American Red Cross
First Aid/CPR/AED

Student Study Guide
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First Aid for Cardiac Emergencies and Choking
Life-threatening cardiac emergencies often strike close to home, where we live, work and play. When you know how to recognize and respond to a cardiac emergency, the life you could save is likely to be that of someone you know—a family member, co-worker or neighbor. Because every minute counts when a person is experiencing a cardiac emergency, the person's survival often depends on lay responders acting quickly and giving appropriate care until EMS personnel arrive and take over.
Heart Attack

A heart attack occurs when blood flow to part of the heart muscle is blocked (e.g., as a result of coronary artery disease). Because the cells in the affected area of the heart muscle are not receiving the oxygen and nutrients they need, they die, causing permanent damage to the heart muscle (Figure 3-1). Seeking advanced medical care as soon as you recognize the signs and symptoms of a heart attack can minimize the damage to the heart and may save the person’s life.

When a person is having a heart attack, every minute counts.

Signs and Symptoms of a Heart Attack

Signs and symptoms of a heart attack vary from person to person, and can be different in women than they are in men. Even people who have had a heart attack before may not experience the same signs and symptoms if they have a second heart attack. A person who is having a heart attack may show any of the following signs and symptoms:

- Chest pain, which can range from mild to unbearable. The person may complain of pressure, squeezing, tightness, aching or heaviness in the chest. The pain or discomfort is persistent, lasting longer than 3 to 5 minutes, or going away and then coming back. It is not relieved by resting, changing position or taking medication. It may be difficult to distinguish the pain of a heart attack from the pain of indigestion, heartburn or a muscle spasm.

- Discomfort or pain that spreads to one or both arms, the back, the shoulder, the neck, the jaw or the upper part of the stomach

- Dizziness or light-headedness

- Trouble breathing, including noisy breathing, shortness of breath or breathing that is faster than normal

- Nausea or vomiting

- Pale, ashen (gray) or slightly bluish skin, especially around the face and fingers

- Sweating

- A feeling of anxiety or impending doom

- Extreme fatigue (tiredness)

- Unresponsiveness
Although men often have the “classic” signs and symptoms of a heart attack, such as chest pain that radiates down one arm, women often have more subtle signs and symptoms or experience the signs and symptoms of a heart attack differently than men do (Figure 3-2). For example, in women, the “classic” signs and symptoms may be milder or accompanied by more general signs and symptoms such as shortness of breath; nausea or vomiting; extreme fatigue; and dizziness or light-headedness. Because these signs and symptoms are so general and nonspecific, women may experience them for hours, days or even weeks leading up to the heart attack but dismiss them as nothing out of the ordinary.

The signs and symptoms of a heart attack may also be more subtle in people with certain medical conditions, such as diabetes.

**First Aid Care for a Heart Attack**

If you think that a person is having a heart attack, call 9-1-1 or the designated emergency number immediately. Trust your instincts. Many people who are having a heart attack delay seeking care because they hope they are experiencing signs and symptoms of a more minor condition that will go away with time, such as indigestion, heartburn, a muscle strain or the flu. People often worry about calling an ambulance and going to the emergency room for a “false alarm.” However, most people who die of a heart attack die within 2 hours of first experiencing signs or symptoms. Even when a heart attack is not fatal, early advanced medical care can help to minimize the damage to the heart. Always seek advanced medical care as soon as signs and symptoms of a heart attack are noted.

If you think that someone might be having a heart attack, you should:

- Call 9-1-1 or the designated emergency number immediately. Never try to drive a person who is experiencing signs and symptoms of a heart attack to the hospital yourself. EMS personnel can transport the person to the hospital safely while initiating care.

- Have the person stop what he or she is doing and rest in a comfortable position to reduce the heart's need for oxygen. Many people experiencing a heart attack find it easier to breathe while sitting.
Loosen any tight or uncomfortable clothing.

- Reassure the person. Anxiety increases the person's discomfort.

- If the person has a history of heart disease and takes a prescribed medication to relieve chest pain (e.g., nitroglycerin), offer to locate the medication and help the person to take it.

- If the person is responsive, able to chew and swallow, and allowed to have aspirin, you may offer two low-dose (81-mg) aspirin tablets or one 5-grain (325-mg) regular-strength aspirin tablet (Box 3-1).

- Closely monitor the person's condition until EMS personnel arrive and take over. Notice any changes in the person's appearance or behavior.

- If you are trained in giving CPR and using an automated external defibrillator (AED), be prepared to give CPR and use an AED if the person becomes unresponsive.

**Cardiac Arrest**

Cardiac arrest is not the same as a heart attack. Remember, a heart attack occurs when blood flow to part of the heart muscle is blocked, causing part of the heart muscle to die. **Cardiac arrest**, on the other hand, occurs when the heart stops beating or beats too ineffectively to circulate blood to the brain and other vital organs. A network of special cells in the heart muscle conducts electrical impulses that coordinate contraction, causing the heart to beat rhythmically. In cardiac arrest, the electrical impulses become abnormal and chaotic. This causes the heart to lose the ability to beat rhythmically, or to stop beating altogether (Figure 3-3).
Cardiovascular disease and certain congenital heart conditions (conditions that a person is born with) can increase a person’s risk for cardiac arrest. Breathing emergencies, such as choking or drowning, can also lead to cardiac arrest because if the body’s supply of oxygen is interrupted, the heart soon stops beating. Every organ in the body needs a steady supply of oxygen in order to work properly, and the heart is no exception. Severe trauma, electric shock and drug overdose are other potential causes of cardiac arrest. Although cardiac arrest is more common in adults, it does occur in young people as well. The most common causes of cardiac arrest in children and infants are breathing emergencies, congenital heart disorders and trauma.

When the heart stops beating properly, the body cannot survive for long. Breathing will soon stop, and the body’s organs will no longer receive the oxygen they need to function. Without oxygen, brain damage can begin in about 4 to 6 minutes, and the damage can become irreversible after about 8 to 10 minutes (Figure 3-4). Death occurs within a matter of minutes if the person does not receive immediate care.

**Box 3-1. Aspirin for a Heart Attack**

You may be able to help a person who is showing early signs and symptoms of a heart attack by offering the person an appropriate dose of aspirin. Aspirin can help to prevent blood clotting and is most effective when given soon after the onset of signs and symptoms of a heart attack. However, you should never delay calling 9-1-1 or the designated emergency number to find or offer aspirin.

Before offering aspirin, make sure the person is responsive, able to chew and swallow, and allowed to have aspirin. Ask the person:

- Are you allergic to aspirin?
- Do you have a stomach ulcer or stomach disease?
- Are you taking any blood thinners, such as warfarin (Coumadin™)?
- Have you ever been told by a healthcare provider to avoid taking aspirin?

If the person answers “no” to each of these questions, you may offer the person two low-dose (81-mg) aspirin tablets or one 5-grain (325-mg) regular-strength aspirin tablet. Have the person chew the aspirin completely. Chewing the aspirin speeds its absorption into the bloodstream.

Do not offer the person an aspirin-containing combination product meant to relieve multiple conditions, or another type of pain medication, such as acetaminophen (Tylenol®), ibuprofen (Motrin®, Advil®) or naproxen (Aleve®). These medications do not work the same way aspirin does and are not beneficial for a person who is experiencing a heart attack.
Signs and Symptoms of Cardiac Arrest

When a person experiences cardiac arrest, you may see the person suddenly collapse. When you check the person, you will find that the person is not responsive and not breathing, or only gasping. (In an unresponsive person, isolated or infrequent gasping in the absence of normal breathing may be agonal breaths, which can occur even after the heart has stopped beating. Agonal breaths are not breathing and are a sign of cardiac arrest.) The person has no heartbeat.

Cardiac arrest can happen suddenly and without any warning signs. When this occurs, the person is said to have experienced sudden cardiac arrest. People who have a history of cardiovascular disease or a congenital heart disorder are at higher risk for sudden cardiac arrest. However, sudden cardiac arrest can happen in people who appear healthy and have no known heart disease or other risk factors for the condition. A person who experiences sudden cardiac arrest is at very high risk for dying and needs immediate care.

First Aid Care for Cardiac Arrest

When a person experiences cardiac arrest, quick action on the part of those who witness the arrest is crucial and gives the person the greatest chance for survival. The Cardiac Chain of Survival describes five actions that, when performed in rapid succession, increase the person's likelihood of surviving cardiac arrest (Box 3-2). In the Cardiac Chain of Survival, each link of the chain depends on, and is connected to, the other links.

Four out of every five cardiac arrests in the United States occur outside of the hospital. That means responders like you are often responsible for initiating the Cardiac Chain of Survival. When you complete the first three links in the Cardiac Chain of Survival—recognizing cardiac arrest and activating the EMS system, immediately beginning CPR and using an AED as soon as possible—you give the person the best chance for surviving the incident.

For each minute that CPR and use of an AED are delayed, the person’s chance for survival is reduced by about 10 percent.

If you think that a person is in cardiac arrest:

- Have someone call 9-1-1 or the designated emergency number immediately.
- Begin CPR immediately.
- Use an AED as soon as possible.
Box 3-2. The Cardiac Chain of Survival

**Adult Cardiac Chain of Survival**

- **Recognition of cardiac arrest and activation of the emergency medical services (EMS) system.** The sooner someone recognizes that a person is in cardiac arrest and calls 9-1-1 or the designated emergency number, the sooner people capable of providing advanced life support will arrive on the scene.

- **Early CPR.** CPR circulates oxygen-containing blood to the brain and other vital organs, helping to prevent brain damage and death.

- **Early defibrillation.** Defibrillation (delivery of an electrical shock using an AED) may restore an effective heart rhythm, significantly increasing the person's chances for survival.

- **Early advanced life support.** Provided by EMS personnel at the scene and en route to the hospital, early advanced life support gives the person access to emergency medical care delivered by trained professionals.

- **Integrated post–cardiac arrest care.** After the person is resuscitated, an interdisciplinary team of medical professionals works to stabilize the person's medical condition, minimize complications, and diagnose and treat the underlying cause of the cardiac arrest to improve survival outcomes.

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**Pediatric Cardiac Chain of Survival**

- **Prevention.** Because cardiac arrest in children often occurs as the result of a preventable injury (such as trauma, drowning, choking or electrocution), the Pediatric Cardiac Chain of Survival has “prevention” as the first link.

- **Early CPR.** CPR circulates oxygen-containing blood to the brain and other vital organs, helping to prevent brain damage and death.

- **Activation of the emergency medical services (EMS) system.** The sooner someone recognizes that a person is in cardiac arrest and calls 9-1-1 or the designated emergency number, the sooner people capable of providing advanced life support will arrive on the scene.

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- **Early advanced life support.** Provided by EMS personnel at the scene and en route to the hospital, early advanced life support gives the person access to emergency medical care delivered by trained professionals.

- **Integrated post–cardiac arrest care.** After the person is resuscitated, an interdisciplinary team of medical professionals works to stabilize the person's medical condition, minimize complications, and diagnose and treat the underlying cause of the cardiac arrest to improve survival outcomes.
CPR

CPR, or cardiopulmonary resuscitation, is a skill that is used when a person is in cardiac arrest to keep oxygenated blood moving to the brain and other vital organs until advanced medical help arrives (Figure 3-5). CPR involves giving sets of 30 chest compressions followed by sets of 2 rescue breaths. When you give compressions, you press down on the person's chest. This squeezes (compresses) the heart between the breastbone (sternum) and spine, moving blood out of the heart and to the brain and other vital organs. After each compression, you must let the chest return to its normal position. This allows blood to flow back into the heart. The rescue breaths you give after each set of 30 compressions deliver a fresh supply of oxygen into the person's lungs. When you give CPR, you help to keep oxygenated blood moving throughout the body, which can buy the person some time until advanced medical help arrives.

Although full CPR (compressions and rescue breaths) is preferred, if you are unable or unwilling for any reason to give full CPR, you can give compression-only CPR instead. In compression-only CPR, you give continuous chest compressions, with no rescue breaths. After checking the scene and the person and calling 9-1-1 or the designated emergency number, give chest compressions without stopping until another trained responder or EMS personnel take over or you notice an obvious sign of life.

AED

While CPR can help to prevent brain damage and death by keeping oxygenated blood moving throughout the body, an AED can correct the underlying problem for some people who go into sudden cardiac arrest. Two abnormal heart rhythms in particular, ventricular fibrillation (V-fib) and ventricular tachycardia (V-tach), can lead to sudden cardiac arrest. In V-fib, the heart muscle simply quivers (fibrillates) weakly instead of contracting strongly. In V-tach, the heart muscle contracts too fast (tachy- means "fast"). Both abnormal rhythms impair the heart's ability to pump and circulate blood throughout the body and are life threatening. However, in many cases, V-fib and V-tach can be corrected by an electrical shock delivered by an AED. This shock disrupts the heart's electrical activity long enough to allow the heart to spontaneously develop an effective rhythm on its own. Starting CPR immediately and using an AED as soon as possible gives the person the best chance for surviving cardiac arrest (Figure 3-6).
Giving CPR

If you check a person and find that he or she is unresponsive and not breathing or only gasping, begin CPR immediately, starting with chest compressions. Proper technique is important. Skill Sheets 3-1, 3-2 and 3-3 describe step by step how to give CPR to an adult, child and infant, respectively. Table 3-1 summarizes the key differences in giving CPR to an adult, child or infant.

Giving CPR to an Adult

First, make sure the person is lying face-up on a firm, flat surface. For example, if the person is on a soft surface like a sofa or bed, quickly move him or her to the floor before you begin. Kneel beside the person.

- **Position your hands.** Place the heel of one hand in the center of the person's chest on the person's breastbone (sternum). If you feel the notch at the end of the breastbone, move your hand slightly toward the person's head. Place your other hand on top of your first hand and interlace your fingers or hold them up so that your fingers are not on the person's chest. If you have arthritis in your hands, you can grasp the wrist of the hand positioned on the chest with your other hand instead. The person's clothing should not interfere with finding the proper hand position or your ability to give effective compressions. If it does, loosen or remove enough clothing to allow deep compressions in the center of the person's chest.

- **Give a set of 30 compressions.** Position your body so that your shoulders are directly over your hands. This will let you push on the chest using a straight up-and-down motion, which moves the most blood with each push and is also less tiring. Keeping
TABLE 3-1 Comparison of CPR Technique in Adults, Children and Infants

<table>
<thead>
<tr>
<th></th>
<th>Adult: About age 12 years or older</th>
<th>Child: Between the ages of 1 and 12 years</th>
<th>Infant: Younger than 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hand Position</strong></td>
<td>Two hands in center of chest</td>
<td>Two hands in center of chest</td>
<td>Two fingers on center of chest, just below the nipple line</td>
</tr>
<tr>
<td><strong>Chest Compressions</strong></td>
<td>Compress at least 2 inches</td>
<td>Compress about 2 inches</td>
<td>Compress about 1½ inches</td>
</tr>
<tr>
<td>Rate:</td>
<td>100–120 compressions/min</td>
<td>100–120 compressions/min</td>
<td>100–120 compressions/min</td>
</tr>
<tr>
<td><strong>Rescue Breaths</strong></td>
<td>Tilt head to past-neutral position; pinch nose shut and form seal over mouth</td>
<td>Tilt head to slightly past-neutral position; pinch nose shut and form seal over mouth</td>
<td>Tilt head to neutral position; form seal over mouth and nose</td>
</tr>
<tr>
<td><strong>Sets</strong></td>
<td>30 chest compressions and 2 rescue breaths</td>
<td>30 chest compressions and 2 rescue breaths</td>
<td>30 chest compressions and 2 rescue breaths</td>
</tr>
</tbody>
</table>
your arms straight, push down at least 2 inches, and then let the chest completely return to its normal position. Push hard and push fast! You want to go at a rate of 100–120 compressions per minute. As you give compressions, count out loud up to 30. Maintain a smooth, steady down-and-up rhythm and do not pause between compressions.

- **Give a set of 2 rescue breaths.** Once you have given 30 compressions, give 2 rescue breaths. First, open the airway using the head-tilt/chin-lift maneuver. Place one of your hands on the person’s forehead and two fingers of your other hand on the bony part of the person’s chin. Tilt the person’s head back and lift the chin. For an adult, tilt the head to a past-neutral position (see Table 3-1). If possible, use a CPR breathing barrier when you are giving rescue breaths, but do not delay rescue breaths to find a breathing barrier or learn how to use it. Pinch the person’s nose shut. Take a normal breath, make a complete seal over the person’s mouth with your mouth, and blow into the person’s mouth to give the first rescue breath. Take another breath, make a seal, and give the second rescue breath. Each rescue breath should last about 1 second and make the person’s chest rise. After you finish giving 2 rescue breaths, return to giving compressions as quickly as possible. The process of giving 2 rescue breaths and getting back to compressions should take less than 10 seconds. Never give more than 2 rescue breaths per set. Table 3-2 describes how to troubleshoot special situations when giving rescue breaths.

Once you begin CPR, continue giving sets of 30 chest compressions and 2 rescue breaths until:

- You notice an obvious sign of life, such as movement. (If the person shows an obvious sign of life, stop CPR, place the person in the recovery position and continue to monitor the person’s condition until EMS personnel take over.)

- An AED is ready to use and no other trained responders are available to assist you with the AED.

**THE PROS KNOW.**

Counting out loud as you give compressions can help you to keep a steady, even rhythm. For compressions 1 through 12, say “one and two and three and four and five and six and…” up to 12. When you get to 13, just say the number: “thirteen, fourteen, fifteen, sixteen…” up to 30. Push down as you say the number and come up as you say “and” (or the second syllable of the number). This will help you to keep a steady, even rhythm.

**THE PROS KNOW.**

Incorrect technique or body position can cause your arms and shoulders to tire quickly when you are giving compressions. Use the weight of your upper body to compress the chest, not your arm muscles. Avoid rocking back and forth, because rocking makes your compressions less effective and wastes your energy. Also avoid leaning on the chest, because leaning prevents the chest from returning to its normal position after each compression, limiting the amount of blood that can return to the heart.

**THE PROS KNOW.**

When giving rescue breaths, keep the person’s head tilted back and avoid taking too large of a breath or blowing too forcefully. Failing to keep the person’s head tilted back, taking too large of a breath, or blowing too forcefully can force air into the person’s stomach instead of into his or her lungs, which can make the person vomit and cause other complications. Remember: Keep the head tilted back, take a normal breath and blow just enough to make the chest rise.
### TABLE 3-2 Special Situations: Rescue Breathing

<table>
<thead>
<tr>
<th>Special Situation</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The breaths do not make the chest rise.</strong></td>
<td>Never give more than 2 rescue breaths per set. If the first rescue breath does not cause the chest to rise, retilt the head to ensure that the airway is properly opened and ensure that the person’s nose and mouth are properly sealed before giving the second rescue breath. If the second breath does not make the chest rise, an object may be blocking the person’s airway. Give CPR with one modification: after each set of compressions and before giving rescue breaths, open the mouth, look for an object in the person’s mouth, and if you see it, remove it.</td>
</tr>
<tr>
<td><strong>The person vomits or there is fluid in the mouth.</strong></td>
<td>Roll the person onto his or her side and clear the mouth of fluid using a gloved finger or a piece of gauze. Then roll the person onto his or her back and resume giving care.</td>
</tr>
<tr>
<td><strong>You are unable to form a tight seal over the person’s mouth (e.g., due to an injury).</strong></td>
<td>Use mouth-to-nose breathing instead. With the person’s head tilted back, close the person’s mouth by pushing on the person’s chin. Make a complete seal over the person’s nose with your mouth and blow in for 1 second to make the chest rise.</td>
</tr>
</tbody>
</table>

*(Continued)*
### Special Situation

The person has a **tracheostomy** or “stoma,” a surgically created opening in the front of the neck that opens into the trachea (windpipe) to form an alternate route for breathing when the upper airway is blocked or damaged.

### Solution

Use mouth-to-stoma breathing instead. Expose the person's neck down to the breastbone and remove anything covering the stoma (e.g., a filter or stoma cover). Wipe away any secretions from the stoma. Make a complete seal over the person's stoma or tracheostomy tube with your mouth and blow in for 1 second to make the chest rise.

- If the chest does not rise, the tracheostomy tube may be blocked. Remove the inner tube and try rescue breaths again.

- If you hear or feel air escaping from the person's mouth or nose, the person is a partial neck breather (i.e., there is still a connection between the trachea and the upper airway, and although the person breathes mainly through the stoma, he or she is also able to breathe to some extent through the mouth and nose). Seal the person's mouth and nose with your hand or a tight-fitting mask so that air does not escape out of the mouth or nose when you give rescue breaths into the stoma.

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- You have performed approximately 2 minutes of CPR (5 sets of 30:2) and another trained responder is available to take over compressions. Giving chest compressions correctly is physically tiring. If more than one responder is available and trained in CPR, the responders should switch responsibility for compressions every 2 minutes, or whenever the responder giving compressions indicates that he or she is tiring. Switching responsibility for giving chest compressions frequently reduces responder fatigue, which improves the quality of chest compressions and leads to a better chance of survival for the person.

- You have performed approximately 2 minutes of CPR (5 sets of 30:2), you are alone and caring for a child, and you need to call 9-1-1 or the designated emergency number.

- EMS personnel take over.

- You are alone and too tired to continue.

- The scene becomes unsafe.

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### Giving CPR to a Child

Giving CPR to a child is very similar to giving CPR to an adult. However, in a child, you open the airway by tilting the head to a slightly past-neutral position, rather than to a past-neutral position (see Table 3-1). Rather than compressing the chest to a depth of at least 2 inches as you would for an adult, you compress the chest to a depth of about 2 inches for a child. Also, for a small child, you may only need to give compressions with one hand, instead of two.
**Giving CPR to an Infant**

The general principles of giving CPR to an infant are the same as they are for children and adults. However, because the infant's body is smaller, you will position your hands differently to deliver compressions. Place the pads of two fingers on the center of the infant’s chest, just below the nipple line. If you feel the notch at the end of the infant’s breastbone, move your fingers slightly toward the infant’s head. Place your other hand on the infant’s forehead. Give compressions by using the pads of your fingers to compress the chest about 1½ inches.

When you give rescue breaths, open the airway by tilting the head to a neutral position (see Table 3-1). Instead of pinching the nose shut and covering the mouth with your mouth, cover the infant’s nose and mouth with your mouth to form a seal.

**Using an AED**

Different types of AEDs are available, but all are similar to operate and use visual displays, voice prompts or both to guide the responder. If your place of employment has an AED on site, know where it is located, how to operate it and how to maintain it (Box 3-3). Also take note of the location of AEDs in public places that you frequent, such as shopping centers, airports, recreation centers and sports arenas.

When a person is in cardiac arrest, use an AED as soon as possible. Skill Sheet 3-4 describes how to use an AED step by step. Environmental and person-specific considerations for safe and effective AED use are given in Box 3-4.

**Using an AED on an Adult**

To use an AED, first turn the device on. Remove or cut away clothing and undergarments to expose the person’s chest. If the person’s chest is wet, dry it using a towel or gauze pad. Dry skin helps the AED pads to stick properly. Do not use an alcohol wipe to dry the skin because alcohol is flammable. Next, apply the AED pads. Peel the backing off the pads as directed, one at a time, to expose the adhesive. Place one pad on the upper right side of the person's chest and the other pad on the lower left side of the person's chest below the armpit, pressing firmly to adhere (Figure 3-7). Plug the connector cable into the AED (if necessary) and follow the device’s directions. Most AEDs will begin to analyze the heart rhythm automatically, but some may require you to push an “analyze” button to start this process. No one should touch the person while the AED is analyzing the heart rhythm because this could result in a faulty reading. Next, the AED
will tell you to push the “shock” button if a shock is advised. Again, avoid touching the person, because anyone who is touching the person while the device is delivering a shock is at risk for receiving a shock as well. After a shock is delivered (or if the AED determines that no shock is necessary), immediately resume CPR, starting with compressions. The AED will continue to check the heart rhythm every 2 minutes. Listen for prompts from the AED and continue giving CPR and using the AED until you notice an obvious sign of life or EMS personnel arrive. If you notice an obvious sign of life, stop CPR but leave the AED turned on and the pads in place on the person’s chest, and continue to follow the AED’s prompts.

Using an AED on a Child or Infant

The procedure for using an AED on a child or infant is the same as the procedure for using an AED on an adult. Some AEDs come with pediatric AED pads that are smaller and designed specifically to analyze a child’s heart rhythm and deliver a lower level of energy. These pads should be used on children up to 8 years of age or weighing less than 55 pounds. Other AEDs have a key or switch that configures the AED for use on a child up to 8 years of age or weighing less than 55 pounds. If pediatric AED pads are not available or the

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**Box 3-3. AED Maintenance**

AEDs require minimal maintenance, but it is important to check them regularly according to the manufacturer's instructions or your employer's policy to ensure that they are in good working order and ready for use whenever they are needed.

- Familiarize yourself with the owner's manual and follow the manufacturer's instructions for maintaining the equipment.

- Familiarize yourself with the method the AED uses to indicate the status of the device. Many AEDs have a status indicator that displays a symbol or illuminates to indicate that the AED is in proper working order and ready to respond. The status indicator may also display symbols indicating that routine maintenance (e.g., a battery change) is needed or that a problem with the device has been detected. Some AEDs have a warning indicator that will illuminate or beep if the AED is not in proper working order and ready to respond.

- Check to make sure the battery is properly installed and within its expiration date.

- Make sure AED pads are adequately stocked, stored in a sealed package, and within their expiration date.

- After using the AED, make sure that all supplies are restocked and that the device is in proper working order.

- If at any time the AED fails to work properly or warning indicators illuminate, take the AED out of service and contact the manufacturer or the appropriate person at your place of employment, according to your employer's policy. You may need to return the AED to the manufacturer for service. If the AED stops working during an emergency, continue giving CPR until EMS personnel take over.
AED does not have a pediatric setting, it is safe to use adult AED pads and adult levels of energy on a child or infant. (Note that the opposite is not true—you should not use pediatric AED pads or the pediatric setting on an adult because the shock delivered will not be sufficient if the person is older than 8 years or weighs more than 55 pounds.)

Just as when you are using an AED on an adult, apply the AED pads to the child's bare, dry chest, placing one pad on the upper right chest and the other pad on the lower left side of the chest below the armpit. If you cannot position the pads this way without them touching (as in the case of an infant or a small child), position one pad in the middle of the chest and the other pad on the back between the shoulder blades (Figure 3-8). Then follow the standard procedure for using an AED.

![Figure 3-8](image)

**Figure 3-8.** If the person is too small to place both AED pads on the front of the chest without them touching, place one on the middle of the chest (A) and the other between the shoulder blades (B).

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**Box 3-4. Considerations for Safe and Effective AED Use**

**Environmental Considerations**

- **Flammable or combustible materials.** Do not use an AED around flammable or combustible materials, such as gasoline or free-flowing oxygen.

- **Metal surfaces.** It is safe to use an AED when the person is lying on a metal surface, as long as appropriate precautions are taken. Do not allow the AED pads to contact the metal surface, and ensure that no one is touching the person when the shock is delivered.

- **Water.** If the person is in water, remove him or her from the water before using the AED. Once you have removed the person from the water, be sure there are no puddles of water around you, the person or the AED.

- **Inclement weather.** It is safe to use AEDs in all weather conditions, including rain and snow. Provide a dry environment if possible (for example, by sheltering the person with umbrellas), but do not delay defibrillation to do so. Remove wet clothing and wipe the person's chest dry before placing the AED pads. Avoid getting the AED or AED pads wet.
Person-Specific Considerations

- **Pregnancy.** It is safe to use an AED on a woman who is pregnant.

- **Pacemakers and implantable cardioverter-defibrillators (ICDs).** A person who has a known arrhythmia (irregular heartbeat) may have a pacemaker or an ICD. These are small devices that are surgically implanted under the skin to automatically prevent or correct an irregular heartbeat. You may be able to see or feel the outline of the pacemaker or ICD in the area below the person’s collarbone, or the person may wear medical identification indicating that he or she has a pacemaker or ICD. If the implanted device is visible or you know that the person has a pacemaker or ICD, adjust pad placement as necessary to avoid placing the AED pads directly over the device because doing so may interfere with the delivery of the shock. However, if you are not sure whether the person has an implanted device, place the pads as you normally would.

- **Transdermal medication patches.** Some types of medications, including nitroglycerin (used to relieve chest pain caused by cardiovascular disease) and smoking-cessation medications, are delivered through patches applied to the skin. Remove any medication patches that you see before applying AED pads and using an AED. Wear gloves to prevent absorption of the drug through your own skin.

- **Chest hair.** Time is critical in a cardiac arrest situation and chest hair rarely interferes with pad adhesion, so in most cases, you should proceed as you normally would—attach the AED pads, pressing firmly to attach them. However, if the person has a great deal of thick chest hair and it seems like the chest hair could interfere with pad-to-skin contact, quickly shave the areas where the pads will be placed and then attach the pads.

- **Jewelry and body piercings.** You do not need to remove the person's jewelry or body piercings before using an AED, but you should avoid placing the AED pads directly over any metallic jewelry or piercings. Adjust pad placement if necessary.

Working as a Team

Remember, when you are giving CPR, you want to give high-quality compressions at the appropriate depth and rate. You also want to minimize interruptions to chest compressions. If you are the only trained responder at the scene, you will begin to tire as you give CPR, and the quality of your compressions will diminish. You will also need to stop CPR to ready the AED for use when it arrives, which means that during that time, there is no oxygenated blood moving through the person’s body.

Working as a team can lead to a better chance of survival for the person in cardiac arrest, by reducing responder fatigue and minimizing interruptions to chest compressions. Trained responders can share the responsibility for giving compressions, switching off every 2 minutes, which reduces fatigue and leads to better-quality compressions. Having two or more trained responders at the scene also minimizes interruptions to chest compressions when the AED arrives.
When two or more responders trained in CPR and using an AED are at the scene, all should identify themselves as being trained. The first responder should begin CPR while the second responder calls 9-1-1 or the designated emergency number, obtains the AED and readies the AED for use by turning the device on, applying the pads to the person’s chest and plugging in the connector cable, if necessary (Figure 3-9). The first responder should not pause CPR until the device is ready to analyze the person’s heart rhythm and the second responder tells everyone to stand clear. While the AED is analyzing, the responders should switch roles so that the second responder can take over giving chest compressions. The responder who is taking over compressions should hover with his or hands positioned just above the person’s chest so that he or she can immediately start compressions as soon as the AED prompts that a shock was delivered or that no shock was advised. The responders then switch roles every time the AED analyzes the person’s heart rhythm, which occurs every 2 minutes.

Figure 3-9. Working as a team can lead to a better chance of survival for the person in cardiac arrest.
Chapter 3 Cardiac Emergencies

Skill Sheet 3-1

Giving CPR to an Adult

1. Verify that the person is unresponsive and not breathing.
   - Shout to get the person’s attention, using the person’s name if you know it. If the person does not respond, tap the person’s shoulder and shout again while checking for normal breathing.
   - If the person does not respond and is not breathing or only gasping, continue to step 2.

2. Place the person on his or her back on a firm, flat surface. Kneel beside the person.

3. Give 30 chest compressions.
   - Place the heel of one hand in the center of the person’s chest, with your other hand on top. Position your body so that your shoulders are directly over your hands.
   - Keeping your arms straight, push down at least 2 inches, and then let the chest return to its normal position.
   - Push hard and push fast! Give compressions at a rate of 100–120 compressions per minute.

4. Give 2 rescue breaths.
   - Place the breathing barrier over the person’s nose and mouth.
   - Open the airway. (Put one hand on the forehead and two fingers on the bony part of the chin and tilt the head back to a past-neutral position.)
   - Pinch the nose shut and make a complete seal over the person’s mouth with your mouth.
   - Take a normal breath and blow into the person’s mouth for about 1 second, looking to see that the chest rises.
   - Take another breath, make a seal, then give the second rescue breath.

Note: If the first rescue breath does not cause the chest to rise, retilt the head and ensure a proper seal before giving the second rescue breath. If the second breath does not make the chest rise, an object may be blocking the airway. After the next set of chest compressions and before attempting rescue breaths, open the mouth, look for an object and, if seen, remove it using a finger sweep. Continue to check the person’s mouth for an object after each set of compressions until the rescue breaths go in.

(Continued)
5. Continue giving sets of 30 chest compressions and 2 rescue breaths until:

- You notice an obvious sign of life.
- An AED is ready to use and no other trained responders are available to assist you with the AED.
- You have performed approximately 2 minutes of CPR (5 sets of 30:2) and another trained responder is available to take over compressions.
- EMS personnel take over.
- You are alone and too tired to continue.
- The scene becomes unsafe.
Skill Sheet 3-2

Giving CPR to a Child

1. Verify that the child is unresponsive and not breathing.
   - Shout to get the child's attention, using the child's name if you know it. If the child does not respond, tap the child's shoulder and shout again while checking for normal breathing.
   - If the child does not respond and is not breathing or only gasping, continue to step 2.

2. Place the child on his or her back on a firm, flat surface. Kneel beside the child.

3. Give 30 chest compressions.
   - Place the heel of one hand in the center of the child's chest, with your other hand on top. Position your body so that your shoulders are directly over your hands. (Alternatively, in a small child, you can use a one-handed CPR technique: place the heel of one hand in the center of the child's chest.)
   - Keeping your arms straight, push down about 2 inches, and then let the chest return to its normal position.
   - Push hard and push fast! Give compressions at a rate of 100–120 compressions per minute.

4. Give 2 rescue breaths.
   - Place the breathing barrier over the child's nose and mouth.
   - Open the airway. (Put one hand on the forehead and two fingers on the bony part of the chin and tilt the head back to a slightly past-neutral position.)
   - Pinch the nose shut and make a complete seal over the child's mouth with your mouth.
   - Take a normal breath and blow into the child's mouth for about 1 second, looking to see that the chest rises.
   - Take another breath, make a seal, then give the second rescue breath.

(Continued)
5. Continue giving sets of 30 chest compressions and 2 rescue breaths until:

- You notice an obvious sign of life.
- An AED is ready to use and no other trained responders are available to assist you with the AED.
- You have performed approximately 2 minutes of CPR (5 sets of 30:2) and another trained responder is available to take over compressions.
- You have performed approximately 2 minutes of CPR (5 sets of 30:2), you are alone and caring for a child, and you need to call 9-1-1 or the designated emergency number.
- EMS personnel take over.
- You are alone and too tired to continue.
- The scene becomes unsafe.
Skill Sheet 3-3

Giving CPR to an Infant

1. Verify that the infant is unresponsive and not breathing.
   - Shout to get the infant’s attention, using the infant’s name if you know it. If the infant does not respond, tap the bottom of the infant’s foot and shout again while checking for normal breathing.
   - If the infant does not respond and is not breathing or only gasping, continue to step 2.

2. Place the infant on his or her back on a firm, flat surface. Stand or kneel next to the infant.

3. Give 30 chest compressions.
   - Place one hand on the infant’s forehead.
   - Place the pad of two fingers on the center of the infant’s chest, just below the nipple line.
   - Compress the chest about 1 ½ inches, and then let the chest return to its normal position.
   - Push hard and push fast! Give compressions at a rate of 100–120 compressions per minute.

4. Give 2 rescue breaths.
   - Place the breathing barrier over the infant’s nose and mouth.
   - Open the airway. (Put one hand on the forehead and two fingers on the bony part of the chin and tilt the head back to a neutral position.)
   - Make a complete seal over the infant’s nose and mouth with your mouth.
   - Take a normal breath and blow into the infant’s nose and mouth for about 1 second, looking to see that the chest rises.
   - Take another breath, make a seal, then give the second rescue breath.

Note: If the first rescue breath does not cause the chest to rise, retilt the head and ensure a proper seal before giving the second rescue breath. If the second breath does not make the chest rise, an object may be blocking the airway. After the next set of chest compressions and before attempting rescue breaths, open the mouth, look for an object and, if seen,
remove it using a finger sweep. Continue to check the infant's mouth for an object after each set of compressions until the rescue breaths go in.

5. Continue giving sets of 30 chest compressions and 2 rescue breaths until:
   - You notice an obvious sign of life.
   - An AED is ready to use and no other trained responders are available to assist you with the AED.
   - You have performed approximately 2 minutes of CPR (5 sets of 30:2) and another trained responder is available to take over compressions.
   - You have performed approximately 2 minutes of CPR (5 sets of 30:2), you are alone and caring for an infant, and you need to call 9-1-1 or the designated emergency number.
   - EMS personnel take over.
   - You are too tired to continue.
   - The scene becomes unsafe.
Skill Sheet 3-4

Using an AED

Note: Do not use pediatric AED pads on an adult or on a child older than 8 years or weighing more than 55 pounds. However, adult AED pads can be used on a child younger than 8 years or weighing less than 55 pounds if pediatric AED pads are not available.

1. Turn on the AED and follow the voice prompts.

2. Remove all clothing covering the chest and, if necessary, wipe the chest dry.

3. Place the pads.
   - Place one pad on the upper right side of the chest and the other on the lower left side of the chest below the armpit.
   - If the pads may touch (e.g., on an infant or small child), place one pad in the middle of the chest and the other pad on the back, between the shoulder blades.

4. Plug the connector cable into the AED, if necessary.

(Continued)
5. Prepare to let the AED analyze the heart’s rhythm.
   - Make sure no one, including you, is touching the person. Say, “EVERYONE CLEAR!” in a loud, commanding voice.
   - If the AED tells you to, push the “analyze” button to start this process.

6. Deliver a shock, if the AED determines one is needed.
   - Make sure no one, including you, is touching the person. Say, “EVERYONE CLEAR!” in a loud, commanding voice.
   - Push the “shock” button to deliver the shock.

7. After the AED delivers the shock, or if no shock is advised:
   - Immediately begin CPR, starting with compressions. Continue giving CPR (about 2 minutes, or 5 sets of 30:2) until prompted by the AED.
   - Continue giving CPR and following the AED’s prompts until you see an obvious sign of life or EMS personnel arrive.
CHOKING

Choking is especially common in young children, but a person of any age can choke. Choking occurs when the airway becomes either partially or completely blocked by a foreign object, such as a piece of food or a small toy; by swelling in the mouth or throat; or by fluids, such as vomit or blood. A person who is choking can quickly become unresponsive and die, so it is important to act quickly.
Risk Factors for Choking

Certain behaviors can put a person at risk for choking, such as talking or laughing with the mouth full or eating too fast. Medical conditions (such as a neurological or muscular condition that affects the person’s ability to chew, swallow or both) can increase risk for choking. So can dental problems or poorly fitting dentures that affect the person’s ability to chew food properly.

Children younger than 5 years are at particularly high risk for choking (Box 4-1). Infants and toddlers explore by putting things in their mouths and can easily choke on them. Even some common foods can be choking hazards in young children. For example, a young child can choke on small foods (such as nuts and seeds);

Box 4-1. Choking Hazards

In children younger than 4 years, the following foods, household objects and toys may be choking hazards:

**Foods**
- Nuts and seeds
- Hot dogs and sausages
- Chunks of meat or cheese
- Chunks of fruit (such as apples) and whole grapes
- Raw vegetables (such as carrots and celery)
- Popcorn
- Peanut butter
- Hard, gooey or sticky candy (such as peppermint candies, fruit strips, marshmallows, gummy bears and chewing gum)
- Large foods that break easily into small pieces (such as teething biscuits and cookies)

**Household Objects and Toys**
- Plastic bags, broken or uninflated balloons, and disposable gloves (the thin material can block the airway)
- Coins
- Buttons
- Small “button” batteries (found inside watches, car key fobs, singing greeting cards, hearing aids and other electronics)
- Magnets
- Marbles
- Beads
- Pebbles
- Pen or marker caps
- Safety pins and hairpins
- Jewelry
- Baby powder
- Vitamins
- Items from the trash (such as eggshells or the pull tabs from soda cans)
- Toys meant for older children, which may be small or have small parts*

*For infants and toddlers, no toy should be smaller than 1¾ inches in diameter. If you can fit the toy through a toilet paper tube, then it is too small and not safe for a young child.
round, firm foods (such as grapes, hot dogs and hard candies); and sticky foods (such as peanut butter). This is because young children do not have the skills needed to chew these foods thoroughly, so they often try to just swallow them whole. Laughing, talking or running with the mouth full can also lead to choking.

**Signs and Symptoms of Choking**

A person who is choking typically has a panicked, confused or surprised facial expression. Some people may place one or both hands on their throat. The person may cough (either forcefully or weakly), or he or she may not be able to cough at all. You may hear high-pitched squeaking noises as the person tries to breathe, or nothing at all. If the airway is totally blocked, the person will not be able to speak, cry or cough. The person’s skin may initially appear flushed (red), but will become pale or bluish in color as the body is deprived of oxygen.

**First Aid for Choking**

If you are with a person who starts to choke, first ask the person if he or she is choking, or check to see if an infant is crying or making other noises. If the person can speak or cry and is coughing forcefully, encourage him or her to keep coughing. A person who is getting enough air to speak, cry or cough forcefully is getting enough air to breathe. But be prepared to act if the person’s condition changes.

If the person is making high-pitched noises or coughing weakly, or if the person is unable to speak or cry, the airway is blocked and the person will soon become unresponsive unless the airway is cleared. Have someone call 9-1-1 or the designated emergency number immediately while you begin to give first aid for choking.

**Caring for an Adult or Child Who Is Choking**

When an adult or child is choking, give a combination of 5 back blows (blows between the shoulder blades) followed by 5 abdominal thrusts (inward and upward thrusts just above the navel) (Figure 4-1). The goal of giving back blows and abdominal thrusts is to force the object out of the airway, allowing the person to breathe.

- **Back blows.** To give back blows, position yourself to the side and slightly behind the person. For a child, you may need to kneel. Place one arm diagonally across the person’s chest (to provide support) and bend the person forward at the waist so that the person’s upper body is as close to parallel to the ground as possible. Firmly strike the person between the shoulder blades with the heel of your other hand. Each back blow should be separate from the others.

- **Abdominal thrusts.** To give abdominal thrusts, stand behind the person, with one foot in front of the other for balance and stability. If possible, place your front foot between the person’s feet. Wrap your arms around the person’s waist. Alternatively, if the person is a child, you can kneel behind the child, wrapping your arms around the child’s waist. Find the person’s navel by placing one finger on the person’s navel, and the adjacent finger above the first. Make a fist with your other hand and place the thumb side just above your fingers. Cover your fist with your other hand and give quick, inward and upward thrusts into the person’s abdomen. Each abdominal thrust should be separate from the others.
Continue giving sets of back blows and abdominal thrusts until the person can cough forcefully, speak, cry, or breathe, or the person becomes unresponsive. After the choking incident is over, even if the person seems fine, he or she should still be evaluated by a healthcare provider to make sure there is no damage to the airway or other internal injuries.

For step-by-step instructions on giving first aid to an adult or child who is choking, see Skill Sheets 4-1 and 4-2. Table 4-1 describes how to troubleshoot special situations when an adult or child is choking.
### TABLE 4-1 Special Situations: Choking in an Adult or Child

<table>
<thead>
<tr>
<th>Special Situation</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The person is too large for you to wrap your arms around to give abdominal thrusts.</td>
<td>Give chest thrusts instead of abdominal thrusts. To give chest thrusts, position yourself behind the person as you would for abdominal thrusts. Place the thumb side of your fist against the center of the person's breastbone. Then cover your fist with your other hand and pull straight back, giving a quick, inward thrust into the person's chest.</td>
</tr>
<tr>
<td>The person is obviously pregnant or known to be pregnant.</td>
<td>Give chest thrusts instead of abdominal thrusts.</td>
</tr>
<tr>
<td>The person is in a wheelchair.</td>
<td>Give abdominal thrusts in the same way that you would for a person who is standing. It may be necessary to kneel behind the wheelchair. If features of the wheelchair make it difficult to give abdominal thrusts, give chest thrusts instead.</td>
</tr>
<tr>
<td>You are alone and choking.</td>
<td>Call 9-1-1 or the designated emergency number using a landline or a GPS-enabled mobile phone. Even if you are not able to speak, the open line will cause the dispatcher to send help. Give yourself abdominal thrusts, using your hands, just as if you were giving abdominal thrusts to another person. Alternatively, bend over and press your abdomen against any firm object, such as the back of a chair or a railing. Do not bend over anything with a sharp edge or corner that might hurt you, and be careful when leaning on a railing that is elevated.</td>
</tr>
</tbody>
</table>
Caring for an Infant Who Is Choking

When an infant is choking, give a combination of 5 back blows followed by 5 chest thrusts (instead of abdominal thrusts) (Figure 4-2). You can sit, kneel or stand to give first aid care to a choking infant, as long as you are able to support the infant on your thigh with the infant's head lower than his or her chest. If the infant is large or your hands are small, you may find it easiest to sit or kneel.

- **Back blows.** First, get the infant into position for back blows. Place your forearm along the infant's back, cradling the back of the infant's head with your hand. Place your other forearm along the infant's front, supporting the infant's jaw with your thumb and fingers. (Be careful not to cover the infant's mouth with your hand while you are supporting the infant's jaw.) Turn the infant over so that he or she is face-down along your forearm. Lower your arm onto your thigh so that the infant's head is lower than his or her chest. Continue to support the infant's jaw with the thumb and fingers of one hand while you firmly strike the infant between the shoulder blades with the heel of your other hand. Keep your fingers up to avoid hitting the infant's head or neck. Each back blow should be separate from the others.

- **Chest thrusts.** Next, place one hand along the infant's back, cradling the back of the infant's head with your hand. While continuing to support the infant's jaw with the thumb and fingers of your other hand, support the infant between your forearms and turn the infant over so that he or she is face-up along your forearm. Lower your arm onto your thigh so that the infant's head is lower than his or her chest. Place the pads of two fingers in the center of the infant's chest, on the breastbone just below the nipple line. Press down about 1½ inches and then let the chest return to its normal position, keeping your fingers in contact with the breastbone. Each chest thrust should be separate from the others.

Continue sets of 5 back blows and 5 chest thrusts until the infant can cough forcefully, cry or breathe, or the infant becomes unresponsive. After the choking incident is over, even if the infant seems fine, he or she should still be evaluated by a healthcare provider to make sure there is no damage to the airway or other internal injuries.

For step-by-step instructions on giving first aid to an infant who is choking, see Skill Sheet 4-3.
If the Person Becomes Unresponsive

If a person who is choking becomes unresponsive, carefully lower him or her to the ground and, if you are trained, begin CPR, starting with chest compressions. After each set of chest compressions and before attempting rescue breaths, open the person's mouth and look for the object. If you see an object in the person's mouth, remove it using your finger (Figure 4-3). Never put your finger in the person's mouth unless you actually see the object. If you cannot see the object and you put your finger in the person's mouth, you might accidentally push the object deeper into the person's throat.

Figure 4-3. If the person becomes unresponsive, look for the object in the person's mouth (A), and if you see it, use a finger sweep to remove it (B).
Skill Sheet 4-1
Caring for an Adult Who Is Choking

1. Verify that the person is choking by asking the person to speak to you.
   - If the person is able to speak to you or is coughing forcefully: Encourage the person to keep coughing, but be prepared to give first aid for choking if the person's condition changes.
   - If the person is unable to speak to you or is coughing weakly: Send someone to call 9-1-1 or the designated emergency number and to obtain an AED and first aid kit. Continue to step 2 after obtaining consent.

2. Give 5 back blows.
   - Position yourself to the side and slightly behind the person. Place one arm diagonally across the person's chest (to provide support) and bend the person forward at the waist so that the person's upper body is as close to parallel to the ground as possible.
   - Firmly strike the person between the shoulder blades with the heel of your hand.

3. Give 5 abdominal thrusts.
   - Have the person stand up straight. Stand behind the person with one foot in front of the other for balance and wrap your arms around the person's waist.
   - Using two fingers of one hand, find the person's navel. With your other hand, make a fist and place the thumb side against the person's stomach, right above your fingers.
   - Cover the fist with your other hand.
   - Pull inward and upward to give an abdominal thrust.

(Continued)
4. Continue giving sets of 5 back blows and 5 abdominal thrusts until:
   - The person can cough forcefully, speak, cry or breathe.
   - The person becomes unresponsive.

**Note:** If the person becomes unresponsive, gently lower him or her to the floor and begin CPR if you are trained, starting with compressions. After each set of compressions and before attempting rescue breaths, open the person’s mouth, look for the object and remove it if seen. Never put your finger in the person’s mouth unless you actually see the object.
### Skill Sheet 4-2

#### Caring for a Child Who Is Choking

1. Verify that the child is choking by asking the child to speak to you.
   - **If the child is able to speak to you or is coughing forcefully:** Encourage the child to keep coughing, but be prepared to give first aid for choking if the child's condition changes.
   - **If the child is unable to speak to you or is coughing weakly:** Send someone to call 9-1-1 or the designated emergency number and to obtain an AED and first aid kit. Continue to step 2 after obtaining consent.

2. Give 5 back blows.
   - Position yourself to the side and slightly behind the child. Place one arm diagonally across the child's chest (to provide support) and bend the child forward at the waist so that the child's upper body is as close to parallel to the ground as possible. Depending on the child's size, you may need to kneel.
   - Firmly strike the child between the shoulder blades with the heel of your hand.

3. Give 5 abdominal thrusts.
   - Have the child stand up straight. Stand behind the child with one foot in front of the other for balance (or kneel) and wrap your arms around the child's waist.
   - Using two fingers of one hand, find the child's navel. With your other hand, make a fist and place the thumb side against the child's stomach, right above your fingers.
   - Cover the fist with your other hand.
   - Pull inward and upward to give an abdominal thrust.

(Continued)
4. Continue giving sets of 5 back blows and 5 abdominal thrusts until:

- The child can cough forcefully, speak, cry or breathe.
- The child becomes unresponsive.

**Note:** *If the child becomes unresponsive, gently lower him or her to the floor and begin CPR if you are trained, starting with compressions. After each set of compressions and before attempting rescue breaths, open the child's mouth, look for the object and remove it if seen. Never put your finger in the child's mouth unless you actually see the object.*
Skill Sheet 4-3
Caring for an Infant Who Is Choking

1. Verify that the infant is choking by checking to see if the infant is crying or coughing forcefully.

- If the infant is crying or coughing forcefully: Allow the infant to keep coughing, but be prepared to give first aid for choking if the infant's condition changes.
- If the infant is unable to cry or is coughing weakly: Send someone to call 9-1-1 or the designated emergency number and to obtain an AED and first aid kit. Continue to step 2 after obtaining consent.

2. Position the infant.

- Place your forearm along the infant's back, cradling the back of the infant's head with your hand.
- Place your other forearm along the infant's front, supporting the infant's jaw with your thumb and fingers.
- Turn the infant over so that he or she is face-down along your forearm.
- Lower your arm onto your thigh so that the infant's head is lower than his or her chest.

Note: Always support the infant’s head, neck and back while giving back blows and chest thrusts.

3. Give 5 back blows.

- Firmly strike the infant between the shoulder blades with the heel of your hand. Keep your fingers up to avoid hitting the infant's head or neck.
4. Reposition the infant.
   - Place one hand along the infant's back, cradling the back of the infant's head with your hand.
   - While continuing to support the infant's jaw with the thumb and fingers of your other hand, support the infant between your forearms and turn the infant over so that he or she is face-up along your forearm.
   - Lower your arm onto your other thigh so that the infant's head is lower than his or her chest.

5. Give 5 chest thrusts.
   - Place the pads of two fingers in the center of the infant's chest on the breastbone, just below the nipple line.
   - Press down about 1½ inches and then let the chest return to its normal position.

6. Continue giving sets of 5 back blows and 5 chest thrusts until:
   - The infant can cough forcefully, cry or breathe.
   - The infant becomes unresponsive.

Note: If the infant becomes unresponsive, lower him or her to a firm, flat surface and begin CPR if you are trained, starting with compressions. After each set of compressions and before attempting rescue breaths, open the infant's mouth, look for the object and remove it if seen. Never put your finger in the infant's mouth unless you actually see the object.
The risk for injury is always present as we go about our daily activities and interact with the world around us. Taking appropriate safety precautions significantly reduces that risk, but injuries do happen. When a person is injured, providing proper first aid can speed recovery and may even save the person’s life.
**Shock**

*Shock* is a progressive, life-threatening condition in which the circulatory system fails to deliver enough oxygen-rich blood to the body’s tissues and organs. As a result, organs and body systems begin to fail. Common causes of shock include severe bleeding and severe allergic reactions (anaphylaxis), but shock can develop quickly after any serious injury or illness. A person who is showing signs and symptoms of shock needs immediate medical attention.

**Signs and Symptoms of Shock**

A person who is going into shock may show any of the following signs and symptoms:

- Restlessness or irritability
- Altered level of consciousness
- Nausea or vomiting
- Pale, ashen (grayish), cool, moist skin
- Rapid breathing
- Rapid, weak heartbeat
- Excessive thirst
- Have the person lie flat on his or her back.
- Control any external bleeding.
- Cover the person with a blanket to prevent loss of body heat.
- Do not give the person anything to eat or drink, even though he or she may complain of thirst. Eating or drinking increases the person’s risk for vomiting and aspiration (inhalation of foreign matter into the lungs). Aspiration can cause serious complications, such as pneumonia.
- Provide reassurance, and help the person rest comfortably. Anxiety and pain can intensify the body’s stress and speed up the progression of shock.
- Continue to monitor the person’s condition and watch for changes in level of consciousness.
Internal Bleeding

**Internal bleeding** (bleeding that occurs inside the body, into a body cavity or space) can be a consequence of traumatic injury and may be life threatening. **Blunt trauma**, which is caused by impact with a flat object or surface, is a common cause of internal bleeding. Mechanisms of injury that can lead to blunt trauma and internal bleeding include falls, being struck by a vehicle or a piece of heavy equipment, being struck by a blunt object (such as a bat) or being thrown into a blunt object (such as a steering wheel). Crushing forces (for example, when a person’s body is squeezed between two hard surfaces) can also cause blunt trauma, leading to internal bleeding. **Penetrating trauma**, which occurs when the body is pierced by a sharp, narrow object (such as a knife or bullet) or impaled on a sharp object (such as a branch or piece of metal), can also lead to internal bleeding.

Internal bleeding may not be immediately obvious because the blood is contained within the body (e.g., within the abdomen, chest or skull). Often, when a person has sustained an injury that could cause internal bleeding, he or she will have other, more obvious injuries as well. When this is the case, medical treatment is usually sought for the more obvious injuries, and the internal bleeding is discovered while the person is being assessed by medical personnel. However, internal bleeding can also occur as a result of seemingly minor trauma, and it may reveal itself hours or days after the initial injury. When the mechanism of injury is one that could lead to internal bleeding (such as blunt or penetrating trauma), be alert to signs and symptoms that may indicate internal bleeding.

**Signs and Symptoms of Internal Bleeding**

As a result of the blood loss, the person may show signs and symptoms of shock, such as excessive thirst; skin that feels cool or moist and looks pale or bluish; an altered level of consciousness; and a rapid, weak heartbeat. The person may cough or vomit blood. You may also notice that the area of the body where the blood is collecting (such as the abdomen) is tender, swollen or rigid, and there may be bruising over the area. If internal bleeding is occurring in an injured limb, the limb may be blue or extremely pale, swollen and rigid.

**First Aid Care for Internal Bleeding**

If a person is showing signs and symptoms of internal bleeding, call 9-1-1 or the designated emergency number immediately, if you have not already done so. If necessary, give first aid care for shock until help arrives.

**Wounds**

A **wound** is an injury that results when the skin or other tissues of the body are damaged. Wounds are generally classified as closed or open.

**Closed Wounds**

When a person has a **closed wound**, the surface of the skin is intact but the underlying tissues are injured. A **bruise (contusion)** is a very common type of closed wound, usually caused by blunt trauma. Bruises occur when the small blood vessels under the surface of the skin are damaged and blood leaks into the surrounding tissues.
Signs and Symptoms of Closed Wounds

The area may appear red or purple, and there may be swelling. The bruised area is often painful.

First Aid Care for Closed Wounds

Applying a cold pack to the bruised area can help to decrease the bleeding and reduce pain and swelling. To make a cold pack, fill a sealable plastic bag with a mixture of ice and water. Before applying the cold pack to the person's skin, wrap it in a thin, dry towel to protect the skin from injury. Hold the cold pack in place for no more than 20 minutes, and then wait at least 20 minutes before applying the cold pack again. If the person is not able to tolerate a 20-minute application, apply the cold pack for periods of 10 minutes on and off. Elevating the injured area may help to reduce swelling, but do not elevate the injured area if doing so causes pain.

Open Wounds

In an open wound, the skin's surface is broken and blood may come through the tear in the skin, resulting in external bleeding (bleeding that is visible on the outside of the body).

Types of Open Wounds

The four main types of open wounds are abrasions, lacerations, avulsions and puncture wounds (Figure 6-1).

- An abrasion occurs when something rubs roughly against the skin, causing damage to the skin's surface. You may hear abrasions referred to as "scrapes," "rug burns," "road rash," or "turf burns." If you have ever had an abrasion, you know how painful these injuries can be! This is because scraping of the outer skin layers exposes sensitive nerve endings. Abrasions are shallow wounds that do not bleed much. However, because of the mechanism of injury (usually a sliding fall), abrasions are often contaminated with dirt and debris. To remove the dirt and debris, rinse the abrasion thoroughly with running water, and then wash the area with soap and water to lower the risk for infection.

- A laceration is a cut, commonly caused by a sharp object such as broken glass or a knife. A laceration can also occur when blunt force splits the skin. Deep lacerations may extend through layers of fat and muscle, damaging nerves, blood vessels and tendons. If nerves are damaged, the laceration may not be painful. Bleeding may be heavy or there may be none at all.

- An avulsion occurs when a portion of the skin, and sometimes the underlying tissue, is partially or completely torn away. Avulsions are commonly caused by animal bites. Elderly people are also susceptible to avulsion wounds as a result of a fall or other trauma because their skin is fragile and tears easily. Avulsion wounds often cause significant bleeding.

- A puncture wound occurs when a pointed object, such as a nail or an animal's tooth, pierces the skin. A gunshot wound is also a puncture wound. Puncture wounds do not bleed much unless a blood vessel has been injured. They carry a high risk for infection because the penetrating object can carry pathogens deep into the body's tissues.
Chapter 6 Traumatic Injuries

First Aid/CP R/AED Participant's Manual

First Aid Care for Open Wounds

Many open wounds are minor and can be cared for effectively using first aid. However, if the wound is deep or extensive, bleeding heavily or uncontrollably, or carries a high risk for infection (e.g., a puncture wound), medical care will be needed (Box 6-1).

Minor Open Wounds

To care for a minor open wound, put on latex-free disposable gloves and other personal protective equipment (PPE) as necessary. Apply direct pressure with a gauze pad to stop the bleeding. It may take several minutes for the bleeding to stop. After the bleeding stops, wash the area with soap and warm water. Rinse under warm running water for about 5 minutes until the wound appears clean and free of debris, and then dry the area. Apply a small amount of antibiotic ointment, cream or gel to the wound if the person has no known allergies or sensitivities to the ingredients. Then cover the area with a sterile gauze pad and a bandage, or apply an adhesive bandage. When you are finished providing care, wash your hands with soap and water, even if you wore gloves.

Myth-Information. Myth: Use hydrogen peroxide to clean a wound and prevent infection; the bubbles mean it is working to kill germs. Although applying hydrogen peroxide to a wound will kill germs, it also can harm the tissue and delay healing. The best way to clean a wound is with soap and warm, running water or saline.
Box 6-1. Does This Wound Need Medical Attention?

Depending on the cause of the wound and the nature of the injury, it may be necessary to see a healthcare provider for treatment.

Tetanus Prophylaxis

When a wound is deep or dirty, you should seek care from a healthcare provider, especially if you do not know or cannot remember when you last had a tetanus booster shot, or if it has been more than 5 years since your last tetanus booster shot. Tetanus is a severe bacterial infection that can result from a puncture wound or a deep laceration. The bacteria that cause tetanus are commonly found in soil and animal manure. Once introduced into the body via a deep or dirty wound, they produce a powerful toxin that can cause muscle paralysis and death. Signs and symptoms of tetanus infection include muscle spasms and stiffness. The spasms and stiffness begin in the jaw and neck, leading to difficulty swallowing (a classic sign of tetanus). As the infection progresses, the muscle spasms and weakness spread to the abdomen and then to the rest of the body.

Although the effects of the tetanus toxin can be managed through administration of an antitoxin, prevention through immunization is a better strategy. The initial tetanus vaccine series is usually given during childhood, and then immunity is maintained through a booster shot given at least every 10 years. Death rates from tetanus infection are highest among those who were never immunized against tetanus and those who fail to maintain adequate immunization through regular booster shots.

Placement of Stitches

Suturing a wound closed can speed the healing process, reduce the chance for infection and minimize scarring. Stitches should be placed within the first few hours after the injury. If you think that a wound needs stitches, it probably does. If in doubt, have the wound evaluated by a healthcare provider. In general, the following types of wounds often require stitches:

- Wounds that are deep or longer than ½ inch
- Wounds on parts of the body where scarring could impair appearance or function (for example, the face, hands or feet)
- Wounds caused by human or animal bites
- Wounds with jagged edges that gape open
- Wounds that are bleeding heavily and uncontrollably
Myth-Information. Myth: Letting a wound “breathe” by exposing it to air helps it to heal. A better strategy to promote wound healing is to keep the wound moist (with an antibiotic ointment, cream or gel) and covered (under a dressing and bandage).

Major Open Wounds

A major open wound (for example, one that involves extensive tissue damage or is bleeding heavily or uncontrollably) requires prompt action. Call 9-1-1 or the designated emergency number immediately and then take steps to control the bleeding until help arrives.

Applying Direct Pressure

Put on latex-free disposable gloves and other personal protective equipment (PPE) as necessary (for example, if blood is spurting, you may need to wear eye and face protection). Cover the area with a
sterile gauze pad or other clean dressing (Box 6-2) and apply direct pressure with your gloved hand until the bleeding stops. This may take as long as 15 minutes. If blood soaks through the first dressing, place another dressing on top of the first and apply additional direct pressure (press harder than you did before, if possible). Repeat with additional dressings as needed, always maintaining direct pressure. Do not remove the blood-soaked dressings because disturbing them may disrupt clot formation and restart the bleeding.

When the bleeding stops, check the skin on the side of the injury farthest away from the heart (e.g., the hand or foot) for feeling, warmth and color. Then apply a bandage over the dressing to maintain pressure on the wound and to hold the dressing in place. To apply a roller bandage, hold one end of the roller bandage in place while you wrap the other end around the wound and dressing several times, using overlapping turns. Make sure the dressing is completely covered and allow a margin of several inches on all sides. Tie or tape the bandage to secure it (Figure 6-2). The bandage should be snug but not too tight. Check for feeling, warmth and color again. If there is a change in feeling, warmth or color from your first check (for example, the skin is cooler or paler than it was before, the area is swollen, or the person complains of a numb or tingly feeling), then the bandage is too tight and needs to be loosened.

Have the person rest comfortably and provide care for shock, if necessary, until help arrives. Remember to wash your hands with soap and water after providing care, even if you wore gloves. Skill Sheet 6-1 describes step by step how to use direct pressure to control external bleeding.

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Box 6-2. **Dressings and Bandages**

Dressings and bandages are staples of any well-stocked first aid kit and have a variety of uses.

**Dressings**

A dressing is a pad that is placed directly on a wound to absorb blood and other fluids, promote clotting and prevent infection. To minimize the chance of infection, dressings should be sterile. There are many different types of dressings available. In a first aid situation, gauze pads, which are available in a variety of sizes, are most commonly used as dressings.

**Bandages**

A bandage is a strip of material used to hold the dressing in place and to control bleeding. Roller bandages, made of gauze or a gauze-like material, are frequently included in first aid kits and come in a variety of widths and lengths. Wrap the bandage around the injured body part, covering the dressing completely and allowing a margin of several inches on all sides. Then tie or tape the bandage to secure it in place. Bandage compresses, which are specially designed to control severe bleeding and usually come in sterile packages, are thick gauze dressings attached to a bandage that is tied in place.
Figure 6-2. To tie a bandage, begin by placing the end of the bandage on the dressing at a 45-degree angle (A). Wrap the bandage one full turn, and then fold the angled end of the bandage up, creating a “dog ear” (B). Continue wrapping the bandage, overlaying the “dog ear” to anchor it and moving upward (C). Once the dressing is covered, roll out the remaining length of bandage (D). While holding the bandage, use the index finger of the other hand to split the bandage in half, moving it down and underneath the limb (E). Bring the two ends of the bandage up and tie them in a bow or knot (F).
Applying a Tourniquet

A **tourniquet** is a device placed around an arm or leg to constrict blood vessels and stop blood flow to a wound. In some life-threatening circumstances, you may need to use a tourniquet to control bleeding as the first step instead of maintaining direct pressure over several minutes. Examples of situations where it may be necessary to use a tourniquet include:

- Severe, life-threatening bleeding that cannot be controlled using direct pressure.
- A physical location that makes it impossible to apply direct pressure to control the bleeding (e.g., the injured person or the person's limb is trapped in a confined space).
- Multiple people with life-threatening injuries who need care.
- A scene that is or becomes unsafe.

If you find yourself in a situation where you need to apply a tourniquet, a commercially manufactured tourniquet is preferred over a makeshift device. Follow the manufacturer's instructions for applying the tourniquet. Although tourniquets may have slightly different designs, all are applied in generally the same way. First, place the tourniquet around the wounded extremity about 2 inches above the wound, avoiding the joint if possible. Secure the tourniquet tightly in place according to the manufacturer's instructions. Twist the rod (windlass) to tighten the tourniquet until the bright red bleeding stops, then secure the rod in place. Note and record the time that you applied the tourniquet and be sure to give EMS personnel this information when they arrive. Once the tourniquet is applied, it should not be removed until the person reaches a healthcare facility. Skill Sheet 6-2 describes step by step how to apply a commercially manufactured tourniquet.

If it is necessary to use a tourniquet and a commercially manufactured tourniquet is not available, make a tourniquet using a strip of soft material that is 2 to 4 inches wide (such as a triangular bandage that has been folded into a tie) and a short, sturdy stick or other rigid object. Tie the stick or other rigid object into the material and twist it to tighten the makeshift tourniquet.

Using Hemostatic Dressings

A **hemostatic dressing** is a dressing treated with a substance that speeds clot formation. As is the case with tourniquets, hemostatic dressings are used when severe life-threatening bleeding exists and standard first aid procedures fail or are not practical. Typically, hemostatic dressings are used on parts of the body where a tourniquet cannot be applied, such as the neck or torso. A hemostatic dressing can also be used to control bleeding from an open wound on an arm or a leg if a tourniquet is ineffective. The hemostatic dressing is applied at the site of the bleeding (possibly inside of the wound) and is used along with direct pressure.

Open Wounds with Embedded Objects

In some cases, the object that caused the wound may remain in the wound. If the embedded object is large (for example, a large piece of glass or metal), do not attempt to remove it. Instead, place several dressings around the object to begin to control blood loss, and then pack bulk dressings or roller bandages around the embedded object to keep it from moving. Bandage the bulk dressings or roller bandages in place around the

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Tourniquets can be extremely painful. If you must apply a tourniquet, make sure the person understands the reason for the tourniquet, and warn the person that it may be painful.
object and seek medical care. Remember to monitor the person for signs and symptoms of shock.

A small partially embedded object, such as a splinter, can usually be removed using first aid techniques; however, medical care should be sought if the splinter is deep, completely embedded in the skin, or located under the nail or in the eye. To remove a simple shallow splinter, grasp the end of the splinter with clean tweezers and pull it out. Then provide care as you would for any minor open wound.

**Traumatic Amputations**

Traumatic amputation is the loss of a body part as a result of an injury. Common causes of traumatic amputations include injuries involving power tools, farming or manufacturing equipment; motor-vehicle collisions; explosions and natural disasters. In a traumatic amputation, the body part might be severed cleanly from the body or ripped away as a result of being subjected to violent tearing or twisting forces. Crushing forces can also result in mangled tissue and traumatic amputations. The body part may be completely detached from the body, or it may still be partially attached. Bleeding may be minimal or severe, depending on the location and nature of the injury.

When a person has experienced a traumatic amputation, call 9-1-1 or the designated emergency number. If the body part is completely detached from the body, try to locate it because surgeons may be able to reattach it. Wrap the amputated body part in sterile gauze or other clean material. Put the wrapped body part in a plastic bag and seal the bag. Keep the bag containing the body part cool by placing it in a larger bag or container filled with a mixture of ice and water. Do not place the bag containing the body part directly on ice or dry ice. Give the bag containing the body part to EMS personnel so that it can be taken to the hospital along with the person.

**Burns**

A burn is a traumatic injury to the skin (and sometimes the underlying tissues as well) caused by contact with extreme heat, chemicals, radiation or electricity (Figure 6-3).

![Figure 6-3. Causes of burns include extreme heat (A), chemicals (B), radiation (C) and electricity (D).](image)
Burns range in severity from minor to critical. A critical burn is one that is life threatening or potentially disfiguring or disabling, and it requires immediate medical attention. When evaluating whether a burn is critical or not, consider the following factors:

- **The depth of the burn.** Burns can be classified according to depth (Figure 6-4). Superficial burns only involve the epidermis (the top layer of skin). Partial-thickness burns involve the epidermis and the dermis (the layer of skin underneath the epidermis that contains blood vessels, nerves, hair follicles and glands). Full-thickness burns involve both layers of skin and may extend into the subcutaneous tissue, muscle or bone underneath. Generally speaking, the deeper the burn, the greater the severity.

- **The percentage of the body's surface area that is burned.** A burn that covers more than one part of the body or covers a large percentage of the person's total body surface area requires medical attention. Even a superficial burn can be a critical burn if it affects a large percentage of the person's total body surface area.

- **The location of the burn.** Burns that affect the hands, feet or groin; those that involve the head, neck, nose, or mouth or affect the person's ability to breathe; and circumferential burns (i.e., those that go all the way around a limb) are considered critical burns.

- **The age of the person.** If the person is younger than 5 years or older than 60 years, the burn should be considered critical, unless it is very minor.

- **The cause of the burn.** Burns caused by electricity, exposure to chemicals, exposure to nuclear radiation or an explosion are considered critical burns.

If you think that a person has a critical burn, call 9-1-1 or the designated emergency number immediately.

**Figure 6-4.** Burns can be classified according to depth.
Signs and Symptoms of Burns

Burned areas can appear red, brown, black (charred) or white. The burned area may be extremely painful or almost painless (if the burn is deep enough to destroy the nerve endings). There may be swelling, blisters or both. The blisters may break and ooze a clear fluid. Burns involving blistering or broken skin should be evaluated by a healthcare provider.

First Aid Care for Burns

**Myth-Information. Myth: Soothe a burn with butter. Not a good idea!** Putting butter, mayonnaise, petroleum jelly or any other greasy substance on a burn is not effective for relieving pain or promoting healing. In fact, applying a greasy substance to the burn can seal in the heat and make the burn worse.

First aid for burns involves three general steps—stop, cool and cover:

- **Stop.** First, after sizing up the scene, stop the burning by removing the source of the injury if it is safe for you to do so. Depending on the cause of the burn, this may involve removing the person from the source or removing the source from the person.

- **Cool.** Next, cool the burn and relieve pain using clean, cool or cold water for at least 10 minutes. Use water that you could drink. Never use ice or ice water to cool a burn because doing so can cause more damage to the skin. If clean cool or cold water is not available, you can apply a cool or cold (but not freezing) compress instead. Cooling a burn over a large area of the body can bring on hypothermia (a body temperature below normal), so be alert to signs and symptoms of this condition (see Chapter 7).

- **Cover.** Finally, cover the burn loosely with a sterile dressing. Make sure that whatever you use to cover the wound is sterile or at least clean, because burns leave the person highly susceptible to infection.

Burns of all types, especially if they cover a large percentage of the body, can cause a person to go into shock, so monitor the person closely. When caring for a burn, do not remove pieces of clothing that are stuck to the burned area, do not attempt to clean a severe burn and do not break any blisters.

Chemical Burns

The general care for a chemical burn is the same as for any other type of burn: stop, cool, cover. However, there are some special considerations for the “stop” step. Because the chemical will continue to burn as long as it is on the skin, you must remove the chemical from the skin as quickly as possible.

- **Dry chemicals.** If the burn was caused by a dry chemical, such as lime, brush off the powder or granules with gloved hands or a cloth, being careful not to get any of the chemical on your skin or on a different area of the person’s skin. Carefully remove, or help the person to remove, any clothing that was contaminated with the chemical. Then flush the area thoroughly with large amounts of cool water for at least 15 minutes or until EMS personnel arrive.
- **Liquid chemicals.** If the burn resulted from a liquid chemical coming into contact with the skin, flush the affected area with large amounts of cool water for at least 15 minutes or until EMS personnel arrive.

If the chemical is in the person’s eye, flush the eye with water until EMS personnel arrive. Tilt the person’s head so that the affected eye is lower than the unaffected eye as you flush.

**Electrical Burns**

First aid for electrical burns also follows the general principle of “stop, cool, cover,” but as with chemical burns, there are some special care considerations when electricity is the cause of the burn. As always, check the scene for safety before entering. Make sure 9-1-1 or the designated emergency number has been called, and if possible, turn off the power at its source. Do not approach or touch the person until you are sure he or she is no longer in contact with the electrical current. Once you have determined that it is safe to approach the person, provide care as needed until help arrives. Because the electrical current that caused the burns can also affect the heart’s rhythm or the person’s ability to breathe (causing the person to go into cardiac arrest), be prepared to give CPR and use an AED if you are trained in these skills.

Anyone who has experienced an electrical burn should be evaluated by a healthcare provider because the person’s injuries may be more extensive than they appear. Although the person may only have a small burn wound where the electrical current entered or left the body, there may be significant internal injuries caused by the current passing through the body.

**Muscle, Bone and Joint Injuries**

Injuries to the muscles, bones and joints include sprains, strains, dislocations and fractures.

- A **sprain** occurs when a ligament is stretched, torn or damaged. Ligaments connect bones to bones at the joints. Sprains most commonly affect the ankle, knee, wrist and finger joints.

- A **strain** occurs when a tendon or muscle is stretched, torn or damaged. Tendons connect muscles to bones. Strains often are caused by lifting something heavy or working a muscle too hard. They usually involve the muscles in the neck, back, thigh or the back of the lower leg. Some strains can reoccur, especially in the neck and back.

- A **dislocation** occurs when the bones that meet at a joint move out of their normal position. This type of injury is usually caused by a violent force that tears the ligaments, allowing the bones to move out of place.

- A **fracture** is a complete break, a chip or a crack in a bone. Fractures can be open (the end of the broken bone breaks through the skin) or closed (the broken bone does not break through the skin).
Signs and Symptoms of Muscle, Bone and Joint Injuries

Muscle, bone and joint injuries can be extremely painful. Sometimes the injury will be very obvious—for example, you may see the ends of a broken bone protruding through the skin, or the injured body part might appear bent or crooked (deformed). If a joint is dislocated, you may see an abnormal bump, ridge or hollow formed by the displaced end of the bone. Other times, signs and symptoms of injury may be more subtle, such as swelling or bruising. Usually, the person will try to avoid using the injured body part because using it causes pain. In some cases, the person may be unable to move the injured body part. The person might also report feeling or hearing “popping” or “snapping” at the time of the injury, or “grating” when moving the injured part.

Sometimes when a person has a muscle, bone or joint injury, you will be able to tell right away that you need to call 9-1-1 or the designated emergency number. But not all muscle, bone or joint injuries result in obvious injuries, and some are not serious enough to summon emergency medical services (EMS) personnel. In general, call 9-1-1 or the designated emergency number if:

- A broken bone is protruding through the skin.
- The injured body part is bent, crooked or looks deformed.
- There is moderate or severe swelling and bruising.
- The person heard or felt “popping” or “snapping” at the time of the injury.
- The person hears or feels “grating” when he or she moves the injured body part.
- The person cannot move or use the injured body part.
- The injured area is cold and numb.
- The injury involves the head, neck or spine.
- The person is having difficulty breathing.
- The cause of the injury (for example, a fall from a height or getting hit by a vehicle) makes you think that the injury may be severe, or that the person may have multiple injuries.
- It is not possible to safely or comfortably move the person to a vehicle for transport to a healthcare facility.

First Aid Care for Muscle, Bone and Joint Injuries

If you have called 9-1-1 or the designated emergency number and are waiting for EMS personnel to arrive, have the person rest without moving or straightening the body part. If the person can tolerate it, apply a cold pack wrapped in a thin, dry towel to the area to reduce swelling and pain.

RICE

In some cases, it may only be necessary for the person to see his or her healthcare provider to have the injury evaluated. If calling EMS is unnecessary, the mnemonic RICE can help you remember how to care for a muscle, bone or joint injury:
R stands for rest. Limit use of the injured body part.

I stands for immobilize. Stabilize the injured body part with an elastic bandage or a splint to limit motion.

C stands for cold. Apply a cold pack wrapped in a thin, dry towel to the area for no more than 20 minutes at a time, and wait at least 20 minutes before applying the cold pack again.

E stands for elevate. Propping the injured part up may help to reduce swelling, but do not do this if raising the injured part causes more pain.

**Myth-Information. Myth: Apply heat to a muscle, bone or joint injury to speed healing.** Although applying heat is commonly used to relieve pain associated with chronic muscle, bone and joint conditions such as arthritis, it is not the best treatment for an acute muscle, bone or joint injury. Applying heat causes the blood vessels in the area to dilate (widen), bringing more blood to the area and increasing swelling. Cold, on the other hand, causes blood vessels to constrict (narrow), reducing blood flow to the area, helping to reduce swelling. In addition, applying cold slows nerve impulses, helping to reduce pain.

**Splinting**

Splinting is a way to prevent movement of an injured bone or joint. It can also help reduce pain. However, you should only apply a splint if you must move the person to get medical help, and if splinting does not cause the person more pain or discomfort.

Splinting involves securing the injured body part to the splint to keep it from moving. Commercial splints are available. You can also make a splint using soft materials (such as blankets, towels or pillows) or rigid materials (such as a folded magazine or a board). You can even use an adjacent part of the body as a splint (for example, you can splint an injured finger to the uninjured finger next to it). This is called an anatomic splint.

Triangular bandages are handy to keep in your first aid kit in case you need to make a splint. A triangular bandage can be used to make a sling (a special kind of splint that is used to hold an injured arm against the chest) and to make ties to hold other kinds of splints in place. A "cravat fold" is used to turn a triangular bandage into a tie (Figure 6-5).

![Figure 6-5. A triangular bandage can be folded into a tie using a cravat fold.](image)
The general rules for applying a splint are the same no matter what type of splint you use:

- Splint the body part in the position in which you found it. Do not try to straighten or move the body part.
- Make sure the splint is long enough to extend above and below the injured area. If a joint is injured, include the bones above and below the joint in the splint. If a bone is injured, include the joints above and below the bone in the splint. If you are not sure what is injured, include both the bones and the joints above and below the injured area in the splint.
- Check for feeling, warmth and color beyond the site of injury before and after splinting to make sure that the splint is not too tight.

Head, Neck and Spinal Injuries

Traumatic accidents (such as falling from a height, getting hit by or being thrown from a vehicle, or sustaining a blow to the head) can cause head, neck or spinal injuries. Head, neck or spinal injuries are serious because they may involve the spinal cord or the brain. Depending on the nature and severity of the injury, the person may be left with a permanent disability (e.g., traumatic brain injury, paralysis). Some head, neck or spinal injuries are fatal.

- **Spinal cord injuries** can result from trauma that causes one or more vertebrae (the bones that surround and protect the spinal cord) to break. The sharp bone fragments can press into the soft tissue of the spinal cord, damaging it. Damage can also occur if the injury causes the soft tissue of the spinal cord to swell, compressing it against the hard bone that surrounds it. Depending on the location and severity of the spinal cord injury, the person may develop paralysis (the loss of movement, sensation or both) in body parts below the level of the injury. **Paraplegia** is paralysis that affects both legs and the lower trunk. **Quadriplegia** is paralysis that affects both arms, the trunk and both legs.

- **Brain injuries** can occur as a result of a blow to the head, a penetrating injury to the head (such as a bullet wound), or exposure to acceleration-deceleration forces that cause the head to snap forward and then back. A blow to the head can lead to a concussion (a traumatic brain injury that alters the way the brain functions; Box 6-3), a brain contusion (bruising of the brain tissue) or a brain hematoma (bleeding into the space between the brain and the skull). Acceleration-deceleration forces, such as can occur with a motor-vehicle collision or a fall from a height, can lead to diffuse axonal injury (tearing of nerves throughout the brain tissue).

Causes of Head, Neck and Spinal Injuries

Many different types of accidents can lead to head, neck or spinal injuries. You should especially consider the possibility of a head, neck or spinal injury if the person:

- Was hit by a vehicle, thrown from a moving vehicle, or was the occupant of a vehicle involved in a motor-vehicle collision.
- Was injured as a result of entering shallow water headfirst.
- Was injured as a result of a fall from a height greater than his or her own height.
- Was participating in a sport and sustained a blow to the head or collided with another player, the ground or a piece of equipment.
Box 6-3. Concussions

A concussion is a common type of traumatic brain injury that involves a temporary loss of brain function. Concussions are particularly common sports-related injuries, but they can occur whenever a person experiences a bump, blow or jolt to the head or body that results in rapid movement of the head. A person who has had one concussion is at increased risk for subsequent concussions.

A concussion can result from even a seemingly minor bump, blow or jolt and may be tricky to recognize. Many people who experience a concussion do not lose consciousness, or they may only lose consciousness very briefly. Your best clues that a person may have a concussion are often changes in the person’s behavior noted after the person has experienced a bump, blow or jolt. For example, the person may seem confused, dazed or stunned; lose the ability to remember or follow simple instructions; or ask repeatedly what happened. The person may complain of a headache, feel nauseated or vomit, have blurred or double vision, complain of dizziness, or be especially sensitive to light or noise. Many people who have experienced a concussion say that the concussion caused them to feel “sluggish,” “groggy” or just “not right.” Signs and symptoms of a concussion usually are apparent soon after the injury, although some can appear hours or days later. For example, the person may sleep more or less than usual. Children may show changes in playing or eating habits. The effects of the concussion can last for several days, weeks or longer.

**Signs and Symptoms of Concussion**

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<td>Difficulty thinking clearly</td>
<td>Headache</td>
<td>Irritability</td>
<td>Changes in sleeping habits (sleeping more or less than usual, difficulty falling asleep)</td>
</tr>
<tr>
<td>Difficulty remembering events that occurred just prior to the incident and just after the incident</td>
<td>Blurry vision</td>
<td>Sadness</td>
<td>Changes in playing and eating habits (in children)</td>
</tr>
<tr>
<td>Difficulty remembering new information</td>
<td>Nausea or vomiting</td>
<td>Heightened emotions</td>
<td></td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>Dizziness</td>
<td>Nervousness or anxiety</td>
<td></td>
</tr>
<tr>
<td>Feeling mentally “foggy”</td>
<td>Sensitivity to noise or light</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty processing information</td>
<td>Balance problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling sluggish (lack of energy)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you think that a person has sustained a concussion, advise the person to stop the activity he or she was engaged in when the incident occurred. The person should follow up with a healthcare provider for a full evaluation. A healthcare provider is best able to evaluate the severity of the injury and make recommendations about when the person can return to normal activities. And, while rare, permanent brain injury and death are potential consequences of failing to identify and respond to a concussion in a timely manner.

**Myth-Information.** *Myth: A person with a concussion who falls asleep could die.* It is generally considered safe for a person with a concussion to go to sleep. However, the person’s healthcare provider may recommend that you wake the person periodically to make sure that his or her condition has not worsened.
Signs and Symptoms of Head, Neck and Spinal Injuries

The signs and symptoms of a head, neck or spinal injury depend on the nature and location of the injury, but could include:

- Unusual bumps, bruises or depressions on the head, neck or back.
- Heavy external bleeding of the head, neck or back.
- Bruising of the head, especially around the eyes and behind the ears.
- Blood or other fluids in the ears or nose.
- Confusion or disorientation.
- Changes in level of consciousness.
- Seizures.
- Impaired breathing or vision.
- Nausea or vomiting.
- Partial or complete loss of movement of any body part.
- Loss of balance.
- Behavior similar to that of a person under the influence of alcohol or drugs (e.g., confusion, stumbling, repeatedly asking the same questions, memory loss, nausea or vomiting, speech problems).
- Severe pain or pressure in the head, neck or back (reported by the person or indicated by the person holding his or her head, neck or back).
- Back pain, weakness, tingling or loss of sensation in the hands, fingers, feet or toes.
- Persistent headache.
- A broken or damaged safety helmet.

First Aid Care for Head, Neck and Spinal Injuries

Because evaluation by medical personnel is needed to determine the severity of a head, neck or spinal injury, you should always assume that an injury involving the head, neck or spine is serious and provide care accordingly. If you suspect a head, neck or spinal injury, call 9-1-1 or the designated emergency number. As long as the person is breathing normally, have him or her remain in the position in which he or she was found. If the person is wearing a helmet, do not remove it unless you are specifically trained to do so and removing the helmet is necessary to give CPR. Similarly, if a child is strapped into a car seat, do not remove him or her from it unless you need to give the child CPR.

**THE PROS KNOW.**

If you suspect that a person has a head, neck or spinal injury, approach the person from the front so that he or she can see you without turning his or her head. Tell the person to respond verbally to your questions, rather than nodding or shaking his or her head.
Nose and Mouth Injuries

Facial trauma can range from minor injuries (cuts and abrasions, bruises, bloody noses and knocked-out teeth) to more severe injuries, such as a fracture of one or more of the facial bones. A person with a facial injury may also have a head, neck or spinal injury, such as a concussion.

Nose Injuries

Falling or getting hit in the nose can result in a nosebleed. Other, nontraumatic causes of nosebleeds include breathing dry air and changes in altitude. Certain medical conditions (such as hypertension, or high blood pressure) and the use of certain medications (such as blood thinners) can make a person more susceptible to nosebleeds.

In most cases, you can stop a nosebleed by having the person pinch his or her nostrils together while sitting with his or her head slightly forward. (Sitting with the head slightly forward helps to keep blood from pooling in the back of the throat, which can lead to choking or, if the blood is swallowed, vomiting.) Keep the nostrils pinched shut for at least 5 minutes before checking to see if the bleeding has stopped. If the bleeding has not stopped after 5 minutes, keep pinching the nostrils shut for another 5 minutes. If the bleeding is severe or gushing, call 9-1-1 or the designated emergency number.

Mouth Injuries

Injuries to the mouth may cause breathing problems if blood or loose teeth block the airway, so make sure the person is able to breathe. If the person is bleeding from the mouth and you do not suspect a serious head, neck or spinal injury, place the person in a seated position leaning slightly forward. This will allow any blood to drain from the mouth. If this position is not possible, place the person on his or her side in the recovery position. Have the person hold a gauze pad at the site of the bleeding and apply direct pressure to stop the bleeding. (If the person is responsive, having the person apply direct pressure to a wound inside his or her own mouth is easier and safer than doing it for the person.)

Lip and Tongue Injuries

For injuries that penetrate the lip, place a rolled gauze pad between the lip and the gum. You can place another gauze pad on the outer surface of the lip. If the tongue is bleeding, apply a gauze pad and direct pressure. Applying a cold pack wrapped in a dry towel to the lips or tongue can help to reduce swelling and ease pain.

Dental Injuries

If a tooth is knocked out, control the bleeding by placing a rolled gauze pad into the space left by the missing tooth and have the person gently bite down to maintain pressure. Try to locate and save the tooth, because a dentist or other healthcare provider may be able to reimplant it. Place the tooth in Hanks’ Balanced Salt solution (e.g., Save-A-Tooth®), if available. If you do not have Hanks’ Balanced Salt solution, place the tooth in egg white, coconut water or whole milk. If these are not available, place the tooth in the injured person’s saliva. Be careful to pick up the tooth only by the crown (the part of the tooth that is normally visible above the gumline) rather than by the root. The person should seek dental or emergency care as soon as possible after the injury. The sooner the tooth is reimplanted, the better the chance that it will survive. Ideally, reimplantation should take place within 30 minutes.

THE PROS KNOW.

Although open wounds on the face and scalp can seem to bleed profusely, the bleeding is usually easily controlled with direct pressure and time.
Chest Injuries

The chest cavity contains the heart, the major blood vessels that enter and leave the heart, the lungs, the trachea and most of the esophagus. These vital organs are protected by a bony cage formed by the ribs and breastbone (sternum). Chest injuries may involve the organs and major blood vessels housed in the chest cavity, the bones that form the chest cavity, or both.

Traumatic chest injuries are frequently caused by blunt trauma. Penetrating trauma (e.g., a stab or gunshot wound) is also a common cause of traumatic chest injuries. Internal bleeding is likely when a person has sustained significant trauma to the chest.

- **Rib fractures** are a common chest injury associated with blunt trauma. Although painful, a simple broken rib rarely is life threatening. Broken ribs are less common in children than in adults because children’s ribs are more flexible and tend to bend rather than break. However, the forces that can cause a broken rib in adults can severely bruise the lung tissue of children, which can be a life-threatening injury.

- **Flail chest** occurs when multiple ribs are broken in more than one place, usually as a result of severe blunt trauma. This interferes with the mechanics of breathing because the injured area is not able to expand properly. (Expansion of the chest is what draws air into the lungs.) Flail chest is also frequently associated with a lung contusion (bruising of the lung tissue), which can be life threatening.

- **Sucking chest wounds** can occur as a result of penetrating trauma. The puncture wound can allow air to enter the space between the lung and the chest wall. The abnormal collection of air in this space puts pressure on the lung, causing it to collapse (a condition called pneumothorax). In addition to putting the person at risk for pneumothorax, the object that caused the puncture wound can injure the organs or vessels contained within the chest cavity and cause varying degrees of internal or external bleeding.

Signs and Symptoms of Chest Injuries

A person with a broken rib may take small, shallow breaths because normal or deep breathing is uncomfortable or painful. The person usually will attempt to ease the pain by supporting the injured area with a hand or arm.

Signs and symptoms of a more serious chest injury (such as multiple broken ribs, internal bleeding, a lung contusion or a sucking chest wound) could include:

- Difficulty breathing.
- Flushed, pale, ashen or bluish skin.
- Severe pain at the site of the injury.
- Bruising at the site of a blunt injury, such as that caused by a seat belt.
- Deformity of the chest wall.
- Unusual movement of the chest wall when the person breathes, which may include paradoxical breathing (when the person inhales, the injured area draws in while the rest of the chest expands, and when the person exhales, the injured area expands while the rest of the chest draws in) or movement of only one side of the chest.
- Coughing up blood, which may be bright red or dark like coffee grounds.
- A “sucking” sound coming from the wound with each breath the person takes (caused by air entering the chest cavity through an open chest wound).
- Signs and symptoms of shock, such as excessive thirst; skin that feels cool or moist and looks pale or bluish; an altered level of consciousness; and a rapid, weak heartbeat.

If the person is showing signs and symptoms of a serious chest injury, or you think that the person might also have a spinal injury, call 9-1-1 or the designated emergency number.
First Aid Care for Chest Injuries

First aid care for a chest injury depends on the type of injury.

**Rib Fracture**

Give the person a pillow or folded blanket to hold against the injured area to provide support and make breathing more comfortable. The person should be evaluated by a healthcare provider, so call 9-1-1 or the designated emergency number if it is not possible to safely or comfortably move the person to a vehicle for transport to a healthcare facility. While you are waiting for help to arrive, have the person rest in a position that will make breathing easier, monitor the person's breathing and give care for shock, if necessary.

**Sucking Chest Wound**

The care for a sucking chest wound is slightly different from the care for other types of open wounds. If external bleeding is present, apply direct pressure to the wound to control the bleeding, but remove each dressing as it becomes saturated with blood and replace it with a clean one as needed. If there is no external bleeding, do not cover the wound. It is important to avoid sealing an open chest wound because doing so could lead to life-threatening complications. While you are waiting for help to arrive, monitor the person's breathing and care for shock, if necessary.

**Abdominal Injuries**

As with chest injuries, abdominal injuries can result from blunt or penetrating trauma and may be accompanied by internal bleeding. It is especially difficult to determine if a person has an abdominal injury if he or she is unresponsive and has no visible signs and symptoms of injury. Always suspect an abdominal injury in a person who has multiple injuries. Conversely, if a person has an abdominal injury, be sure to check the person for other injuries because abdominal injuries are often accompanied by injuries to the chest, pelvis or head.

**Signs and Symptoms of Abdominal Injuries**

Signs and symptoms of a serious abdominal injury could include:

- Severe pain.
- Organs protruding from the abdomen.
- A tender, swollen or rigid abdomen.
- Bruising over the abdomen.
- Nausea.
- Vomiting (sometimes blood).
- Signs and symptoms of shock, such as excessive thirst; skin that feels cool or moist and looks pale or bluish; an altered level of consciousness; and a rapid, weak heartbeat.
First Aid Care for Abdominal Injuries

Call 9-1-1 or the designated emergency number for any serious abdominal injury. Carefully position the person on his or her back with his or her knees bent, unless that position causes the person pain or the person has other injuries. While you are waiting for help to arrive, monitor the person’s condition and give care for shock, if necessary.

Abdominal organs may protrude through a severe open wound. If organs are protruding through the wound, do not push them back in and do not apply direct pressure to try and stop minor bleeding. After putting on latex-free disposable gloves, remove clothing from around the wound. Moisten sterile dressings with clean, warm tap water or saline and apply them loosely over the wound. Then cover the dressings loosely with plastic wrap or aluminum foil, if available.

Pelvic Injuries

The pelvis is a ring-shaped group of bones that provides support for the trunk; connects the trunk to the legs; and protects the bladder, the rectum, several major arteries and, in women, the reproductive organs. The hip joint is formed by the acetabulum (a cup-shaped indentation on the pelvis) and the upper part of the femur (the thigh bone).

Blunt trauma to the pelvic region can result in pelvic fractures and damage to the internal organs, blood vessels and nerves that are normally protected by the pelvic bones. Usually pelvic fractures result from high-energy impacts (for example, a motor-vehicle collision), but in older adults with osteoporosis (a disease in which loss of bone tissue causes the bones to become fragile and prone to breaking), minor trauma or a fall can result in breaking the pelvis or the upper part of the femur where it forms the hip joint with the pelvis. Pelvic injuries are serious and may be life threatening because of the risk of damage to major arteries or internal organs. Fractures of bones in this area may cause severe internal bleeding and are associated with an increased risk for death in older adults.

Signs and Symptoms of Pelvic Injuries

Signs and symptoms of a pelvic injury may include the following:

■ Severe pain at the site of the injury
■ Bruising, swelling or both at the site of the injury
■ Instability of the pelvic bones
■ Blood-tinged urine
■ Loss of sensation in the legs or an inability to move the legs
■ Signs and symptoms of shock, such as excessive thirst; skin that feels cool or moist and looks pale or bluish; an altered level of consciousness; and a rapid, weak heartbeat

First Aid Care for Pelvic Injuries

Always call 9-1-1 or the designated emergency number if you suspect a pelvic injury. Avoid moving the person unnecessarily because movement can make the pelvic injury worse, and the person may also have injuries to the lower spine. If possible, try to keep the person lying flat, and give care for shock if necessary.
### Skill Sheet 6-1

**Using Direct Pressure to Control External Bleeding**

1. Cover the wound with a sterile gauze pad and apply direct pressure until the bleeding stops.
   - If blood soaks through the first gauze pad, put another one on top and apply additional direct pressure (press harder than you did before, if possible). It may take several minutes for the bleeding to stop.

2. When the bleeding stops, check for circulation (feeling, warmth and color) beyond the injury.

3. Apply a roller bandage. Wrap the bandage around the wound several times to hold the gauze pad(s) in place.
   - Tie or tape the bandage to secure it.
   - Check for circulation (feeling, warmth and color) beyond the injury. If there is a change in feeling, warmth or color (indicating that the bandage is too tight), gently loosen it.

4. Remove your gloves and wash your hands.

**Note:** If the bleeding does not stop with the application of direct pressure, call 9-1-1 or the designated emergency number if you have not already, and give care for shock if necessary.
Skill Sheet 6-2

Using a Commercial Tourniquet

Note: Always follow the manufacturer’s instructions when applying a tourniquet.

1. Place the tourniquet around the limb, approximately 2 inches above the wound. Avoid placing the tourniquet over a joint.

2. Secure the tourniquet tightly in place according to the manufacturer’s instructions.

3. Tighten the tourniquet by twisting the rod until the flow of bright red blood stops.

4. Secure the rod in place using the clip or holder.

5. Note and record the time that you applied the tourniquet and give this information to EMS personnel when they arrive.

- Once you apply a tourniquet, do not loosen or remove it.