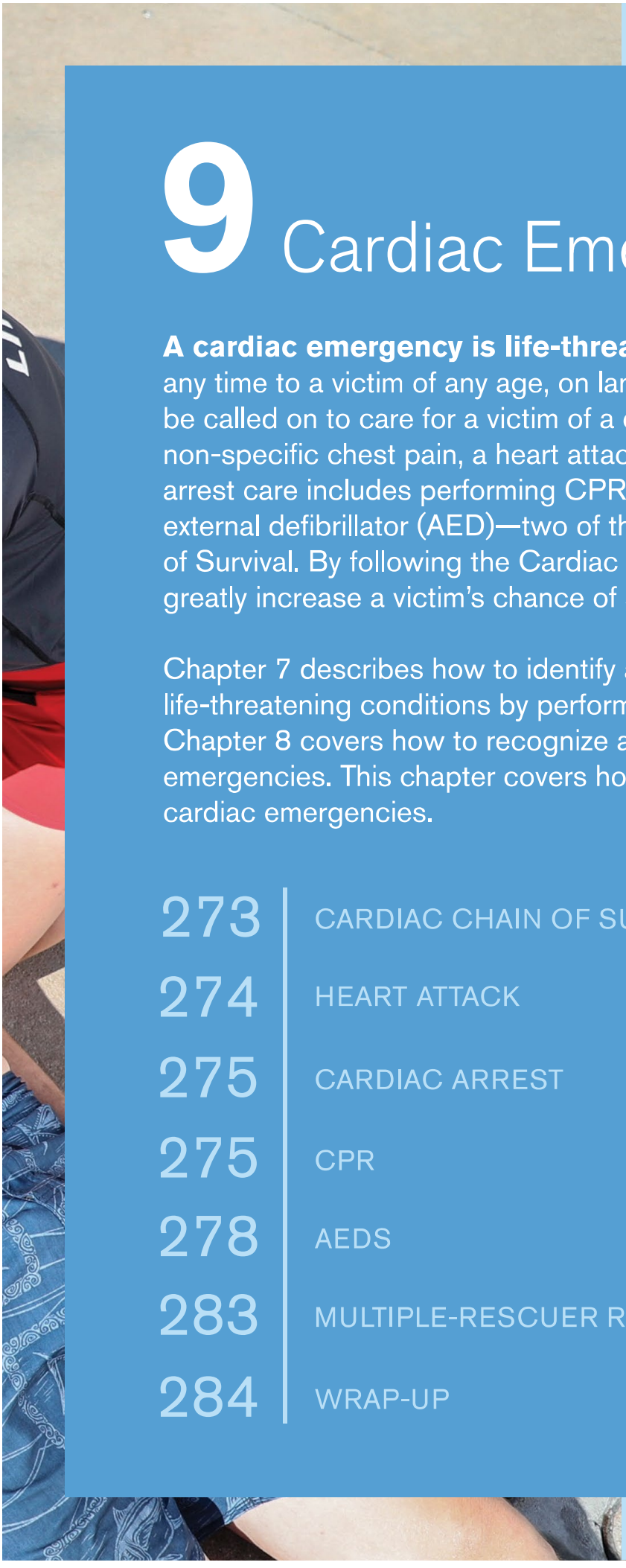

9 Cardiac Emergencies

A cardiac emergency is life-threatening. It can happen at any time to a victim of any age, on land or in the water. You may be called on to care for a victim of a cardiac emergency, including non-specific chest pain, a heart attack or cardiac arrest. Cardiac arrest care includes performing CPR and using an automated external defibrillator (AED)—two of the links in the Cardiac Chain of Survival. By following the Cardiac Chain of Survival, you can greatly increase a victim's chance of survival from cardiac arrest.

Chapter 7 describes how to identify and give initial care for life-threatening conditions by performing a primary assessment. Chapter 8 covers how to recognize and care for breathing emergencies. This chapter covers how to provide care for several cardiac emergencies.

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9-1 CARDIAC CHAIN OF SURVIVAL

To effectively respond to cardiac arrest, it is important to understand the Cardiac Chain of Survival (Figure 9-1). The Cardiac Chain of Survival for adults consists of five links:

- Recognition of cardiac arrest and activation of the emergency response system
- Early CPR to keep oxygen-rich blood flowing and to help delay brain damage and death
- Early defibrillation to help restore an effective heart rhythm and significantly increase the victim's chance for survival
- Advanced life support using advanced medical personnel who can provide the proper tools and medication needed to continue the lifesaving care
- Integrated post-cardiac arrest care to optimize ventilation and oxygenation and treat hypotension immediately after the return of spontaneous circulation

The pediatric Cardiac Chain of Survival is similar to the adult Cardiac Chain of Survival (Figure 9-2). The five links include the following:

- Injury prevention and safety
- Early, high-quality CPR
- Rapid activation of the emergency medical services (EMS) system or response team to get help on the way quickly—no matter the victim's age
- Effective, advanced life support
- Integrated post-cardiac arrest care

For each minute CPR and defibrillation are delayed, the victim's chance for survival is reduced by about 10 percent.

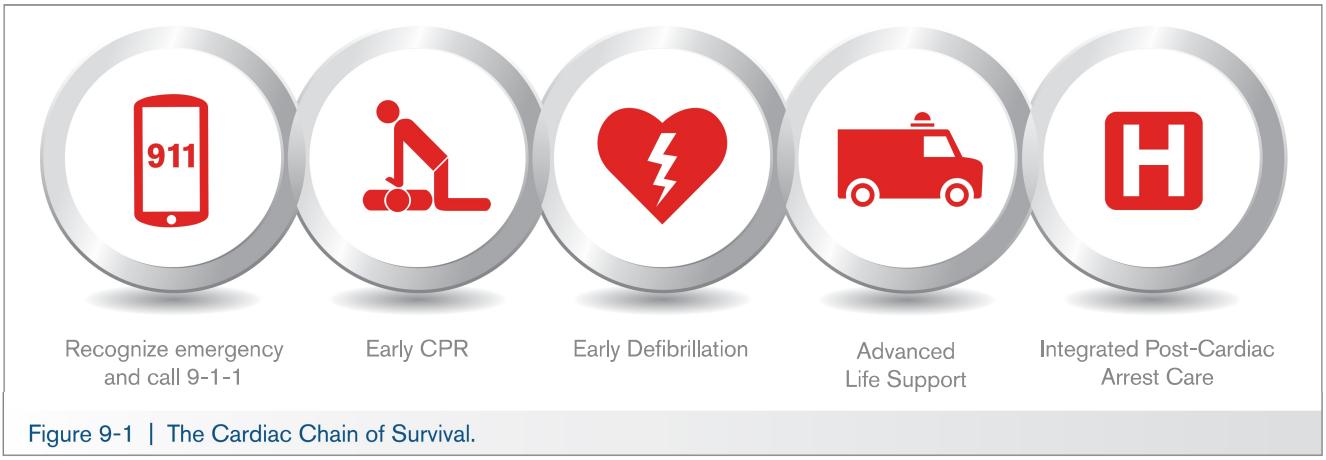

Figure 9-1 | The Cardiac Chain of Survival.

Figure 9-2 | The Pediatric Chain of Survival.

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9-2 HEART ATTACK

When the muscle of the heart suffers a loss of oxygenated blood, the result is a **myocardial infarction (MI)**, or heart attack. A heart attack is not the same as a cardiac arrest, but it can cause a cardiac arrest. Heart attacks usually result from cardiovascular disease, but can be caused by a myocardial contusion or bruising to the heart caused by a traumatic event.

Recognizing a Heart Attack

A heart attack refers to the necrosis (death) of heart tissue as a result of a loss of oxygenated blood. The sooner the signs and symptoms are recognized and treated, the better the victim's chance of survival. Even victims who have had a heart attack may not recognize the signs because each heart attack may have different signs and symptoms.

Summon EMS personnel and provide prompt care if, during the SAMPLE history (discussed in Chapter 10), the victim shows or reports any of the signs and symptoms listed below or if you suspect that the victim may be suffering from a heart attack. Ask open-ended questions, such as, "How are you feeling?" to hear the symptoms described in the victim's own words. The signs and symptoms include:

- Chest discomfort or pain that is severe, lasts longer than 3 to 5 minutes, goes away and comes back or persists even during rest
- Discomfort, pressure or pain that is persistent and ranges from discomfort to an unbearable crushing sensation in the center of the chest, possibly spreading to the shoulder, arm, neck, jaw, stomach or back, and is usually not relieved by resting, changing position or taking medication
- Chest pain that comes and goes
- Difficulty breathing, such as at a faster rate than normal, or noisy breathing
- Pale or ashen skin, especially around the face
- Sweating, especially on the face
- Dizziness or light headedness
- Nausea or vomiting
- Fatigue, lightheadedness or loss of consciousness

These warning signs may occur with or without chest pain. When women experience chest pain, it may be atypical—sudden, sharp but short-lived pain outside the breastbone. Like women, other individuals—such as older adults or those with diabetes—are somewhat more likely to experience some of the other warning signs, such as:

- Shortness of breath
- Nausea or vomiting
- Back or jaw pain
- Unexplained fatigue or malaise

Caring for a Heart Attack

If you think someone is having a heart attack:

- Take immediate action and summon EMS personnel.
- Have the victim stop any activity and rest in a comfortable position.
- Loosen tight or uncomfortable clothing.
- Closely monitor the victim until EMS personnel take over. Note any changes in the victim's appearance or behavior.
- Comfort the victim.
- Be prepared to perform CPR and use an AED.

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Administering Aspirin for a Heart Attack

You may be able to help a victim who is awake and alert and is showing signs of a heart attack by offering an appropriate dose of aspirin, if local protocols allow or medical direction permits. Aspirin never should replace advanced medical care, and you should never delay calling EMS to find or offer aspirin.

If the victim is awake and alert and able to take medicine by mouth, ask:

- Are you allergic to aspirin?
- Do you have a stomach ulcer or stomach disease?
- Are you taking any blood thinners, such as Coumadin® (warfarin)?
- Have you been told by a healthcare provider not to take aspirin?

If the victim answers "no" to all of these questions, and if local protocols allow, consider administering two 81-mg, low-dose aspirins (162 mg total), or up to one 5-grain, 325-mg aspirin tablet, based on what is available. (It is not necessary to give more than two low-dose aspirins.) The aspirin *must be chewed* before swallowing.

Be sure that you only give aspirin and not acetaminophen (e.g., Tylenol®) or nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen (e.g., Motrin® or Advil®) or naproxen (e.g., Aleve®). These medications do not work the same way aspirin does and are not beneficial for a person who is experiencing a heart attack. Enteric-coated aspirin is fine to administer as long as it is chewed.

9-3 CARDIAC ARREST

Cardiac arrest is a life-threatening emergency that may be caused by a heart attack, drowning, electrocution, respiratory arrest or other conditions. Cardiac arrest occurs when the heart stops beating or beats too irregularly or weakly to circulate blood effectively. Cardiac arrest can occur suddenly and without warning.

In many cases, the victim has already been experiencing the signs and symptoms of a heart attack. However, sudden cardiac arrest is often the first sign of sudden death.

The signs of a cardiac arrest include:

- Sudden collapse
- Unresponsiveness
- Abnormal breathing
- No pulse

9-4 CPR

A victim who is unresponsive, not breathing normally and has no pulse is in cardiac arrest and needs CPR (Figure 9-3). The objective of CPR is to perform a combination of effective chest compressions and ventilations to circulate blood that contains oxygen to the victim's brain and other vital organs. In most cases, CPR is performed in cycles of 30 chest compressions followed by 2 ventilations.

Figure 9-3 | CPR is delivered in cycles of chest compressions and ventilations.

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Summoning EMS personnel immediately is critical for the victim's survival. If an AED is available, it should be used in combination with CPR and according to local protocols until EMS personnel take over.

One component of CPR is chest compressions. To ensure optimal victim outcomes, high-quality CPR must be performed. You can ensure high-quality CPR by providing high-quality chest compressions, making sure that the:

- Victim is on a firm, flat surface to allow for adequate compression, such as the floor or ground.
- Chest is exposed to ensure proper hand placement and the ability to visualize chest recoil.
- Hands are correctly positioned with the heel of one hand in the center of the chest on the lower half of the victim's sternum, with the other hand on top. Most responders find that interlacing their fingers makes it easier to provide compressions while keeping the fingers off the chest.
- Arms are as straight as possible, with the shoulders directly over the hands to promote effective compressions. Locking elbows will help maintain straight arms.
- Compressions are given at the correct rate—at least 100 per minute to a maximum of 120 per minute—and at the proper depth to ensure adequate circulation:
  - For an adult, compress the chest at least 2 inches, but no more than 2.4 inches.
  - For a child, compress the chest about 2 inches.
  - For an infant, compress the chest about 1½ inches.
- Chest must be allowed to fully recoil between each compression to allow blood to flow back into the heart following the compression.
- Interruptions to chest compressions are minimized.

For more details, see Table 9-1.

Chest Compression Fraction

Chest compression fraction, or CCF, is the term used to denote the proportion of time that chest compressions are performed. It represents the fraction of time spent performing compressions; that is, the time that the responders are in contact with the victim's chest, divided by the total time of the resuscitation, beginning with the start of CPR until CPR is stopped, for whatever reason. Expert consensus identifies a CCF of at least 60 percent to promote optimal outcomes, with a goal of 80 percent.

To achieve the best CCF percentage, a coordinated team approach is needed, with each member assuming specific roles, anticipating the next action steps for yourself and other team members. This coordinated team approach also includes integrating and assimilating additional safety members and EMS personnel who arrive on the scene.

Keep in mind that there are no national protocols in place for high-performance CPR. How you function within a team setting, including how additional personnel assimilate into the team, may vary depending on your local protocols or practice.

Remember that when giving ventilations to a victim during CPR, you should:

- Maintain an open airway by keeping the head tilted back in the proper position.
- Seal the mask over the victim's mouth and nose.
- Blow into the one-way valve, ensuring that you can see the chest begin to rise and fall. Each ventilation should last about 1 second, with a brief pause between breaths to let the chest fall.

After ventilations, quickly reposition your hands on the center of the chest and start another cycle of 30 compressions and 2 ventilations.

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Two-Rescuer CPR

When an additional rescuer is available, you should provide two-rescuer CPR. One rescuer gives chest compressions and the other gives ventilations (Figure 9-4). Rescuers should change positions (alternate giving compressions and ventilations) at least every 2 minutes (5 cycles of 30 compressions and 2 ventilations) to reduce rescuer fatigue, or during the analysis of the AED. Changing positions should take less than 5 seconds.

When CPR is in progress by one rescuer and a second rescuer arrives, the second rescuer should confirm whether EMS personnel have been summoned. If EMS personnel have not been summoned, the second rescuer should do so before getting the AED or assisting with care. If EMS personnel have been summoned, the second rescuer should get the AED, or if an AED is not available, help perform two-rescuer CPR.

When performing two-rescuer CPR on a child or infant, rescuers should change the compression-to-ventilation ratio from 30 compressions for every 2 ventilations (30:2) to 15 compressions for every 2 ventilations (15:2). This provides more frequent ventilations for children and infants. When providing two-rescuer CPR to an infant, rescuers should also perform a different technique, called the encircling thumbs technique.

Once you begin CPR, do not stop. Continue CPR until:

- You see an obvious sign of life, such as normal breathing or victim movement.
- An AED is ready to analyze the victim's heart rhythm.
- Other trained responders, such as a member of your safety team or EMS personnel, take over and relieve you from compression and ventilation responsibilities.
- You are alone and too exhausted to continue.
- The scene becomes unsafe.

When performing CPR, the victim may vomit, there may be frothing at the nose and mouth, and the scene may be chaotic. The victim also may produce agonal breaths. Remember that agonal breaths are not normal breathing—this victim needs CPR.

Understand that, despite your best efforts, not all victims of cardiac arrest survive.

Figure 9-4 | During two-rescuer CPR, one rescuer gives ventilations and the other gives chest compressions.

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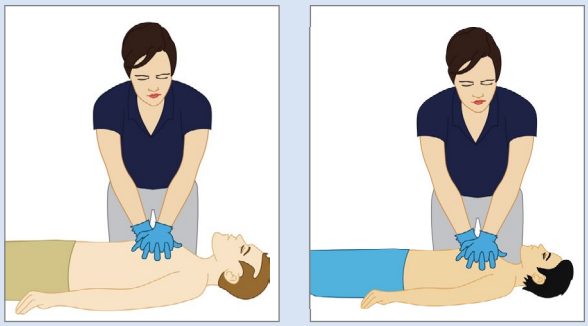
Table 9-1: Summary of Techniques for CPR—Adult, Child and Infant			
	Adult	**Child**	**Infant**
Hand position	Heel of one hand in center of chest (on lower half of sternum) with the other hand on top 		Two fingers on the center of the chest (just below the nipple line)
Compression depth	At least 2 inches (Try to avoid greater than 2.4 inches if using a feedback device.)	About 2 inches	About 1½ inches
Ventilations	Until chest begins to rise (1 second per ventilation)		
Cycles (one rescuer)	30 chest compressions and 2 ventilations		
Cycles (two rescuers)	30 chest compressions and 2 ventilations	15 chest compressions and 2 ventilations	
Rate	Between 100 and 120 compressions per minute		

9-5 AEDS

AEDs are portable electronic devices that analyze the heart's rhythm and provide an electrical shock (Figure 9-5). Defibrillation is the delivery of an electrical shock that may help re-establish an effective rhythm. CPR can help by supplying blood that contains oxygen to the brain and other vital organs. However, the sooner an AED is used, the greater the likelihood of survival. You must assess victims quickly and be prepared to use an AED in cases of cardiac arrest.

Figure 9-5 | An AED

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Did You Know?

For each minute CPR and defibrillation are delayed, the victim's chance for survival is reduced by about 10 percent.

When the Heart Stops

Any damage to the heart from disease or injury can disrupt the heart's electrical system, which normally triggers the contraction—or pumping action—of the heart muscle. This disruption can result in an abnormal heart rhythm, possibly stopping circulation. Two common treatable abnormal rhythms that cause sudden cardiac arrest are **ventricular fibrillation (VF)** and pulseless **ventricular tachycardia (VT)**. In VF, the ventricles quiver, or fibrillate, without any organized rhythm, and the electrical impulses fire at random, creating chaos and preventing the heart from pumping and circulating blood. There is no normal breathing and no pulse. In pulseless VT, an abnormal electrical impulse controls the heart. This abnormal impulse fires so fast that the heart's chambers do not have time to fill, and the heart is unable to pump blood effectively. As with V-fib, there is no normal breathing or pulse with pulseless VT.

In many cases, VF and VT can be corrected by early defibrillation. If VF or VT is not corrected, all electrical activity will eventually cease, a condition called **asystole**. Asystole cannot be corrected by defibrillation. You cannot tell what, if any, rhythm the heart has by feeling for a pulse. An AED will analyze the heart's rhythm and determine if there is a shockable rhythm.

Using an AED on Adults

When cardiac arrest occurs, use an AED as soon as it is available and ready. First, turn on the AED and follow the audible and visual prompts. Apply the AED pads as instructed and allow the AED to analyze the heart rhythm. Ensure that no one is touching the victim during the analysis. Continue to follow the prompts of the AED. If CPR is in progress when the AED arrives, do not interrupt chest compressions and ventilations until the AED is turned on, the AED pads are applied and the AED is ready to analyze the heart rhythm, unless you are the only rescuer able to operate the AED and perform CPR.

After a shock is delivered, or if no shock is advised, immediately resume chest compressions and continue performing about 2 minutes of CPR before the AED re-analyzes the heart rhythm. If there are 2 or more rescuers, you should change positions (alternate performing compressions and operating the AED) about every 2 minutes, or as the AED is analyzing the heart rhythm, in order to reduce rescuer fatigue. If at any time you notice an obvious sign of life, such as normal breathing or movement, stop CPR and monitor the victim's condition. Administer emergency oxygen, if available and you are trained and authorized to do so.

Using an AED on Children and Infants

While the incidence of cardiac arrest in children and infants is relatively low compared with that of adults, cardiac arrest does happen to young children. Causes of cardiac arrests in children include:

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- Airway and breathing problems
- Traumatic injuries or accidents (e.g., drowning, motor-vehicle collision, electrocution or poisoning)
- A hard blow to the chest
- Congenital heart disease
- Sudden infant death syndrome (SIDS)

AEDs equipped with pediatric AED pads are capable of delivering the lower levels of energy considered appropriate for infants and children up to 8 years old or weighing less than 55 pounds. Use pediatric AED pads and/or equipment for a pediatric victim, if available. If pediatric-specific equipment is not available, an AED designed for adults can be used on children and infants. Pediatric pads should not be used on adults.

Always follow local protocols, medical direction and the manufacturer's instructions. For a child or infant in cardiac arrest, follow the same general steps and precautions as when using an AED on an adult. If the pads risk touching each other because of the victim's smaller chest size, place one pad on the child's chest and the other on the back. For an infant, always place one pad on the chest and the other on the back.

DO'S AND DON'TS FOR AED USE

Follow these general precautions when using an AED.

Do's

- **Do** make sure that no one is touching or is in contact with the victim or the resuscitation equipment before shocking a victim with an AED.
- **Do** use an AED if a victim is experiencing cardiac arrest as a result of traumatic injuries. Follow local protocols or practice.
- **Do** use an AED for a victim who is pregnant. The mother's survival is paramount to the infant's survival. Follow local protocols and medical direction.
- **Do** use an AED on a victim who has a pacemaker, other implantable cardioverter defibrillators or metal body piercings. To maintain safety, avoid placing the AED pads directly over these items. Position the pads so they are at least an inch away.

Don'ts

- **Do not** use alcohol to wipe the victim's chest dry. Alcohol is flammable.
- **Do not** touch the victim while the AED is analyzing. Touching or moving the victim could affect the analysis.
- **Do not** touch the victim while the device is defibrillating. You or someone else could be shocked.
- **Do not** defibrillate a victim when around flammable or combustible materials, such as gasoline or free-flowing oxygen. (If oxygen is begin administered to a victim when an AED is ready to be used, make sure to close the tank before shocking.)
- **Do not** use an AED on a victim wearing a medication patch on the chest until the patch and medication are removed. With a gloved hand, remove any patches from the chest and wipe away any residual medication before applying the pads.

Special AED Situations

Some situations require special precautions when using an AED. These include using AEDs around water, on victims of trauma or hypothermia, or when confronted with AED protocols that differ than those discussed here. Be familiar with these situations, and know how to respond appropriately. Always follow manufacturer's recommendations.

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AEDs Around Water

A shock delivered **in** water could harm rescuers or bystanders; however, AEDs are safe to use on victims who have been removed from the water. If the victim is in water:

- Remove the victim from the water before defibrillation. A shock delivered in water could harm rescuers or bystanders.
- Be sure that there are no deep puddles of water around you, the victim or the AED.
- Remove any wet clothing from the victim's chest to place the AED pads properly, if necessary.
- Dry the victim's chest and attach the AED pads (Figure 9-6).

If it is raining, take steps to make sure that the victim is as dry as possible and sheltered from the rain. Ensure that the victim's chest is wiped dry. Do not delay defibrillation when taking steps to create a dry environment. AEDs are safe, even in rain and snow, when all precautions and manufacturer's operating instructions are followed. Avoid getting the AED or AED pads wet, and keep them out of any deep puddles of water, if possible.

Pacemakers and Implantable Cardioverter-Defibrillators

Pacemakers are small, implantable devices sometimes located in the area below the left collarbone. There may be a small lump that can be felt under the skin (Figure 9-7). An implantable cardioverter-defibrillator (ICD) is a miniature version of an AED that automatically prevents or corrects irregular heart rhythms. Sometimes, a victim's heart beats irregularly, even if the victim has a pacemaker or an ICD.

- If the implanted device is visible, or you know that the victim has one, do not place the AED pad directly over the device. This may interfere with the delivery of the shock. Adjust AED pad placement, if necessary, and continue to follow the AED instructions.
- If you are not sure whether the victim has an implanted device, use the AED as needed. It will not harm the victim or rescuer.
- Follow any special precautions associated with ICDs, but do not delay CPR or defibrillation.

It is possible to receive a mild shock if an implantable ICD delivers a shock to the victim while CPR is performed. This risk of injury to rescuers is minimal, and the amount of electrical energy involved is much lower than an AED.

Transdermal Medication Patches

A transdermal medication patch administers medication through the skin. The most common of these patches is the nitroglycerin patch, used by those with a history of cardiac disease. Since you might absorb nitroglycerin or other medications, remove the patch from the victim's chest with a gloved hand before defibrillation (Figure 9-8). Never place AED electrode pads directly on top of medication patches.

Figure 9-6 | Before using an AED, be sure the victim is not lying in any puddles of water. Dry the victim's chest, then attach the AED pads.

Figure 9-7 | Scars or a small lump may indicate that the patient has had some sort of device implanted.

Figure 9-8 | Remove any type of transdermal medication patch from the victim's chest with a gloved hand before defibrillation.

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Hypothermia

Hypothermia is a life-threatening condition in which the entire body cools because of its inability to keep itself warm. Some people who have experienced hypothermia have been resuscitated successfully, even after prolonged exposure to the cold.

If the victim is not breathing and does not have a pulse, begin CPR until an AED becomes available. Follow local protocols regarding whether you should use an AED in this situation.

If the victim is wet, follow these steps:

- Remove wet clothing, dry the victim's chest and protect the victim from further heat loss.
- Attach the AED pads.
- If a shock is indicated, deliver it, following the instructions of the AED.
- Follow local protocols regarding whether additional shocks should be delivered.
- Do not withhold CPR or defibrillation to re-warm the victim.
- Be careful not to unnecessarily shake a victim who has experienced hypothermia, as this could result in an irregular heart rhythm.

Chest Hair

Some victims may have excessive chest hair that may cause difficulty with pad-to-skin contact. Since the time it takes to deliver the first shock is critical, and chest hair rarely interferes with pad adhesion, attach the pads and analyze the heart's rhythm as soon as possible.

- Press firmly on the pads to attach them to the victim's chest. If you get a "Check pads" or similar message from the AED, remove the pads and replace them with new ones if available. The pad adhesive may pull out some of the chest hair, which may solve the problem, but most AED cases contain a safety razor to assist in hair removal.
- If you continue to get the "Check pads" message, remove the pads, quickly shave the victim's chest and attach new pads to the victim's chest.
  - When in doubt, or in a situation when only one set of pads is available, shave the chest first.

Trauma

If a victim is in cardiac arrest resulting from traumatic injuries, you should still use an AED. Administer defibrillation according to local protocols.

Metal Surfaces

It is safe to deliver a shock to a victim in cardiac arrest on a metal surface, such as bleachers, as long as appropriate safety precautions are taken. Care should be taken that defibrillation electrode pads do not contact the conductive (metal) surface and that no one is touching the victim when the shock button is pressed.

Jewelry and Body Piercings

You do not need to remove jewelry and body piercings when using an AED. Leaving them on the victim will do no harm. However, do **not** place the AED pad directly over metallic jewelry or body piercings. Adjust pad placement at least an inch away, if necessary, and continue to follow established protocols.

Pregnancy

The best way to care for a pregnant woman in cardiac arrest is the same for all victims, including CPR and use of an AED. The fetus has the best chance of survival if the mother survives the event, and care should not be altered for fear that the electrical shock from an AED may harm the fetus. Follow local protocols and medical direction.

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AED Maintenance

For defibrillators to perform optimally, they must be maintained. AEDs require minimal maintenance. These devices have various self-testing features. Familiarize yourself with any visual or audible prompts the AED may have that warn of malfunction or a low battery. Read the operator's manual thoroughly, and check with the manufacturer to obtain all necessary information regarding maintenance.

If the machine detects any malfunction, you should inform management, who will contact the manufacturer. The device may need to be returned to the manufacturer for service. While AEDs require minimal maintenance, it is important to remember the following:

- Follow the manufacturer's specific recommendations for periodic equipment checks.
- Make sure that the batteries have enough energy for one complete rescue. (A fully charged backup battery should be readily available.)
- Make sure that the correct defibrillator pads are in the package and are properly sealed.
- Check any expiration dates on AED pads and batteries, and replace as necessary.
- After use, make sure that all accessories are replaced and that the machine is in proper working order before placing the unit back in service.
- If at any time the machine fails to work properly, or you recognize any warning indicators, discontinue use, place the unit out of service and contact the manufacturer immediately.

9-6 MULTIPLE-RESCUER RESPONSE

In the aquatic environment, more than two rescuers often respond to an emergency. In many cases, three or more rescuers provide care for an unresponsive victim. When an unresponsive victim has been removed from the water and needs CPR, care might begin with one rescuer until other rescuers arrive on the scene with additional equipment and begin assisting in providing care.

Roles for multiple-rescuer response for an unresponsive victim may include (Figure 9-9):

Figure 9-9 | In a multiple-rescuer response, lifeguards work together to provide care.

- **Circulation.** The rescuer provides compressions and also may operate the AED if giving care alone. If an additional rescuer is available, they should place the pads and operate the AED.
- **Airway.** The rescuer is positioned behind the victim's head to maintain an open airway and ensure the mask is positioned and sealed to provide effective ventilations.
- **Breathing.** Two rescuers provide ventilations using a bag-valve-mask (BVM) resuscitator. Emergency oxygen may be attached to the BVM if rescuers are trained to administer emergency oxygen. If the victim vomits during CPR, the rescuer pauses CPR, rolls the victim on their side and clears the vomit from the victim's mouth by using a finger sweep or a suction device. After clearing the vomit, resume CPR starting with compressions.

Practice-multiple rescuer response drills regularly with your team. Each member of the team should be able to arrive on the scene and perform any of the roles necessary in providing the appropriate care. See the flow chart at the end of the chapter for an example of how multiple rescuer response operates.

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Blog Post #4 | Second AES Visit

July 10th 7:45 pm

We've had an incredibly busy summer! Since my last post, we had two visits with different Red Cross examiners, including another unannounced visit that happened last night. About an hour before closing, I was in the breakroom when I heard the whistle blast. I ran out to the pool deck as the guard covering the deep-end was entering the water. I didn't see an active victim, and while I couldn't see the bottom of the pool from where I was standing, I knew that this could be a passive drowning victim who needed life-saving resuscitative care. I grabbed the crash bag containing the AED and BVMs and ran toward the deep-end. I arrived on the scene as the rescuing lifeguard surfaced with a manikin in her arms—that's when I realized this was another AES visit.

After the pool closed for the day, we stayed for an hour of in-service training with the Red Cross examiner to practice our multiple-rescuer response skills. We worked in teams and had to extricate passive "victims" from the water using a backboard. Then, we provided care while our examiner timed us. We had to perform a primary assessment with two ventilations in under a minute, but because we've been practicing all summer, my team had no problem beating the 1-minute challenge. I hope we'll never have to use these skills, but if we do, we'll be prepared.

9-7 WRAP-UP

As a professional lifeguard, you should be able to recognize and respond to cardiac emergencies, including heart attacks and cardiac arrest. To do this, you must understand the importance of the five links of the Cardiac Chain of Survival: early recognition of the emergency and early access to EMS, early CPR, early defibrillation, early advanced medical care and integrated post-cardiac arrest care.

When using an AED, always follow local protocols. AEDs are relatively easy to operate and generally require minimal training and retraining. Remember that AEDs are safe to use on victims who have been removed from the water, but you must first make sure you, the victim and the AED are not in deep puddles.

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BENCHMARKS FOR LIFEGUARDS

Lifeguard's should:

- Minimize interruptions of high-quality chest compressions.
- Use the appropriate compression depth based on the victim's age.
- Maintain a chest compression fraction (CCF) of at least 60 percent, with a goal of 80 percent.
- Use the appropriate compression rate.
- Allow for a full chest recoil to allow blood to flow into the heart.
- Avoid rescuer fatigue by changing positions at least every 2 minutes.

BENCHMARKS FOR LIFEGUARDING OPERATIONS

As professional responders, lifeguards should have:

- Familiarity with facility-specific AED equipment.
- Practice multiple-rescuer response techniques, including two-responder CPR and how to operate effectively within a multiple-rescuer resuscitation situation.
- Effective communication and collaboration with other responders and bystanders.
- An understanding of care practice and protocols as determined by a local medical director.
- Regular refresher training and practice of rescue and care skills, as skills degrade quickly following a training session—this in-service training includes practicing with other responders on team, dynamics skills during resuscitation and multiple-rescuer response techniques.

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Chapter 9 Review

1. Describe the five links in the Cardiac Chain of Survival for adults:

1)

2)

3)

4)

5)

2. Fill in the blank: For each minute CPR and defibrillation are delayed, the victim's chance for survival is reduced by about ____ percent.

3. What should you do if you think someone is having a heart attack?

4. Signs of cardiac arrest include (circle all that apply):

A | Sudden collapse

B | Vomiting

C | No pulse

D | Unresponsiveness

E | Rapid pulse

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Chapter 9 Review

5. What is the objective of CPR?

6. Fill in the blank: Compressions given at the correct rate are at least ____ per minute to a maximum of ____ per minute.

7. What is the appropriate compression depth when providing CPR on an adult?

A | At least 2 inches but no more than 2.4 inches

B | At least 2.4 inches but no more than 3 inches

C | 2 inches

D | 1½ inches

8. When providing two-rescuer CPR, when should rescuers change positions?

A | At least every 2 minutes

B | After 5 cycles of 30 compressions and 2 ventilations

C | During the analysis of the AED

D | All of the above

9. You arrive on the scene when another lifeguard is performing CPR, what should you do first?

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Chapter 9 Review

10. When performing two-rescuer CPR on an infant, describe how lifeguards should modify the following:

Compression-to-ventilation ratio:

The compression technique:

11. Provide three examples why a lifeguard could or should stop CPR:

1)

2)

3)

12. True or False: It is not appropriate to use an AED on a victim who is pregnant?

Why?

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Flow Chart: Example of Multiple-Rescuer Response—CPR in Progress

This flow chart is an example of how multiple rescuers come on to the scene and help care for the victim. Follow the protocols for the EAP for your facility. A victim may not exhibit all of the symptoms or exhibit the symptoms in this order (e.g., obstructed airway). Always provide the appropriate care for the conditions found.

You should use an AED as soon as it is available and ready to use. Using an AED has priority over using a BVM or administering emergency oxygen.

If a rescuer is needed to get or prepare the AED, stop using the BVM and perform two-person CPR until the AED is ready to analyze.

This example assumes that the EAP has been activated, EMS personnel have been called and a primary assessment has been done. The victim is not breathing and has no pulse. Additional rescuers are coming in to support the efforts of the initial rescuers and are bringing equipment.

1. The initial rescuers begin two-rescuer CPR.

- Rescuers 1 and 2 perform two-rescuer CPR.
- Rescuer 1 gives ventilations while Rescuer 2 gives chest compressions.

2. An additional rescuer arrives with the AED. CPR continues until the AED pads are placed on the victim and it is ready to begin analyzing.

- Rescuer 3:
  - Turns on the AED and follows the prompts.
  - Attaches the pads to the victim's bare chest.
  - Plugs in the connector, if necessary.
  - Says, "Clear."
  - Pushes the Analyze button, if necessary.
  - If a shock is advised, says, "Clear," and delivers the shock by pressing the Shock button, if necessary.
    - The compressor changes place with another responder. The new compressor hovers hands a few inches above the chest during analysis to prepare for CPR.

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3. After the shock, or if no shock is advised, Rescuers 1, 2 and 3 perform about 2 minutes of CPR until the AED begins to analyze or signs of life return.

4. An additional rescuer arrives with the BVM and assists with care.

- One rescuer assembles the BVM, if necessary. Administer emergency oxygen, if trained and authorized to do so.
- One rescuer places and seals the mask of the BVM and maintains an open airway.
- One rescuer provides ventilations by squeezing the bag.
- One rescuer performs compressions.
  - **If the victim vomits:**
    - Rescuers quickly roll the victim onto the side.
    - A rescuer on the side of the victim clears the victim's mouth out after vomiting stops, using a finger sweep and suction, if necessary.
    - Turn the victim onto the back and continue providing care.
  - **If ventilations do not make the chest clearly rise:**
    - One rescuer re-tilts the head.
    - One rescuer attempts 1 ventilation.
  - **If the ventilation attempt still does not make the chest clearly rise:**
    - One rescuer gives 30 chest compressions.
    - One rescuer looks inside the mouth and removes any visible, large debris from the mouth using a finger sweep and suction, if necessary.
- One rescuer replaces the mask.
- One rescuer opens the airway and seals the mask.
- One rescuer provides ventilations.
- One rescuer performs compressions.

Notes:

- *If at any time you notice normal breathing or any other signs of life, stop CPR and monitor the victim's condition.*
- *Rescuers should change positions (alternate performing compressions and giving ventilations) about every 2 minutes, or when the AED analyzes, to reduce rescuer fatigue. Changing positions should take less than 5 seconds.*

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One-Rescuer CPR

Notes:

- *Activate the EAP, size up the scene while forming an initial impression, use PPE, perform primary assessment and get an AED on the scene as soon as possible.*
- *Ensure the victim is on a firm, flat surface, such as the floor or a table.*
- *Expose the victim's chest to ensure proper hand placement and the ability to visualize chest recoil.*

If the victim is not breathing and has no pulse:

1 Give 30 chest compressions.

- Adult or child: Place the heel of one hand in the center of the chest on the lower half of sternum with the other hand on top.
  - Keep your arms as straight as possible and shoulders directly over your hands.
- Infant: Place one hand on the infant's forehead. Place two or three fingers from your hand closest to the infant's feet on the center of the chest just below the nipple line. The fingers should be oriented so they are parallel not perpendicular to the sternum.
- Push hard, push fast.
  - Compress the chest at a depth of:
    - Adult: At least 2 inches but not more than 2.4 inches.
    - Child: About 2 inches.
    - Infant: 1½ inches.
  - Compress the chest at a rate of at least 100 per minute but no more than 120 per minute.
    - Let the chest fully recoil between each compression.

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One-Rescuer CPR *continued*

2. Give 2 ventilations.

3. Perform cycles of 30 compressions and 2 ventilations.

Do not stop CPR except in one of the following situations:

- You see an obvious sign of life, such as normal breathing or victim movement.
- An AED is ready to analyze the victim's heart rhythm.
- Another trained responder or responders take over, such as a member of your safety team or EMS personnel, and relieve you from giving compressions or ventilations.
- You are alone and too exhausted to continue.
- The scene becomes unsafe.

Notes:

- *Keep your fingers off the chest when performing compressions on an adult or child by interlacing your fingers.*
- *Use your body weight, not your arms, to compress the chest.*
- *Count out loud or to yourself to help keep an even pace.*

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Two-Rescuer CPR–Adult and Child

Notes:

- *Activate the EAP, size up the scene while forming an initial impression, use PPE, perform a primary assessment and get an AED on the scene as soon as possible.*
- *Ensure the victim is on a firm, flat surface, such as the floor or a table.*
- *Expose the victim's chest to ensure proper hand placement and the ability to visualize chest recoil.*

If the victim is not breathing and has no pulse:

1. Rescuer 2 finds the correct hand position to give chest compressions.
   - Place two hands on the center of the chest.

2. Rescuer 2 gives chest compressions.
   - Push hard, push fast.
     - Compress the chest at a depth of:
       - Adult: At least 2 inches but not more than 2.4 inches.
       - Child: About 2 inches.
     - Compress the chest at a rate of at least 100 per minute but no more than 120 per minute.

3. Rescuer 1 gives 2 ventilations.

4. Perform about 2 minutes of compressions and ventilations.
   - Adult: Perform cycles of 30 compressions and 2 ventilations.
   - Child: Perform cycles of 15 compressions and 2 ventilations.

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Two-Rescuer CPR–Adult and Child *continued*

5 Rescuers change positions at least every 2 minutes (5 cycles of 30 compressions and 2 ventilations) and/or while the AED is analyzing the heart rythym.

- Rescuer 2 calls for a position change by using the word "change" at the end of the last compression cycle:
  - Adult: Use the word "change" in place of the word "thirty."
  - Child: Use the word "change" in place of the word "fifteen."
- Rescuer 1 gives 2 ventilations.
- Rescuer 2 quickly moves to the victim's head with their own mask.
- Rescuer 1 quickly moves into position at the victim's chest and locates correct hand position on the chest.
- Changing positions should take less than 5 seconds.

6 Rescuer 1 begins chest compressions.

- Continue cycles of compressions and ventilations.

Continue CPR until:

- You see an obvious sign of life, such as normal breathing or victim movement.
- An AED is ready to analyze the victim's heart rhythm.
- Another trained responder or responders take over, such as a member of your safety team or EMS personnel, and relieve you from giving compressions or ventilations.
- You are alone and too exhausted to continue.
- The scene becomes unsafe.

Notes:

- *Keep your fingers off the chest when performing compressions on an adult or child by interlacing your fingers.*
- *Use your body weight, not your arms, to compress the chest.*
- *Count out loud to help keep an even pace.*

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Two-Rescuer CPR—Infant

Notes:

- *Activate the EAP, size up the scene while forming an initial impression, use PPE, perform a primary assessment and get an AED on the scene as soon as possible.*
- *Ensure the victim is on a firm, flat surface, such as the floor or a table.*
- *Expose the victim's chest to ensure proper hand placement and the ability to visualize chest recoil.*

If the victim is not breathing and has no pulse:

1 Rescuer 2 finds the correct hand position to give chest compressions.

- Use the encircling thumbs technique to give chest compressions.
  - Place thumbs next to each other on the center of the chest just below the nipple line.
  - Place both hands underneath the infant's back and support the infant's back with your fingers.
  - Ensure that your hands do not compress or squeeze the side of the ribs.
- If available, a towel or padding can be placed underneath the infant's shoulders to help maintain the head in the neutral position.

2 Rescuer 2 gives chest compressions.

- Push hard, push fast.
  - Compress the chest about 1½ inches at a rate of at least 100 compressions per minute but no more than 120 per minute.

3 Rescuer 1 gives 2 ventilations.

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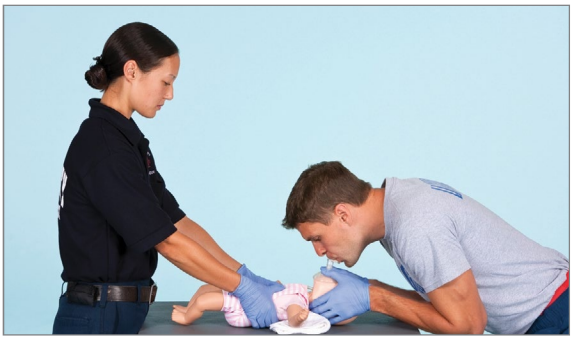
Two-Rescuer CPR—Infant *continued*

4 Perform cycles of 15 compressions and 2 ventilations for about 2 minutes.

5 Rescuers change positions at least every 2 minutes and/or during the analysis of the AED.

- Rescuer 2 calls for a position change by using the word "change" in place of saying "fifteen" at the end of the last compression cycle.
- Rescuer 1 gives 2 ventilations.
- Rescuer 2 quickly moves to the victim's head with their own mask.
- Rescuer 1 quickly moves into position at the victim's chest and locates correct hand position on the chest.
- Changing positions should take less than 5 seconds.



6 Rescuer 1 begins chest compressions.

- Continue cycles of compressions and ventilations.

Continue CPR until:

- You see an obvious sign of life, such as normal breathing or victim movement.
- An AED is ready to analyze the victim's heart rhythm.
- Another trained responder or responders take over, such as a member of your safety team or EMS personnel, and relieve you from giving compressions and ventilations.
- You are alone and too exhausted to continue.
- The scene becomes unsafe.

Note:

- *Count out loud to help keep an even pace.*

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USING AN AED

Using an AED

Notes:

- *Activate the EAP, size up the scene while forming an initial impression, use PPE, perform a primary assessment and get an AED on the scene as soon as possible.*
- *Ensure the victim is on a firm, flat surface, such as the floor or a table.*

If the victim is not breathing and has no pulse:

1. Turn on the AED and follow the audible and/or visual prompts.

2. Expose the victim's chest and wipe it dry if necessary.

Tip: Remove any medication patches with a gloved hand and wipe away any remaining medication residue.

3. Attach the AED pads to the victim's bare, dry chest.
   - Place one pad on the victim's upper right chest and the other pad on the left side of the chest.
     - Child: Use pediatric AED pads, if available. If the pads risk touching each other, place one pad in the middle of the child's chest and the other pad on the child's back, between the shoulder blades.
     - Infant: Always place one pad on the chest and the other on the back.

4. Plug in the connector, if necessary.

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Using an AED *continued*

5 Stand clear.

- Make sure that no one, including you, is touching the victim.
- Say, "Everyone, stand clear!"

6 Analyze the heart rhythm.

- Push the "Analyze" button, if necessary. Let the AED analyze the heart rhythm.

7 Deliver a shock or perform CPR based on the AED recommendation.

- If a shock is advised:
  - Make sure no one, including you, is touching the victim.
  - Say, "Everyone clear" in a loud commanding voice.
  - Deliver the shock by pushing the "Shock" button, if necessary.
  - After delivering the shock, perform about 2 minutes of CPR, starting with chest compressions.
- If no shock is advised:
  - Perform about 2 minutes of CPR, starting with chest compressions.
  - Continue to follow the prompts of the AED.

Notes:

- *If at any time you notice an obvious sign of life, such as normal breathing or victim movement, stop CPR and monitor the victim's condition.*
- *The AED will not advise a shock for normal or absent heart rhythms.*
- *If two trained rescuers are present, one should perform CPR while the second rescuer operates the AED.*
- *Do not interrupt CPR (chest compressions and ventilations) until the AED pads are applied and the AED is turned on and ready to analyze unless you are the only rescuer able to operate the AED and perform CPR.*
- *If there are multiple responders, they should:*
  - *Hover with their hands a few inches above the chest during the AED analysis and the shock (if indicated) to minimize interruptions to resuming CPR.*
  - *Resume compressions immediately following the delivery of a shock or after the AED determines that no shock is advised.*
  - *Switch responsibility for compressions each time the AED performs an analysis to limit their fatigue.*
  - *Do not wait for the AED to deliver a "resume CPR" prompt before resuming compressions.*

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CPR WITH AIRWAY OBSTRUCTION

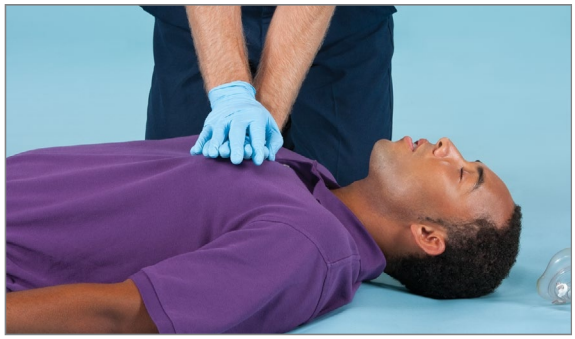
CPR with Airway Obstruction

If a person who is choking becomes unresponsive, summon EMS if you have not already done so, then lower them to a firm, flat surface and immediately begin CPR, starting with chest compressions.

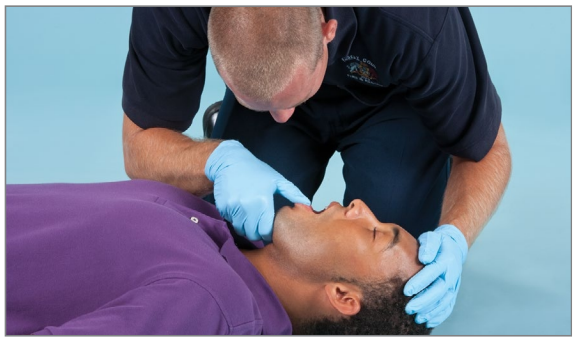
1. Begin CPR starting with 30 chest compressions.

   Compress the chest to a depth of:

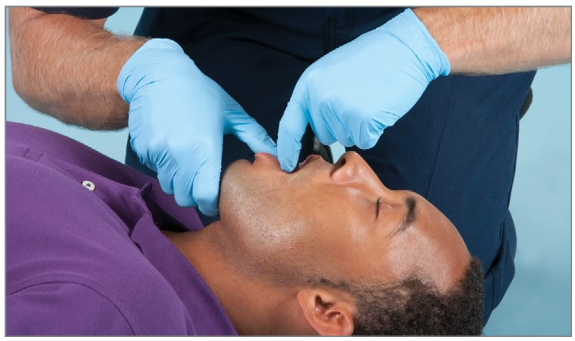
   - Adult: At least 2 inches but no more than 2.4 inches
   - Child: About 2 inches
   - Infant: About 1½ inches



2. Before attempting ventilations, open the victim's mouth and look for the object.
   - If you see an object in the victim's mouth, carefully remove it using a finger sweep. To perform a finger sweep, slide your finger along the inside of the victim's cheek, using a hooking motion to sweep out the object.
   - Never perform a blind finger sweep.



3. Replace the resuscitation mask and give 2 ventilations.



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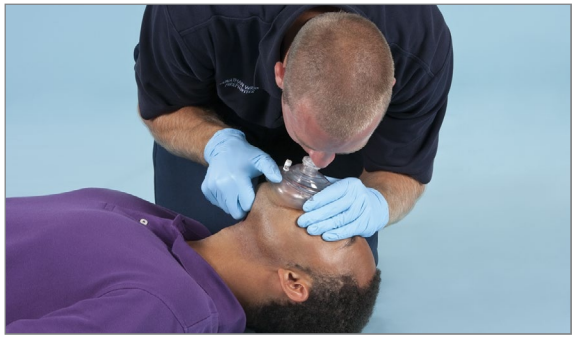
CPR with Airway Obstruction *continued*

4 Continue to provide care by repeating this cycle until:

- The victim begins to breathe on their own.
- Another trained rescuer takes over.
- More advanced medical personnel, such as EMS personnel, take over.
- You are too exhausted to continue.
- The scene becomes unsafe.
- Your ventilations are successful; continue CPR.



Note:

Continuing cycles of 30 compressions and 2 ventilations is the most effective way to provide care. Even if ventilations fail to make the chest rise, compressions may help clear the airway by moving the blockage to the upper airway where it can be seen and removed. Continue to check the victim's mouth for an object after each set of compressions until ventilations make the chest clearly rise.

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