6 Shock

Shock

Perfusion is when adequate blood and oxygen are provided to all cells in different tissues and organs in the body. Shock occurs when the body's tissues do not receive enough oxygen-rich blood. Do not confuse this with electric shock or being shocked, as in being scared or surprised. Shock (hypoperfusion) describes a state of collapse and failure of the cardiovascular system in which blood circulation decreases and eventually ceases. Shock can be associated with a wide variety of conditions—from a heart attack to a severe allergic reaction.

Causes of Shock

Understanding the basic physiologic causes of shock will better prepare you to treat it. The damage caused by shock depends on which body part is deprived of oxygen and for how long. For example, without oxygen, the brain will be irreparably damaged in 4 to 6 minutes, the abdominal organs in 45 to 90 minutes, and the skin and muscle cells in 3 to 6 hours.

To understand shock, think of the circulatory system as having three components: a working pump (the heart), a network of pipes (the blood vessels), and an adequate amount of fluid (the blood) pumped through the pipes. Damage to any of these components can deprive tissues of blood and produce the condition known as shock. These

chapter at a glance

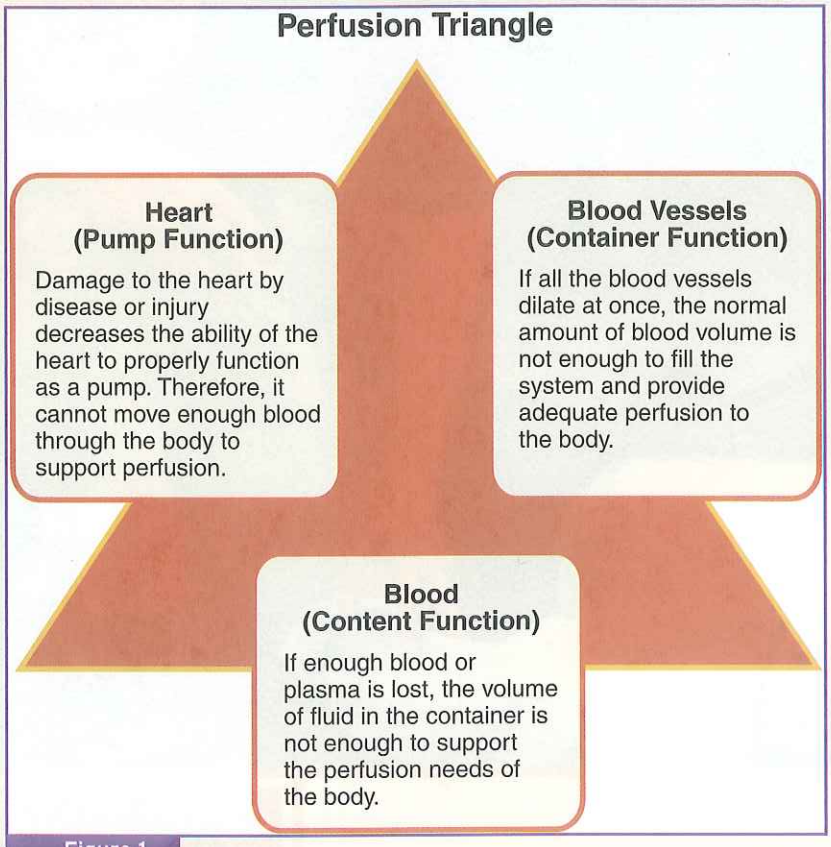


Figure 1

Perfusion triangle.

three parts can be referred to as the perfusion triangle Figure 1. When a victim is in shock, one or more of the three sides is not working properly.

Causes of shock can be both cardiovascular and noncardiovascular. The noncardiovascular causes of shock are respiratory insufficiency, psychogenic shock, and anaphylaxis, an extreme allergic reaction to a foreign substance Figure 2.

Cardiovascular Causes of Shock

- *Pump failure.* Cardiogenic shock is caused by inadequate function of the heart, or pump failure. Circulation requires the constant pumping action of a normal heart muscle. Many diseases can cause destruction or inflammation of this muscle. The heart can adapt somewhat to these problems, but if too much muscle damage occurs, as sometimes happens in a heart attack, the heart no longer functions well. The major effect is the backup of blood into the lungs. The resulting buildup of fluid in the lungs is called pulmonary edema.
- *Content failure.* In injuries, shock is most often the result of fluid or blood loss. This type of shock is called hypovolemic (low-volume) shock or hemorrhagic shock. The loss can be due to internal or external bleeding. Hypovolemic shock also occurs with severe thermal burns. Plasma, the fluid portion of the blood, leaks from the circulatory system into burned tissues adjacent to the injury. Dehydration aggravates shock. In all these circumstances, the common factor is an insufficient volume of blood within the vascular system to provide adequate perfusion to the tissues.
- *Poor vessel function.* Spinal cord damage can injure the part of the nervous system that controls blood vessel size and muscle tone. Neurogenic shock can result. Cut off from their impulses to contract, muscles in the blood vessels dilate (relax) widely, increasing the size and capacity of the vascular system. The blood in the body can no longer fill the enlarged vessels Figure 3.
- *Combined vessel and content failure.* Septic shock is seen in victims who have severe bacterial infections that produce toxins (poisons). The toxins damage the vessel walls, causing them to become leaky and making them unable to contract well. Widespread vessel dilation, combined with the loss of plasma through injured vessel walls, results

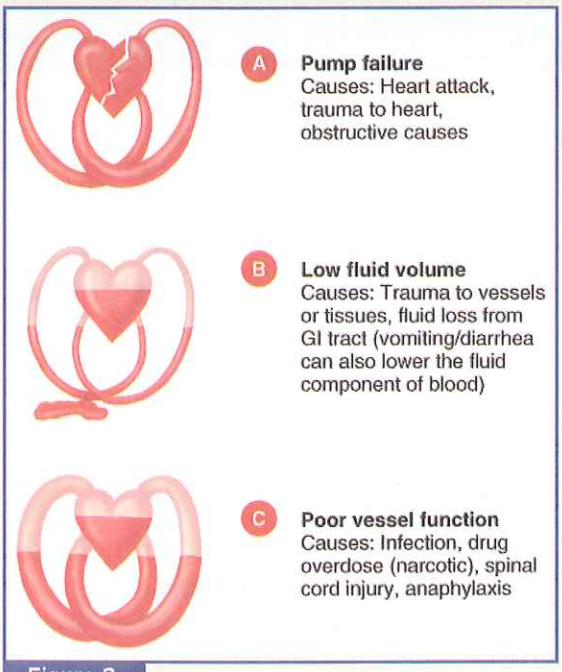


Figure 2

There are three basic causes of shock and impaired tissue function. **A.** Pump failure occurs when the heart is damaged by disease, injury, or obstructive causes. The heart may not generate enough energy to move the blood through the system. **B.** Low fluid volume, often a result of bleeding, leads to inadequate perfusion. **C.** The blood vessels can dilate excessively so that the blood within them, even though it is of normal volume, is in adequate to fill the system and provide efficient perfusion.

in shock. Septic shock is almost always a complication of a serious illness, injury, or surgery. Septic shock also occurs with anaphylaxis.

Noncardiovascular Cause of Shock

- *Respiratory insufficiency.* A severe chest injury or an airway obstruction can make a victim unable to breathe adequately. Insufficient oxygen in the blood can produce shock as rapidly as vascular causes, even when cardiovascular function is normal. Circulation of nonoxygenated blood will not benefit the victim.
- *Anaphylactic shock.* Anaphylaxis, or anaphylactic shock, occurs when the immune system reacts violently to a substance to which it has already been sensitized. Severe allergic reactions commonly follow exposure by one of these:

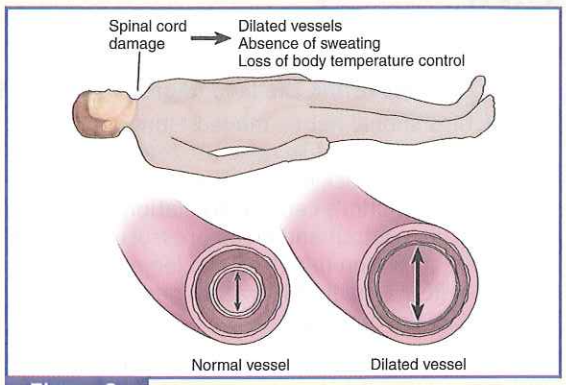


Figure 3

Neurogenic shock.

- Medications (penicillin and related drugs, aspirin, sulfa drugs)
- Food (shellfish, nuts—especially peanuts, eggs)
- Insect stings (honeybee, wasp, yellow jacket, hornet, fire ant)

Anaphylactic reactions can develop in minutes or even seconds after contact with the substance to which a victim is sensitized. The signs of such allergic reactions are distinct from those of other forms of shock. Table 1 shows the signs and symptoms of anaphylactic shock.

In anaphylactic shock, although there is no loss of blood, no vascular damage, and only a slight possibility of cardiac muscular injury, the widespread vascular dilation causes poor oxygenation and poor perfusion of tissues, which can easily cause death.

- *Psychogenic shock.* Psychogenic shock is a sudden nervous system reaction that produces a temporary vascular dilation, resulting in fainting, or syncope. Blood pools in the dilated vessels, reducing the blood supply to the brain, and the victim becomes unresponsive. Causes of fainting (psychogenic shock) include fear, bad news, or unpleasant sights (often the sight of blood).

The Progression of Shock

Although shock itself cannot be seen, you can see its signs and symptoms progress. The early stage of hemorrhagic (blood loss) shock, when the body can still compensate for blood loss, is called compensated

Q&A

What is the optimal position for a person in shock? Does elevating the legs improve outcome?

Most victims should not be moved. However, first aiders are often taught to raise the feet of a suspected victim of shock in theory to return blood volume to the victim's central circulation, thus raising cardiac output and blood pressure. While the evidence is mixed on the effects of leg elevation, no studies in the medical literature demonstrate improved victim outcome.

The elevation of the legs for a victim suffering potential pelvic or lower extremities injuries may not be apparent to a first aider and the elevation of the legs may cause a greater harm. Therefore, the legs should not be raised if a leg is injured or if moving an injured leg causes pain.

shock. The late stage, when blood pressure is falling, is decompensated shock. The final stage, when shock is terminal, is called irreversible shock. Even transfusion will not save the victim's life at this point.

Care for Shock

Because every injury affects the circulatory system to some degree, first aiders should automatically treat injured victims for shock. Shock is one of the most common causes of death in an injured victim. Even if an injured victim does not have signs or symptoms of shock, first aiders should care for shock. You can prevent shock from getting worse; first aiders cannot reverse it.

General Care for Shock

1. Monitor breathing and, if absent, begin CPR.
2. Control all obvious external bleeding.
3. Place the victim on his or her back (supine position). Those having a heart attack or those with lung disease breathe easier in a half-sitting position Figure 4.
4. Do not move the victim if there are suspected fractures or head, spine, or torso injuries. Loosen tight clothing at the neck, chest, and waist.
5. Splint any bone or joint injuries to minimize pain and bleeding. This also prevents further damage to tissues.

Table 1 Signs and Symptoms of Anaphylactic Shock

Skin

- Flushing, itching, or burning, especially over the face and upper chest
- Hives, which can spread over large areas of the body
- Swelling, especially of the face, tongue, and lips
- Bluish lips (cyanosis)

Circulatory system

- Weak pulse (you might be barely able to feel it)
- Dizziness
- Fainting and unresponsiveness

Respiratory system

- Sneezing or itching in the nostrils
- Tightness in the chest, with a persistent, dry cough
- Breathing difficulty
- Secretions of fluid and mucus into the throat and lungs
- Wheezing (forced expirations during breathing)
- Breathing stops

CAUTION

DO NOT place victims with breathing difficulties, chest injuries, penetrating eye injuries, or heart attacks on their backs. Place them in a half-sitting position to help breathing.

DO NOT give the victim anything to eat or drink. It could cause nausea and vomiting. It could also cause complications if surgery is needed.

DO NOT lift the foot of a bed or stretcher—breathing will be affected, and the blood flow from the brain could be impeded and lead to brain swelling.

DO NOT raise the legs of a victim with head injuries, stroke, chest injuries, breathing difficulty, or those of a victim in whom a heart attack is suspected.

DO NOT use external heat sources (such as hot water bottles or heating pads).

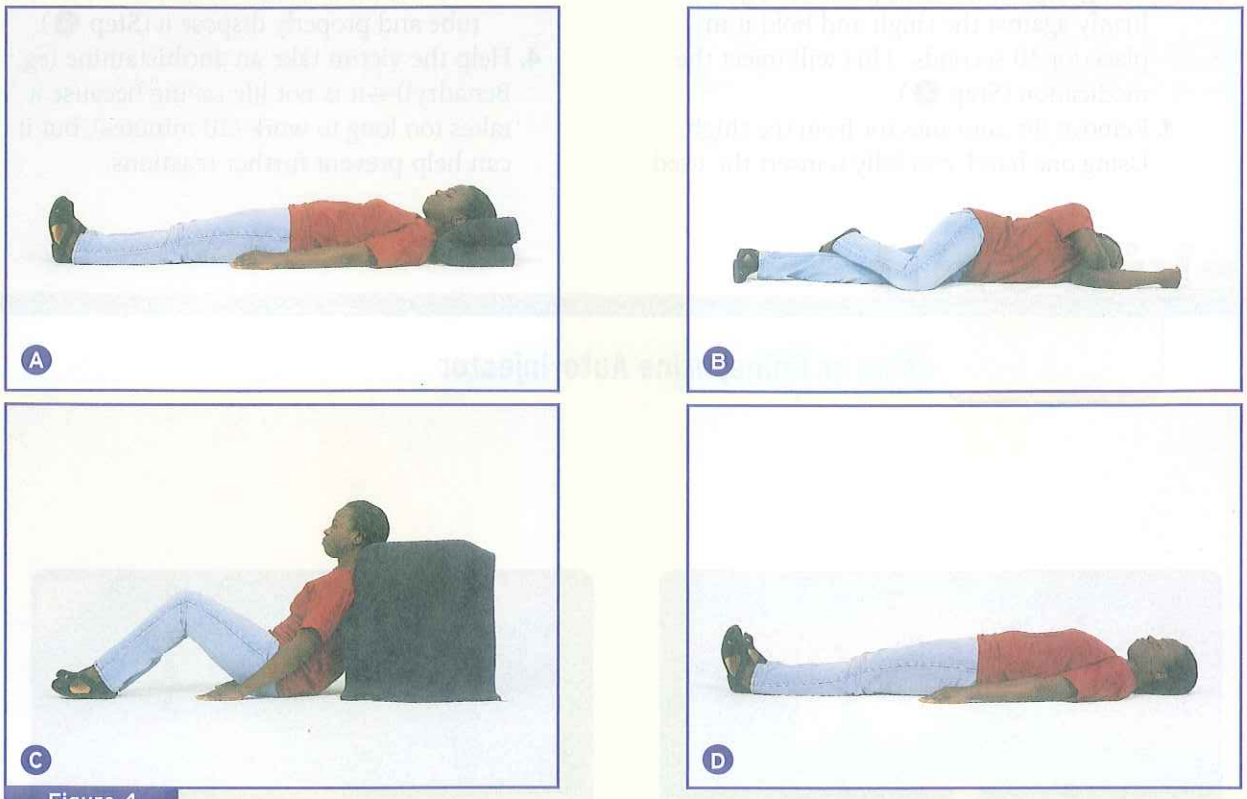


Figure 4

Shock positions. **A.** For a victim with head injury, elevate the head (if spinal injury is not suspected). **B.** Position an unresponsive or stroke victim in the recovery position. **C.** Use a half-sitting position for victims with breathing difficulties, chest injuries, or a heart attack. **D.** Keep the victim flat if a spinal injury or leg fracture is suspected.

6. Keep the victim warm. Place blankets under and over the victim. Do not use external heat sources (for example, hot water bottles or heating pads).
7. Handle the victim gently.
8. Seek immediate medical care. Depending on the problem, it might require calling 9-1-1 or transporting a victim using a private vehicle if EMS is not available.

Care for Anaphylaxis

1. Call 9-1-1 immediately.
2. Monitor breathing and, if absent, begin CPR.
3. If the victim has his or her own physician-prescribed epinephrine, help him or her use it. Some people have an epinephrine auto-injector, which allows them to administer an emergency dose of epinephrine. If you are assisting with or using an auto-injector, follow these steps Skill Drill 1:
   a. Obtain the victim's physician-prescribed epinephrine. Determine that the prescription is the victim's and has not expired.
   b. Remove the safety cap from the auto-injector (**Step** 1).
   c. Support the victim's thigh against movement.
   d. Prepare to thrust the tip of the auto-injector against the victim's outer thigh, midway between the hip and the knee. It is designed to work through light clothing.

e. Using a quick motion, push the injector firmly against the thigh and hold it in place for 10 seconds. This will inject the medication (**Step** 2).
f. Remove the auto-injector from the thigh. Using one hand, carefully reinsert the used auto-injector, needle first, into the carrying tube and properly dispose it (**Step** 3).

4. Help the victim take an antihistamine (eg, Benadryl)—it is not life saving because it takes too long to work (20 minutes), but it can help prevent further reactions.

skill drill

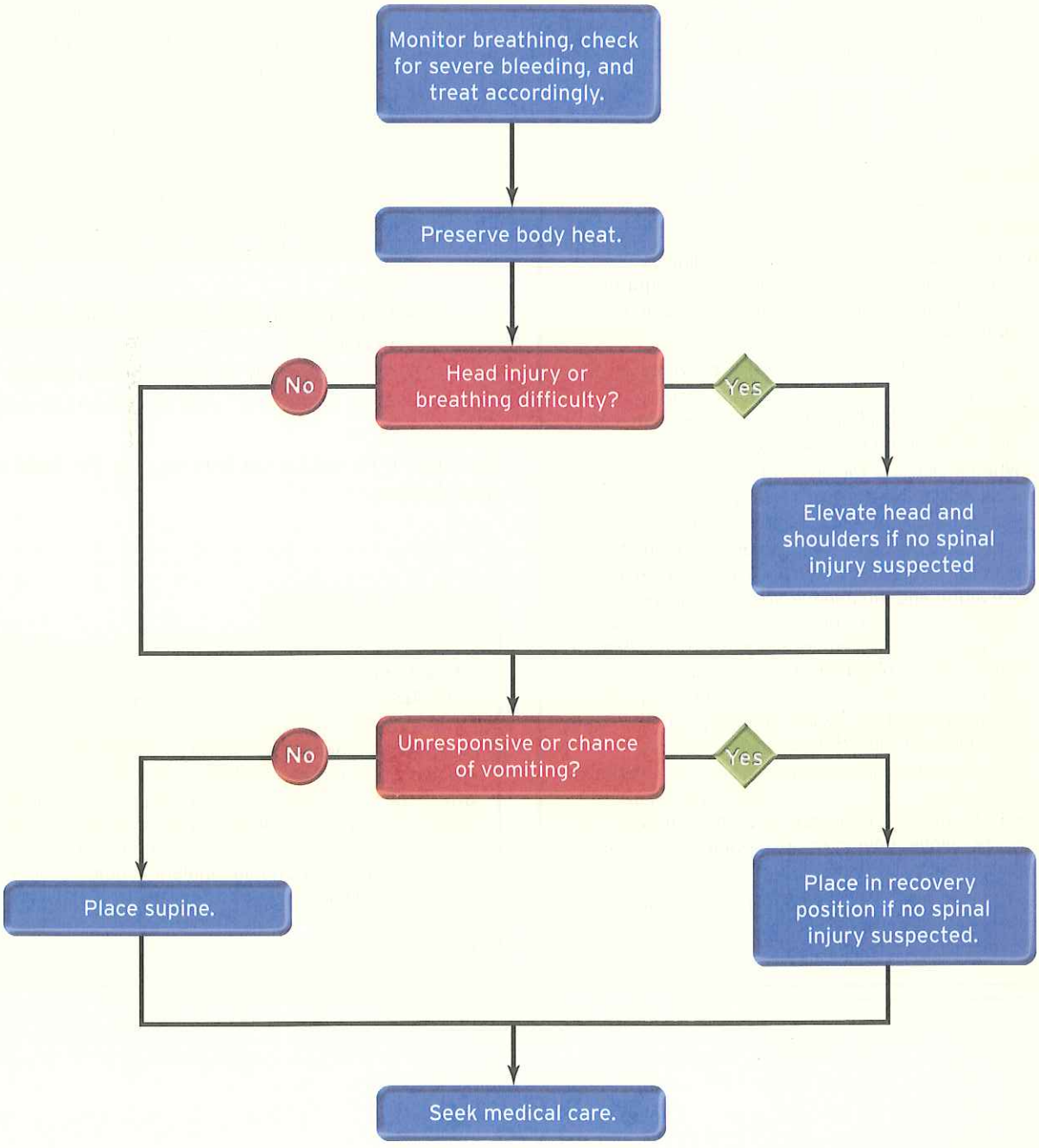
1 Using an Epinephrine Auto-Injector

1 Remove safety cap.

2 Thrust auto-injector against the thigh and hold in place for 10 seconds.

3 Reinsert used auto-injector, needle first, into the carrying tube.

Shock


Monitor breathing, check for severe bleeding, and treat accordingly.
Preserve body heat.
Head injury or breathing difficulty?
No
Yes
Elevate head and shoulders if no spinal injury suspected
Unresponsive or chance of vomiting?
No
Yes
Place supine.
Place in recovery position if no spinal injury suspected.
Seek medical care.

Care for Fainting (Psychogenic Shock)

In most cases of fainting, once the victim collapses and is lying down, blood circulation to the brain is restored and responsiveness usually returns.

If you feel faint:

- Lie down or sit down. Do not place your head between your knees because if you faint you may fall. Some believe that this position also kinks the body and inhibits blood flow returning from the legs to the heart.

If someone else faints:

1. Check for breathing and, if absent, begin CPR and call 9-1-1.
2. Keep the victim flat in a comfortable position or on his or her back. Consider raising the legs 6 to 12 inches unless there are head or spine injuries suspected.
3. Check for possible head and spine injuries, especially in older victims. If the victim is unable to walk without weakness, dizziness, or pain, suspect a head injury or another problem. Call 9-1-1 immediately and treat for possible spine injury.
4. If the person fell, check for and treat any injuries.
5. Allow fresh air to reach the victim (eg, open a window). Ask bystanders to stand clear.

For more information on fainting, see the *Sudden Illness* chapter.

Q&A

When can a victim be moved?

When possible, do not move a victim. This is especially true for a victim whose spine might be injured. Victims can be moved in the following circumstances:

- When hazards exist (eg, burning building, potential explosion, hazardous materials, vehicular traffic, landslide, avalanche), you can move the victim to a safer area.
- When a victim is facing downward (prone position) and is unresponsive, you can roll the victim to face upward (supine position).
- When a victim has breathing difficulty due to vomit or other body fluids (eg, blood) or if you are alone and must leave an unresponsive victim to get help, you can place the victim in a modified HAINES recovery position (High Arm IN Endangered Spine). Do this by placing one arm above and next to the head. Roll the body, as a single unit, to the victim's side. Support the head, which lies on the extended arm.
- When shock begins appearing, keep the victim in a supine position. The feet can be raised about 6 to 12 inches if there are no injuries. If pain occurs while moving or positioning the victim, do not raise the feet.

Source: Markenson D, et al. 2010. Part 13: First Aid: 2010 Consensus on First Aid Science. *Circulation.* 122(suppl):S532-S605.

Q&A

Should smelling salts or ammonia inhalant capsules be used on a person who has fainted or is unresponsive?

No. You shouldn't splash water on or slap the person's face either. Inhalants can adversely affect the victim by causing an asthma attack in an asthmatic person. Inhaled ammonia could burn the nasal mucous membrane. The strong smell of either smelling salts or ammonia inhalants could cause a victim to suddenly jerk his or her head, which could adversely affect any pre-existing cervical spine injury.

Emergency Care Wrap-up

Condition	What to Look For	What to Do
Shock (cardiogenic, hemorrhagic, septic, neurogenic)	Agitation Anxiety Restlessness Feeling of impending doom Altered mental status Weak, rapid, or absent pulse Clammy (pale, cool, moist) skin* Paleness, with cyanosis about the lips Shallow, rapid breathing Shortness of breath Nausea or vomiting	Monitor breathing and provide care if needed. Control all obvious bleeding. Place the victim on his or her back. (Those having a heart attack or those with lung disease breathe easier in a half-sitting position). Do not move the victim if there are suspected fractures or head, spine, or torso injuries. Splint any bone or joint injuries. Place blankets under and over the victim. Handle the victim gently. Seek medical care by calling 9-1-1 if signs of shock are present.
Anaphylaxis	**Skin** Flushing, itching, or burning, especially over the face and upper chest Hives, which can spread over large areas of the body Swelling, especially of the face, tongue, and lips Bluish lips (cyanosis) **Circulatory system** Weak pulse (you might be barely able to feel it) Dizziness Fainting and unresponsiveness **Respiratory system** Sneezing or itching in the nostrils Tightness in the chest, with a persistent dry cough Breathing difficulty Secretions of fluid and mucus into the throat and lungs Wheezing (forced expirations during breathing) Breathing stops	Call 9-1-1 immediately. Monitor breathing, and if necessary, give CPR. If the victim has his or her own prescribed epinephrine, help the victim use it. If you are assisting with or using an auto-injector, follow the container's instructions. Give an antihistamine (such as Benadryl)—it is not life saving because it takes too long to work (20 minutes), but can prevent further reactions.

*Victims of neurogenic shock have warm, pink skin.

prep kit

Ready for Review

- Shock is a state of collapse and failure of the cardiovascular system in which blood circulation decreases and eventually ceases.
- The damage caused by shock depends on which body part is deprived of oxygen and for how long.
- Causes of shock can be both cardiovascular and noncardiovascular.
- Anaphylaxis occurs when the immune system reacts violently to a substance to which it has already been sensitized.
- Although shock itself cannot be seen, you can see its signs and symptoms progress.
- First aiders should automatically treat victims for shock.

Vital Vocabulary

anaphylaxis A life-threatening allergic reaction.

epinephrine auto-injector Prescribed device used to administer an emergency dose of epinephrine to a victim experiencing anaphylaxis.

shock Inadequate tissue oxygenation resulting from serious injury or illness.

Assessment in Action

You are walking up a popular canyon trail on a cool fall afternoon. You hear someone call for help further up the trail, near a cliff. You jog up the trail and find a hiker bent over another person at the base of a cliff. The hiker says the person lying motionless fell about 20 feet while climbing the cliff with no ropes or harness. There are no obvious signs of injury. The victim appears to be breathing and no serious bleeding is seen.

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

Yes No **1.** You should suspect spinal injury.

Yes No **2.** You should preserve the victim's body heat, but do not use external heat sources.

Yes No **3.** You should offer the victim something to eat and drink.

Yes No **4.** There is no need to seek medical care for this situation.

Check Your Knowledge

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

Yes No **1.** Place all severely injured victims in the recovery position.

Yes No **2.** Prevent body heat loss by putting blankets under and over the victim.

Yes No **3.** A shock victim with possible spinal injuries should be placed in a seated position.

Yes No **4.** A shock victim with breathing difficulty or chest injury should be placed on his or her back.

Yes No **5.** Anxiety and restlessness are signs of shock.

Yes No **6.** An epinephrine auto-injector requires a doctor's prescription.

Yes No **7.** All severely injured or ill victims should be treated for shock.

Yes No **8.** Treat severely injured victims for shock even if there are no signs of it.

Yes No **9.** Anaphylaxis is a life-threatening breathing emergency.

Yes No **10.** Victims in shock have hot skin.