples
 - a. Inadequate mixing of oxygen and carbon dioxide in the air the diver breathes
 - b. Accidental feeding of poisonous carbon monoxide into the breathing apparatus
 - c. Both are the result of faulty connections in the diving gear.
3. Can cause drowning or rapid ascent
4. Requires emergency resuscitation and transport

C. Ascent problems

1. Most serious and dangerous injuries associated with diving are related to ascending. Treatment usually requires aggressive resuscitation.

- a. Air embolism
 - b. Decompression sickness (also called “the bends”)
2. Air embolism
 - a. Most dangerous and most common emergency in scuba diving
 - b. Diver holds breath during rapid ascent
 - c. Air pressure in the lungs remains high while external pressure on the chest decreases
 1. Causes the alveoli in the lungs to rupture.
 2. Air released from rupture can cause problems.
 - a. Pneumothorax
 - b. Pneumomediastinum
 - c. Air emboli
 3. Pneumothorax and pneumomediastinum both result in pain and severe dyspnea.
 4. An air embolus will act as a plug and prevent normal flow of blood and oxygen.
 - a. Brain and spinal cord are the organs most severely affected by air embolism, because they require a constant supply of oxygen.
 - d. Signs and symptoms of air embolism
 1. Blotching (mottling of the skin)
 2. Froth at the nose and mouth
 3. Severe pain in muscles, joints, or abdomen
 4. Dyspnea and/or chest pain
 5. Dizziness, nausea, and vomiting
 6. Dysphasia (difficulty speaking)
 7. Difficulty with vision
 8. Paralysis and/or coma
 9. Irregular pulse or cardiac arrest
 3. Decompression sickness (“the bends”)
 - a. Bubbles of gas, especially nitrogen, obstruct the blood vessels.
 - b. Results from too rapid an ascent from a dive
 - c. Exact mechanism of injury is unknown.
 1. During the dive, nitrogen that is being breathed dissolves in the blood and tissues because it is under pressure.
 2. During ascent, the external pressure is decreased and the dissolved nitrogen forms small bubbles within those tissues.
 - d. Problems similar to those that occur in air embolism
 1. Severe pain in certain tissues or spaces in the body is the most common problem.
 2. Most striking symptom is abdominal and/or joint pain so severe that the patient literally doubles up or “bends”
 - e. Dive tables and computers are available to show the proper rate of ascent from a dive, including the number and length of pauses that a diver should make on the way up.
 1. However, even divers who stay within these limits can suffer the bends.
 - f. Even after a “safe dive,” decompression sickness can occur.
 1. Driving a car up a mountain
 2. Flying in an unpressurized airplane that climbs too rapidly
 3. Risk of this diminishes after 24 to 48 hours.
 4. Problem is exactly the same as rapid ascent from a deep dive.
 - a. Sudden decrease of external pressure on the body and release of dissolved nitrogen from the blood forms bubbles of nitrogen gas within the blood vessels.
 4. Time frame
 - a. Air embolism occurs immediately upon return to the surface.
 - b. Decompression sickness may not occur for several hours.
 5. Treatment
 - a. Same as that for air embolism and decompression sickness
 - b. Usually reversible with proper treatment
 - c. Treatment
 1. Remove the patient from the water.

2. Keep the patient calm.
3. Begin BLS and administer oxygen.
4. Place the patient in a left lateral recumbent position with the head down.
5. Provide prompt transport to the nearest recompression facility (hyperbaric chamber).
 - a. Usually a small room that is pressurized to more than atmospheric pressure
 - b. Allows bubbles of gas to dissolve into the blood and equalizes the pressures inside and outside the lungs
 - c. Once these pressures are equalized, gradual decompression can be accomplished under controlled conditions to prevent the bubbles from reforming.
 - d. If the bubbles block critical blood vessels that supply the brain or spinal cord, permanent central nervous systems injury may result.

V. Other Water Hazards

Time: 5 Minutes

Slide: 36

Lecture/Discussion

- A. Pay close attention to the body temperature of a person who is rescued from cold water.
- B. Treat hypothermia caused by immersion in cold water the same way you treat hypothermia caused by cold exposure.
- C. A person swimming in shallow water may suffer from breath-holding syncope.
1. Loss of consciousness caused by a decreased stimulus for breathing
 2. People at risk are swimmers who breathe in and out rapidly and deeply before entering the water in an effort to expand capacity to stay underwater.
 3. This hyperventilation lowers the carbon dioxide level.
 4. Because an elevated level of carbon dioxide in the blood is the strongest stimulus for breathing, the swimmer may not feel the need to breathe even after using up all the oxygen in his or her lungs.
 5. Emergency treatment is the same as that for a drowning or near drowning.
- D. Injuries caused by water hazards may be complicated by immersion in cold water.
1. Boat propellers
 2. Sharp rocks
 3. Water skis
 4. Dangerous marine life

VI. Prevention

Time: 5 Minutes

Slide: 37

Lecture/Discussion

- A. B health care professionals should be involved in public education efforts.
1. Make people aware of the hazards of swimming pools and water recreation
- B. Pools should be surrounded with appropriate enclosures.
- C. Adult and teenage drownings associated with the use of alcohol

VII. Geriatric Care

Time: 5 Minutes

Slide: 38

Lecture/Discussion

- A. As age increases, the body can lose its ability to respond to the environment.
- B. Heatstroke can develop relatively quickly.
1. Factors that increase the possibility of heatstroke in the elderly:
 - a. Medications
 - b. Diabetes
 - c. Alcohol abuse
 - d. Malnutrition
 - e. Parkinsonism
 - f. Hyperthyroidism
 - g. Obesity
 2. Because of reduced circulation to the skin, heat loss via conduction, convection, and radiation is low.
 3. Since aging alters the ability to perspire, loss through evaporation is reduced.
- C. Because of decreased muscle mass or tone, hypothermic elderly patients may not shiver.
1. Decreased muscle mass and body fat result in less insulation.
 2. Because of the body's altered response to heat loss and its ability to gain heat, hypothermia may not be suspected.
- D. Temperatures that threaten older patients may not seem uncomfortable to responders.
- E. Treatment for hypothermia
1. Protect against heat loss.
 2. Cover all exposed areas and protect the head.

VIII. Skill Drills

Time: 20 Minutes

Demonstration/Group Activity

It is strongly recommended that Skill Drill 18-2 be presented as a training video or poolside demonstration by lifeguards or water rescue team members.

Remember to maintain an adequate instructor to student ratio. A ratio of 1 instructor to 6 students is recommended by the DOT EMT-B National Standard Curriculum. Also remember that each student is to be evaluated on each skill prior to the completion of the course.

Purpose

Following instructor-facilitated demonstrations, this activity allows students to practice and demonstrate competency in patient care skill related to environmental emergencies.

Materials Needed

1. BSI supplies (gloves, mask, goggles, gowns)
2. Training video or water rescue team member/lifeguards for poolside demonstration

Instructor Directions

1. Demonstrate each skill, emphasizing any critical points or procedures.
2. Based on the specific skill, assign each student to a partner or team. Provide each partner/team with equipment or materials as needed.
3. Direct students to practice each skill using team members as patients and observers. Closely monitor the practice sessions and provide constructive comments and redirecting.
4. As individual students achieve success, conduct skill proficiency exams. Students failing the exam should be given redirection and opportunity to practice before being retested.

Skills

- A. Treating for Heat Exhaustion (Skill Drill 18-1)
- B. Stabilizing a Suspected Neck Injury in the Water (18-2)

Post-Lecture

I. Prep Kit Activities

Time: 60 Minutes

Small Group Activity/Individual Activity/Discussion

Note: The Prep Kit contains various student-centered end-of-chapter activities designed as enhancement to the instructor's presentation. As time permits, these activities may be presented in class. They are also designed to be used as outside/homework activities.

A. Assessment in Action

This activity is designed to assist the student in gaining a further understanding of issues surrounding heat emergencies. The activity incorporates both critical thinking and application of basic EMT-B knowledge.

Purpose

This activity allows the student an opportunity to analyze an emergency care scenario and develop responses to critical thinking questions.

Instructor Directions

1. Direct students to read the "Assessment in Action" scenario located in the Prep Kit at the end of Chapter 18.
2. For the quiz questions, direct students to read and individually answer the quiz questions at the end of the scenario. Allow approximately 10 minutes for this part of the activity. Facilitate a class review and dialogue of the answers, allowing students to correct responses as needed. Use the quiz question answers noted below to assist in building this review. Allow approximately 10 minutes for this part of the activity.
3. You may also use these as individual activities and ask students to turn in their comments on a separate piece of paper.

Answers to Multiple-Choice Questions

1. Answer: D In heat-related illness, muscle cramps are triggered because of electrolyte loss through sweating and, in this case, through vomiting and diarrhea. The pulse, BP, and respirations do not cause muscle cramps.
2. Answer: B Move this patient to a cooler environment immediately. This patient is talking and exchanging air adequately (talking in complete sentences). Once he is moved to a cooler environment, administer oxygen. If oxygen is readily available, it may be applied during the movement to a cooler environment. Listening to breath sounds and obtaining a more complete medical history can be done after he is removed to a cooler environment.
3. Answer: D Exchanging oxygen for carbon dioxide (or vice versa) is not affected by this patient's exposure to heat. The high temperature does not reduce a person's ability to compensate through breathing.

4. Answer: B Cold packs need to be covered with a washcloth prior to application to avoid frostbite on the skin. Covering with a heavy towel will interfere with the effect of the cold pack. Applying ice packs directly to the skin increases the risk of frostbite.
5. Answer: C Because of the potential for complications, this patient should be encouraged to go to the hospital for a complete evaluation. Law enforcement is not necessary. Suggesting that the patient drive himself home is inappropriate. Letting the patient return to work without encouraging him to be checked is neglecting your responsibility to inform the patient of the possible consequences.
6. Answer: A This avoids most routes of exposure while giving you access to a part of the body that would normally be sheltered and warm. Gently pinching the skin is a test for hydration. Reading the thermostat does not tell you about the patient's body temperature. Feeling the temperature of exhaled air is not accurate and runs the risk of an exposure.
7. Answer: D Because hypothermia causes the pulse to slow down, and this patient's pulse is irregular, a full count for 45 to 60 seconds is necessary to get an accurate picture of his heart rate. If his pulse were regular, a count at 30 seconds would be acceptable.
8. Answer: B The goal is always to prevent further heat loss. In this case, warming the patient as fast as possible and conducting active rewarming should not be done in the field. This patient does not meet the criteria for application of the AED.
9. Answer: A Applying heat packs and hot water bottles is appropriate only if the patient is alert and oriented. Vigorous massaging of the extremities is never appropriate. Administering warm fluids is only appropriate if the patient is alert and oriented.

Challenging Question

10. Answer: This patient is past the point of shivering and is probably in moderate or severe hypothermia.

B. Points to Ponder

This activity will allow you to help your students probe the more difficult situations that they may face. Use this as an opportunity to allow them to express differences of opinion and approach, while directing them to be thorough and decisive in their answers. Encourage challenges.

Purpose

To allow students an opportunity to apply critical thinking analysis to a given case study or situation.

Instructor Directions

1. Direct students to read the "Points to Ponder" scenario found in the Prep Kit at the end of Chapter 18.
2. You may wish to assign students to a partner or a group and direct them to review the discussion question at the end of the scenario and prepare a response. Allow approximately 10 minutes for this part of the activity. Facilitate a class dialogue centered on the discussion point. Allow approximately 10 minutes for this part of the activity as well.
3. You may also use this as an individual activity and ask students to turn in their comments on a separate piece of paper.
4. Personally review the scenario and discussion question based on your experience and knowledge as an emergency care worker. Develop your own key points for guiding this discussion.

Scenario

You are staged at a search for a toddler who walked away from her home. Your partner has agreed to stay with the ambulance while you help search for the child. It is a cold snowy night and everyone knows that it is unlikely a young child will survive the cold. The child has been missing about 10 hours when you notice her father sitting in an alley holding something. When you approach him you see that he is holding the child and crying. The child is blue, limp and cold and you cannot feel a pulse. You want to take the child and begin resuscitation because you cannot be sure how long she has been unresponsive. The father tells you no, that she is dead and he just wants to hold her and be with her. The father refuses to let go of her and starts to move away from you. How would you handle this situation? Would you force the child from the father? Does the father have the right to refuse treatment? Is the child "saveable?" Who could help you in this case?

Issues

- Stages of Grief
- Living DNRs
- Parental Rights
- Consent

- Care for Family and Friends
- Personal Feelings Regarding Children
- EMT's Need to "Do Something"

C. Online Outlook

This activity requires students to have access to the Internet. This may be accomplished through personal access, employer access, or through a local educational institution. Some community colleges, universities, or adult education centers may have classrooms with Internet capability that will allow for this activity to be completed in class. Check out local access points and encourage students to complete this activity as part of their ongoing reinforcement of the basic EMT-B knowledge and skills.

Purpose

Instructor Directions

1. Use the Internet and go to www.emtb.com. Follow the directions on the web site to access the exercises for Chapter 18.
2. Review the chapter activities and take note of desired or correct student responses.
3. Direct students to complete this activity in their student workbook.
4. As time allows, conduct an in-class review of the Internet activity and provide feedback to students as needed.
5. Be sure to check the web site before assigning this activity, as specific chapter-related activities may change from time to time.

II. Lesson Review

Time: 10 Minutes

Discussion

Note: Facilitate a review of this lesson's major topics using the review questions as direct or overhead questions. Answers are found throughout this lesson plan with IRK references listed for each question.

- A. What are the five ways the body can lose heat? (Lecture I-C)
- B. What are three ways heat loss can be modified? (Lecture I-D)
- C. Describe hypothermia, its stages, signs and symptoms, and treatment. (Lecture I-E)
- D. What are the major categories of local cold injuries and how are they treated? (Lecture I-G)
- E. List the three forms of heat illness and describe their presentation and treatment. (Lecture II)
- F. What is the emergency medical care for a near drowning incident? (Lecture IV-D)
- G. What is the procedure for handling a possible spinal injury in a submersion incident? (Lecture III-F)
- H. What protective mechanisms may be activated in cold water drowning? What does this mean in relation to resuscitation efforts? (Lecture III-H)
- I. List the problems most often encountered in the various steps of a scuba dive (descent, at bottom, ascent). (Lecture IV-A-C)
- J. Describe the two most serious scuba diving emergencies, their care, signs and symptoms, and treatment. (Lecture IV-C)
- K. What is breath-holding syncope and how is it treated? (Lecture V-C)

III. Assignments

Time: 5 Minutes

Lecture

- A. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by instructor).
- B. Read Chapter 19: *Behavioral Emergencies* for the next class session.