

# Cardiac Emergencies



A cardiac emergency is a life-threatening emergency that can occur at any time to a victim of any age. Lifeguards may be called upon to care for a victim of a cardiac emergency. This care includes performing cardiopulmonary resuscitation (CPR) and using an automated external defibrillator (AED). By following the Cardiac Chain of Survival, a lifeguard can increase a victim's chance of survival.

## CARDIAC CHAIN OF SURVIVAL

The initial assessment section in Chapter 6 explained how to identify and care for life-threatening conditions. A lifeguard's priorities focused on the victim's airway, breathing and circulation (ABCs). As professional rescuers, lifeguards must learn how to provide care for cardiac emergencies, such as heart attacks and cardiac arrest. To effectively respond to cardiac emergencies, it helps to understand the importance of the Cardiac Chain of Survival. The four links in the Cardiac Chain of Survival are—

**1. Early recognition of the emergency and early access to emergency medical services (EMS).** The sooner 9-1-1 or the local emergency number is called, the sooner EMS personnel arrive and take over.

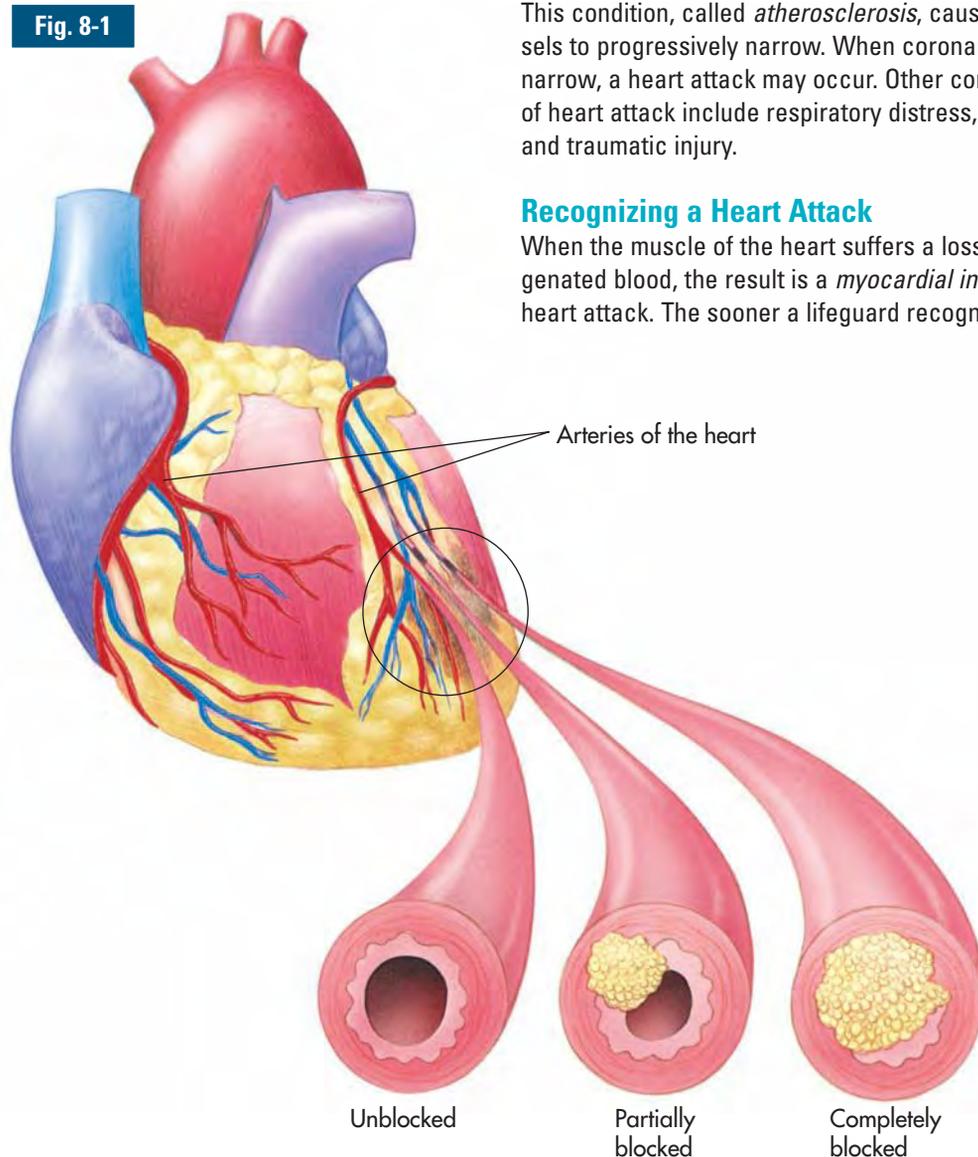
- 2. Early CPR.** CPR helps supply oxygen to the brain and other vital organs to keep the victim alive until an AED is used or advanced medical care is provided.
- 3. Early defibrillation.** An electrical shock called defibrillation may restore a normal heart rhythm. Each minute defibrillation is delayed reduces the victim's chance of survival by about 10 percent.
- 4. Early advanced medical care.** EMS personnel who provide more advanced care and transport the victim to the hospital.

### Common Causes of a Heart Attack

Heart attacks usually result from cardiovascular disease. Cardiovascular disease is the leading cause of death for adults in the United States. Cardiovascular disease develops slowly when deposits of cholesterol, a fatty substance made by the body, and other material may gradually build up on the inner walls of the arteries (**Fig. 8-1**). This condition, called *atherosclerosis*, causes these vessels to progressively narrow. When coronary arteries narrow, a heart attack may occur. Other common causes of heart attack include respiratory distress, electrocution and traumatic injury.

### Recognizing a Heart Attack

When the muscle of the heart suffers a loss of oxygenated blood, the result is a *myocardial infarction*, or heart attack. The sooner a lifeguard recognizes the signs

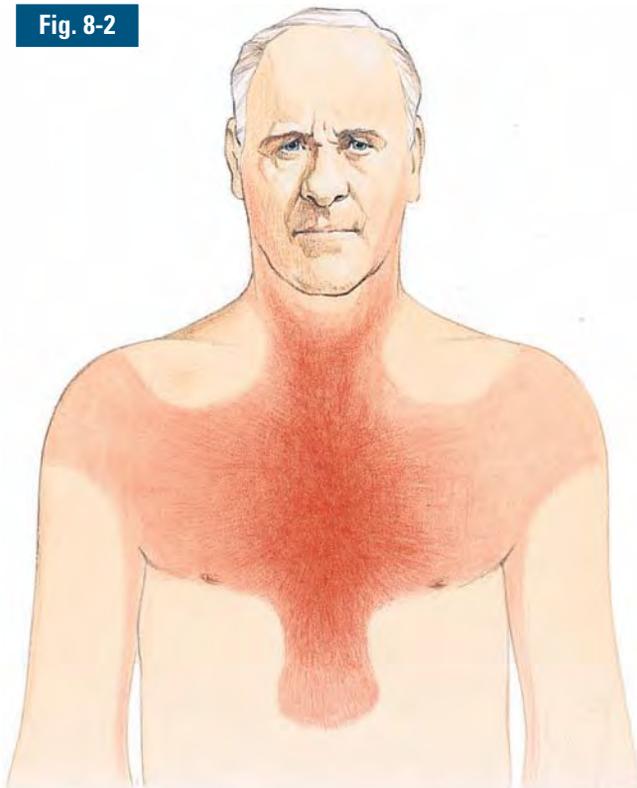


and symptoms of a heart attack and acts, the better chance a lifeguard has to save a life. While many people will deny they are having a heart attack, it is important that a lifeguard summon EMS personnel by calling 9-1-1 or the local emergency number if the victim shows some or all of the following signs and symptoms:

- **Discomfort, pressure or pain.** The major signal is persistent discomfort, pressure or pain in the chest that does not go away. Unfortunately, it is not always easy to distinguish heart attack pain from the pain of indigestion, muscle spasms or other conditions. This often causes people to delay getting medical care. Brief, stabbing pain or pain that gets worse when the person bends or breathes deeply is not usually caused by a heart problem.

The pain associated with a heart attack can range from discomfort to an unbearable crushing sensation in the chest. The victim may describe it as pressure, squeezing, tightness, aching or heaviness in the chest. Many heart attacks start slowly, as mild pain or discomfort. Often the victim feels discomfort or pain in the center of the chest (**Fig. 8-2**). It may spread to the shoulder, arm, neck, jaw or back. The discomfort or pain becomes constant. It is usually not relieved by resting, changing position or taking medicine. When interviewing the victim, a lifeguard should ask open-ended questions, such as “Can you describe the pain

**Fig. 8-2**



for me?” and allow the victim to respond in his or her own words.

Any chest pain that is severe, lasts longer than 3 to 5 minutes, goes away and comes back or persists even during rest requires medical care at once. Even people who have had a previous heart attack may not recognize the signs and symptoms because each heart attack can have entirely different signs and symptoms.

- **Pain that comes and goes.** Some people with coronary heart disease may have chest pain or pressure that comes and goes. This type of pain is called *angina pectoris*, a medical term for pain in the chest. It develops when the heart needs more oxygen than it gets because the arteries leading to it are too narrow. When a person with angina is exercising, excited or emotionally upset, the heart might not get enough oxygen. This lack of oxygen can cause chest discomfort or pain.
  - A person who knows he or she has angina may tell a lifeguard about the condition. People with angina usually have medicine to take to stop the pain. Stopping physical activity or easing the distress and taking the medicine usually ends the discomfort or pain of angina.
- **Trouble breathing.** Another signal of a heart attack is trouble breathing. The victim may be breathing faster than normal because the body tries to get much-needed oxygen to the heart.
- **Other signs and symptoms.** The victim's skin may be pale or ashen, especially around the face. The face also may be damp with sweat. Some people suffering from a heart attack sweat heavily or feel dizzy. These signs and symptoms are caused by the stress put on the body when the heart does not work as it should. Both men and women experience the most common signs and symptoms of a heart attack—chest pain or discomfort. But women are somewhat more likely to experience some of the other warning signals, particularly shortness of breath, nausea or vomiting and back or jaw pain. Women also tend to delay telling others about their signs and symptoms to avoid bothering or worrying them.

### Care for a Heart Attack

If someone is having a heart attack—

- Take immediate action and summon EMS personnel.
- Have the victim stop what he or she is doing and rest. Assist the victim out of the water, if needed.
- Loosen any tight or uncomfortable clothing.
- Closely monitor the victim until EMS personnel arrive. Notice any changes in the victim's appearance or behavior.

## Aspirin Administration

A conscious victim who is showing early signs and symptoms of a heart attack can be helped by offering him or her an appropriate dose of aspirin when the signs and symptoms first begin. However, offer aspirin only if medically appropriate and local protocols allow, and never delay summoning EMS personnel. Always summon EMS personnel as soon as the signs and symptoms of a heart attack are recognized, and then help the victim to be comfortable before giving him or her aspirin.

Then, if the victim is able to take medicine by mouth, ask the victim—

- Are you allergic to aspirin?
- Do you have a stomach ulcer or stomach disease?
- Are you taking any blood thinners, such as Coumadin™ or Warfarin™?
- Have you been told by a doctor not to take aspirin?

If the victim answers no to all of these questions, offer him or her two chewable (162 mg) baby aspirins, or up to one 5-grain (325 mg) adult aspirin tablet with a small amount of water. Be sure that only aspirin is used and not Tylenol™, acetaminophen, Motrin™, Advil™ or ibuprofen, which are painkillers. Likewise, do not use coated aspirin products or products meant for multiple uses such as cold, fever and headache.

Doses of aspirin may be offered if the victim has been under a rescuer's care, has regained consciousness and is able to take the aspirin by mouth.

**LIFEGUARDING TIP: Lifeguards should follow local protocols or medical directives when applicable.**

- Comfort the victim.
- If medically appropriate and local protocols or medical direction permit, give aspirin if the victim can swallow and has no known contraindications.
- Assist the victim with his or her prescribed medication.
- Administer emergency oxygen if available and trained to do so.
- Be prepared to perform CPR or use an AED.

## Cardiac Arrest

Cardiac arrest is a life-threatening emergency. It may be caused by a heart attack, electrocution, respiratory arrest, drowning or other conditions. *Cardiac arrest* occurs when the heart stops beating or is beating too irregularly or weakly to circulate blood effectively. It can occur suddenly and without warning. In many cases, the victim may already be experiencing the signs and symptoms of a heart attack.

The signs of cardiac arrest include—

- Unconsciousness.
- No movement or breathing.
- No pulse.

## CPR

A victim who is unconscious, not moving or breathing and has no pulse is in cardiac arrest and needs CPR. CPR is a combination of rescue breaths and chest compressions. Summoning EMS personnel immediately is critical for the victim's survival. If an AED is available, use the AED according to local protocols and in combination with CPR until more EMS personnel arrive and take over.

Effective chest compressions are essential for quality CPR. Effective chest compressions circulate blood to the victim's brain and other vital organs. Chest compressions can also increase the likelihood that a successful shock from an AED can be delivered to a victim suffering a sudden cardiac arrest, especially if more than 4 minutes have elapsed since the victim's collapse. To ensure quality CPR (**Table 8-1**)—

- Compress the chest at a rate of about 100 compressions per minute for any victim.
- Chest compressions should be deep. Compress the chest of an adult about 1½ to 2 inches, a child about 1 to 1½ inches and an infant about ½ to 1 inch.

**TABLE 8-1 SUMMARY OF TECHNIQUES FOR CPR—ADULT, CHILD AND INFANT**

	Adult	Child	Infant
<b>Hand Position:</b>	Two hands on the center of the chest	Two hands or one hand on the center of the chest	Two or three fingers on the center of the chest (just below the nipple line)
<b>Compress:</b>	About 1½ to 2 inches	About 1 to 1½ inches	About ½ to 1 inch
<b>Breathe:</b>	Until chest clearly rises (about 1 second per breath)	Until chest clearly rises (about 1 second per breath)	Until chest clearly rises (about 1 second per breath)
<b>Cycle: (1 rescuer)</b>	30 compressions 2 breaths	30 compressions 2 breaths	30 compressions 2 breaths
<b>Cycle: (2 rescuers)</b>	30 compressions 2 breaths	15 compressions 2 breaths	15 compressions 2 breaths
<b>Rate:</b>	About 100 compressions per minute	About 100 compressions per minute	About 100 compressions per minute

- Let the chest fully recoil to its normal position after each compression before starting the next compression.

A lifeguard should continue CPR until another trained rescuer arrives and takes over, an AED becomes available and ready to use, he or she is too exhausted to continue, the scene becomes unsafe or an obvious sign of life is detected. When performing CPR, it is not unusual for the victim's ribs to break or cartilage to separate. The victim may vomit and the scene may be chaotic. As professional rescuers with a duty to respond, lifeguards need to understand that despite their best efforts to provide quality care, not all victims of cardiac arrest survive.

### CPR—Adult

If an unconscious adult is not moving or breathing and has no pulse, begin CPR.

To perform CPR for an adult—

1. Conduct an initial assessment.
2. Find the correct hand position to give compressions (**Fig. 8-3**).
  - Place the heel of one hand on the center of the chest.
  - Place the other hand on top.
3. Give 30 chest compressions (**Fig. 8-4**).
  - Compress the chest about 1½ to 2 inches.
  - Let the chest fully recoil to its normal position after each compression.

**Fig. 8-3****Fig. 8-4**

- Compress at a rate of about 100 compressions per minute.

### LIFEGUARDING TIPS:

- **Keep the fingers off the chest when giving chest compressions.**
  - **Use body weight, not the arms, to compress the chest.**
  - **Position the shoulders over the hands with the elbows locked.**
  - **If the victim is obviously pregnant or known to be pregnant, adjust hand positions to be slightly higher on the chest.**
  - **Take pressure off the chest between chest compressions, but leave the hands in place.**
  - **Counting out loud helps keep an even pace.**
4. Replace the resuscitation mask and give 2 rescue breaths (Fig. 8-5).
    - Each rescue breath should last about 1 second.
    - Give rescue breaths that make the chest clearly rise.
  5. Perform cycles of 30 compressions and 2 rescue breaths (Fig. 8-6).
    - Continue CPR until—
      - Another trained rescuer arrives and takes over.
      - An AED becomes available and is ready to use.
      - The lifeguard is too exhausted to continue.
      - The scene becomes unsafe.
      - An obvious sign of life is detected.

**LIFEGUARDING TIP: An AED should be used as soon as one becomes available.**

Fig. 8-6



### CPR—Child and Infant

CPR for children and infants is similar to the technique used for adults but is modified because of their smaller body sizes. Cardiac arrest in children and infants is usually caused by a respiratory emergency. If a lifeguard recognizes a child or infant is in respiratory distress or arrest, provide care immediately. If cardiac arrest occurs, begin CPR.

### CPR—Child

To perform CPR for a child—

1. Conduct an initial assessment.
2. Find the correct hand position to give compressions (Fig. 8-7).
  - Place the heel of one hand on the center of the chest.
  - Place the other hand on top.
3. Give 30 chest compressions (Fig. 8-8).
  - Compress the chest about 1 to 1½ inches.
  - Let the chest fully recoil to its normal position after each compression.
  - Compress at a rate of about 100 compressions per minute.

Fig. 8-5



Fig. 8-7



Fig. 8-8



Fig. 8-10

**LIFEGUARDING TIPS:**

- **Keep the fingers off the chest when giving chest compressions.**
- **Use body weight, not the arms, to compress the chest.**
- **Position the shoulders over the hands with the elbows locked.**
- **Counting out loud helps keep an even pace.**
- **A one-handed technique can be used to compress the chest of a child. If using only one hand for compressions, place it on the center of the child's chest while the other hand is on the child's forehead.**

4. Replace the resuscitation mask and give 2 rescue breaths (Fig. 8-9).
  - Each rescue breath should last about 1 second.
  - Give rescue breaths that make the chest clearly rise.
5. Perform cycles of 30 compressions and 2 rescue breaths (Fig. 8-10).

- Continue CPR until—
  - Another trained rescuer arrives and takes over.
  - An AED becomes available and is ready to use.
  - The lifeguard is too exhausted to continue.
  - The scene becomes unsafe.
  - An obvious sign of life is detected.

**LIFEGUARDING TIP: An AED should be used as soon as one becomes available.**

**CPR—Infant**

To perform CPR for an infant—

1. Conduct an initial assessment.

**LIFEGUARDING TIP: Place the infant on his or her back on a firm, flat surface, such as the floor or a table.**

2. Find the correct hand position to give compressions (Fig. 8-11).
  - Put 2 or 3 fingers on the center of the chest just below the nipple line.
  - Keep one hand on the infant's forehead to maintain an open airway.

Fig. 8-9



Fig. 8-11



Fig. 8-12



3. Give 30 chest compressions (Fig. 8-12).
  - Compress the chest about  $\frac{1}{2}$  to 1 inch.
  - Let the chest fully recoil to its normal position after each compression.
  - Compress at a rate of about 100 compressions per minute.

#### LIFEGUARDING TIPS:

- **Take the pressure off the chest between compressions, but leave the fingers in place.**
  - **Counting out loud helps keep an even pace.**
4. Replace the resuscitation mask and give 2 rescue breaths (Fig. 8-13).
    - Each rescue breath should last about 1 second.
    - Give rescue breaths that make the chest clearly rise.
  5. Perform cycles of 30 compressions and 2 rescue breaths (Fig. 8-14).
    - Continue CPR until—
      - Another trained rescuer arrives and takes over.
      - The lifeguard is too exhausted to continue.
      - The scene becomes unsafe.
      - An obvious sign of life is detected.

Fig. 8-13



Fig. 8-14



### Two-Rescuer CPR

When an additional rescuer is available, provide two-rescuer CPR. One rescuer gives rescue breaths and the other rescuer gives chest compressions. When providing two-rescuer CPR to an adult, rescuers should perform 30 compressions and 2 rescue breaths during each cycle. When performing two-rescuer CPR on a child or infant, rescuers should change the compression-to-rescue breaths ratio to 15:2. This provides more frequent respirations for children and infants. Rescuers should change positions (alternate turns giving compressions and breaths) about every 2 minutes. Changing positions should take less than 5 seconds.

Perform two-rescuer CPR in the following situations:

- Two rescuers arrive on the scene at the same time and begin CPR together
- One rescuer is performing CPR and a second rescuer becomes available

When CPR is being performed by one rescuer and a second rescuer arrives, the second rescuer should ask 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, the second rescuer should help perform two-rescuer CPR.

### Two-Rescuer CPR—Adult and Child

To perform two-rescuer CPR on an adult or child, follow these steps:

1. **Rescuer 1** conducts an initial assessment.
2. **Rescuer 2** finds the correct hand position to give compressions.
  - Place the heel of one hand on the center of the chest.
  - Place the other hand on top.
3. **Rescuer 2** gives chest compressions (Fig. 8-15).
  - Give compressions when **Rescuer 1** says, "Victim has no pulse. Begin CPR."

Fig. 8-15



- **Adult:** 30 compressions, compress the chest about 1½ to 2 inches
  - **Child:** 15 compressions, compress the chest about 1 to 1½ inches
  - Let the chest fully recoil to its normal position after each compression.
  - Compress at a rate of about 100 compressions per minute.
4. **Rescuer 1** replaces the mask and gives 2 rescue breaths (Fig. 8-16).
    - Each rescue breath should last about 1 second.
    - Rescue breaths should make the chest clearly rise.
  5. Rescuers do about 2 minutes of compressions and breaths.
    - **Adult:** cycles of 30 chest compressions and 2 rescue breaths
    - **Child:** cycles of 15 chest compressions and 2 rescue breaths
  6. Rescuers change positions.
    - **Rescuer 2** calls for a position change by using the word “change” at the end of the last compression cycle.
    - **Rescuer 1** gives 2 rescue breaths.
    - **Rescuer 2** moves to the victim’s head with his or her own mask.

Fig. 8-16



- **Rescuer 1** moves into position at the victim’s chest and locates the correct hand position on the victim’s chest.
  - Changing positions should take less than 5 seconds.
7. **Rescuer 1** gives chest compressions (Fig. 8-17).
    - Continue cycles of chest compressions and rescue breaths.

Rescuers should continue performing two-rescuer CPR until—

- Another trained rescuer arrives and takes over.
- An AED is available and ready to use.
- The rescuers are too exhausted to continue.
- The scene becomes unsafe.
- An obvious sign of life is detected.

When providing two-rescuer CPR to an infant, rescuers should perform the two-thumb-encircling-hands chest compression technique with thoracic squeeze. To perform two-rescuer CPR on an infant, follow these steps:

1. **Rescuer 1** conducts an initial assessment.
2. **Rescuer 2** finds the correct hand position to give compressions (Fig. 8-18).

Fig. 8-17



Fig. 8-18



Fig. 8-19



- If available, place a towel or padding underneath the infant's shoulders to help maintain the head in the neutral position.
  - Place the 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 the fingers.
  - Ensure that the hands do not compress or squeeze the side of the ribs.
3. **Rescuer 2** gives 15 chest compressions (**Fig. 8-19**).
    - Give compressions when **Rescuer 1** says, "Victim has no pulse, begin CPR."
    - Use both thumbs to compress the chest about  $\frac{1}{2}$  to 1 inch at a rate of about 100 compressions per minute.
    - Let the chest fully recoil to its normal position after each compression.
  4. **Rescuer 1** replaces the mask and gives 2 rescue breaths (**Fig. 8-20**).
    - Each rescue breath should last about 1 second.
    - Give rescue breaths that make the chest clearly rise.

Fig. 8-20



5. Rescuers do about 2 minutes of 15 chest compressions and 2 rescue breaths.
6. Rescuers change positions.
  - **Rescuer 2** calls for a position change by using the word "change" in place of the word "15" in the last compression cycle.
  - **Rescuer 1** gives 2 rescue breaths.
  - **Rescuer 2** moves to the infant's head with his or her own mask.
  - **Rescuer 1** moves into position and locates the correct finger placement on the infant's chest.
  - Changing positions should take less than 5 seconds.
7. **Rescuer 1** gives chest compressions (**Fig. 8-21**).
  - Continue cycles of 15 chest compressions and 2 rescue breaths.

Rescuers should continue performing two-rescuer CPR on an infant until—

- Another trained rescuer arrives and takes over.
- The rescuers are too exhausted to continue.
- The scene becomes unsafe.
- An obvious sign of life is detected.

### CPR—Special Situations

Lifeguards should continue CPR without interruptions for as long as possible. They should attempt to limit any interruptions to only seconds, except for specific interventions, such as insertion of an advanced airway device or use of a defibrillator.

Sometimes lifeguards may have to move a victim to perform CPR. For example, in a stairwell, lifeguards should move the victim to a flat area at the head or foot of the stairs to perform CPR (do not interrupt CPR for longer than about 30 seconds). If a victim is being transferred to an ambulance or into the emergency department, do not interrupt CPR.

Fig. 8-21



Fig. 8-22



## AEDs

Each year, approximately 500,000 Americans die of cardiac arrest. CPR started promptly can help by keeping blood that contains oxygen flowing to the brain and other vital organs. However, in many cases, CPR alone cannot correct the underlying heart problem and return the heart to a normal rhythm. An AED is needed to correct the problem (Fig. 8-22). An AED is an automated device that recognizes a heart rhythm that requires a shock. AEDs provide an electrical shock to the heart, called *defibrillation*. The sooner the shock is administered, the greater the likelihood of the victim's survival. Lifeguards must assess victims quickly and be prepared to use an AED in cases of cardiac arrest.

## The Heart's Electrical System

The heart's electrical system controls the pumping action of the heart. Under normal conditions, specialized cells of the heart initiate and transmit electrical impulses. These

cells make up the *conduction system*. Electrical impulses travel through the upper chambers of the heart, called the *atria*, to the lower chambers of the heart, called the *ventricles* (Fig. 8-23).

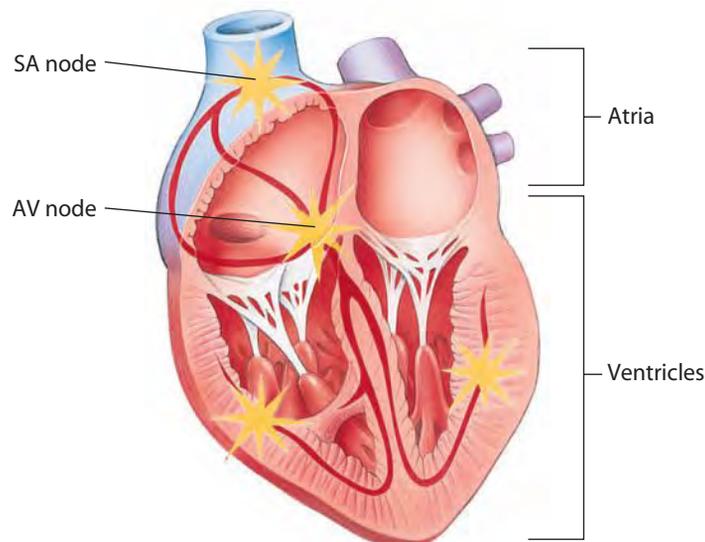
The normal point of origin of the electrical impulse is the *sinoatrial (SA) node* above the atria. This impulse travels to a point midway between the atria and ventricles. This point is called the *atrioventricular (AV) node*. The pathway divides after the AV node into two branches, then into the right and left ventricles. These right and left branches become a network of fibers, called *Purkinje fibers*, which spread electrical impulses across the heart. Under normal conditions, this impulse reaches the muscular walls of the ventricles and causes the ventricles to contract. This contraction forces blood out of the heart to circulate through the body. The contraction of the left ventricle results in a pulse. The pauses between the pulse beats are the periods between contractions. When the heart muscles contract, blood is forced out of the heart. When they relax, blood refills the chambers.

Electrical activity of the heart can be evaluated with a cardiac monitor or electrocardiograph. Electrodes attached to an electrocardiograph pick up electrical impulses and transmit them to a monitor. This graphic record is referred to as an *electrocardiogram (ECG)*. Heart rhythms appear on an ECG as a series of peaks and valleys.

## When the Heart Stops

Any damage to the heart from disease or injury can disrupt the heart's electrical system. This disruption can result in an abnormal heart rhythm that can stop circulation. The two most common abnormal rhythms initially present in

Fig. 8-23



sudden cardiac arrest victims are *ventricular fibrillation (V-fib)* and *ventricular tachycardia (V-tach)*. V-fib is a state of totally disorganized electrical activity in the heart. It results in *fibrillation*, or quivering, of the ventricles. In this state, the ventricles cannot pump blood and there is no movement or breathing and no pulse. V-tach is a very rapid contraction of the ventricles. Though there is electrical activity resulting in a regular rhythm, the rate is often so fast that the heart is unable to pump blood properly. As with V-fib, there is no movement or breathing and no pulse.

### Defibrillation

In many cases, V-fib and V-tach rhythms can be corrected by early defibrillation. Delivering an electrical shock with an AED disrupts the electrical activity of V-fib and V-tach long enough to allow the heart to spontaneously develop an effective rhythm on its own. If V-fib or V-tach is not interrupted, all electrical activity will eventually cease, a condition called *asystole*. Asystole cannot be corrected by defibrillation. Remember that feeling for a pulse will not help determine what, if any, rhythm the heart has. CPR, started immediately and continued until defibrillation, helps maintain a low level of circulation in the body until the abnormal rhythm can be corrected by defibrillation.

### Using an AED—Adult

When a cardiac arrest occurs, an AED should be used as soon as it is available and ready to use.

To use an AED on an adult—

1. Conduct an initial assessment.
2. Turn on the AED (Fig. 8-24).
3. Wipe the victim's chest dry (Fig. 8-25).
4. Attach the pads (Fig. 8-26).
  - Place one pad on the victim's upper right chest.
  - Place the other pad on the victim's lower left side.
5. Plug the connector into the AED, if necessary (Fig. 8-27).
6. Make sure that no one, including you, is touching the victim (Fig. 8-28).
  - Look to see that no one is touching the victim.
  - Say, "EVERYONE STAND CLEAR."
7. Push the "analyze" button, if necessary. Let the AED analyze the heart rhythm.
8. If a shock is advised, push the "shock" button (Fig. 8-29).
  - Look to see that no one is touching the victim.
  - Say, "EVERYONE STAND CLEAR."
9. After the shock, or if no shock is indicated—
  - Perform 5 cycles (about 2 minutes) of CPR before analyzing the heart rhythm again (Fig. 8-30).

Fig. 8-24



Fig. 8-25



Fig. 8-26



Fig. 8-27



- If at any time an obvious sign of life is detected, stop CPR and monitor the victim's ABCs.
- Administer emergency oxygen, if available and trained to do so.

If a second rescuer arrives with an AED while CPR is in progress, **Rescuer 1** should continue CPR until **Rescuer 2** is finished preparing the AED for use.

**Rescuer 2** should complete the following steps:

1. Turn on the AED (Fig. 8-31).
2. Wipe the victim's chest dry (Fig. 8-32).
3. Attach the pads (Fig. 8-33).
  - Place one pad on the victim's upper right chest.
  - Place the other pad on the victim's lower left side.
4. Plug the connector into the AED, if necessary (Fig. 8-34).
5. Make sure that no one, including Rescuer 1, is touching the victim (Fig. 8-35).
  - Look to see that nobody is touching the victim.
  - Say, "EVERYONE STAND CLEAR."
6. Push the "analyze" button, if necessary. Let the AED analyze the heart rhythm.

Fig. 8-28



Fig. 8-29



Fig. 8-30



Fig. 8-31



Fig. 8-32



Fig. 8-33



Fig. 8-34



Fig. 8-35



Fig. 8-36



Fig. 8-37



7. If a shock is advised, push the “shock” button (Fig. 8-36).
  - Look to see that no one is touching the victim.
  - “Say, “EVERYONE STAND CLEAR.”
8. After the shock, or if no shock is indicated—
  - **Rescuer 1** should perform 5 cycles (about 2 minutes) of CPR before analyzing the heart rhythm again (Fig. 8-37).
  - If at any time an obvious sign of life is detected, stop CPR and monitor the victim’s ABCs.
  - Administer emergency oxygen, if available and trained to do so.

### Using an AED—Child

While the incidence of cardiac arrest in children is relatively low compared with adults, cardiac arrest resulting from V-fib does happen to young children. Most cardiac arrests in children are not sudden. The most common causes of cardiac arrest in children are—

- Airway and breathing problems.
- Traumatic injuries or accidents (e.g., automobile, drowning, electrocution or poisoning).
- A hard blow to the chest.
- Congenital heart disease.

AEDs equipped with pediatric AED pads are capable of delivering appropriate levels of energy to children between 1 and 8 years of age or weighing less than 55 pounds. Use

pediatric AED pads and/or equipment, if available. If pediatric-specific equipment is not available, an AED designed for adults may be used on a child. Always follow local protocols and manufacturer’s instructions.

For a child in cardiac arrest, follow the same general steps and precautions that are used when using an AED on an adult.

To use an AED on a child—

1. Conduct an initial assessment.
2. Turn on the AED.
3. Wipe the child’s chest dry.
4. Attach the pads.
  - Use pediatric AED pads, if available.
  - Place one pad on the child’s upper right chest.
  - Place the other pad on the child’s lower left side.
  - Make sure the pads are not touching. If the pads risk touching each other on a child, place one pad on the child’s chest (Fig. 8-38, A) and the other pad on the child’s back (between the shoulder blades) (Fig. 8-38, B).
5. Plug the connector into the AED, if necessary.
6. Make sure that no one, including you, is touching the child.
  - Look to see that no one is touching the child.
  - Say, “EVERYONE STAND CLEAR.”
7. Push the “analyze” button, if necessary. Let the AED analyze the heart rhythm.

Fig. 8-38



8. If a shock is advised, push the “shock” button.
  - Look to see that nobody is touching the child.
  - Say, “EVERYONE STAND CLEAR.”
9. After the shock, or if no shock is indicated—
  - Perform 5 cycles (about 2 minutes) of CPR before analyzing the heart rhythm again.
  - If at any time an obvious sign of life is detected, stop CPR and monitor the child’s ABCs.
  - Administer emergency oxygen, if available and trained to do so.

If a second rescuer arrives with an AED while CPR is in progress, **Rescuer 1** should continue CPR until **Rescuer 2** is finished preparing the AED for use.

**Rescuer 2** should complete the following steps:

1. Turn on the AED.
2. Wipe the child’s chest dry (Fig. 8-39).
3. Attach the pads (Fig. 8-40).
  - Use pediatric AED pads, if available.
  - Place one pad on the child’s upper right chest.
  - Place the other pad on the child’s lower left side.
  - Make sure the pads are not touching. If the pads risk touching each other on a child, place one pad on the child’s chest (Fig. 8-41, A) and the other pad on the child’s back (between the shoulder blades) (Fig. 8-41, B).
4. Plug the connector into the AED, if necessary.

Fig. 8-39



Fig. 8-40



Fig. 8-41



5. Make sure that nobody, including **Rescuer 1**, is touching the child.
  - Look to see that nobody is touching the child.
  - Say, “EVERYONE STAND CLEAR.”
6. Push the “analyze” button, if necessary. Let the AED analyze the heart rhythm.
7. If a shock is advised, push the “shock” button.
  - Look to see that no one is touching the child.
  - Say, “EVERYONE STAND CLEAR.”
8. After the shock, or if no shock is indicated—
  - **Rescuer 1** performs 5 cycles (about 2 minutes) of CPR before analyzing the heart rhythm again (**Fig. 8-42**).
  - If at any time an obvious sign of life is detected, stop CPR and monitor the child’s ABCs.
  - Administer emergency oxygen, if available and trained to do so.

### AED Precautions

Take the following precautions when using an AED:

- Do not touch the victim while defibrillating. Someone could be shocked.
- Before shocking a victim with an AED, make sure that no one is touching or is in contact with the victim or the resuscitation equipment.
- Do not touch the victim while the AED is analyzing. Touching or moving the victim may affect the analysis.
- Do not use alcohol to wipe the victim’s chest dry. Alcohol is flammable.
- Do not defibrillate someone when around flammable or combustible materials such as gasoline or free-flowing oxygen.
- Do not use an AED in a moving vehicle. Movement may affect the analysis.
- Do not use an AED on a victim who is in contact with water. Move the victim away from puddles of water, swimming pools or out of the rain, before defibrillating.
- Do not use an AED and/or pads designed for adults on a child under age 8 or less than 55 pounds, unless pediatric pads specific to the device are not available. Local protocols may differ on this and should be followed.
- Do not use pediatric AED pads on an adult, as they may not deliver enough energy for defibrillation.



Fig. 8-42

- Do not use an AED on a victim wearing a nitroglycerin patch or other patch on the chest. With a gloved hand, remove any patches from the chest before attaching the device.
- Do not use a mobile phone or radio within 6 feet of the AED. This may interrupt analysis.

### AEDs—Special Situations

Some situations require lifeguards to pay special attention when using an AED. These include using AEDs around water, using AEDs on victims with implantable devices or nitroglycerin patches and using AEDs on victims of trauma or hypothermia. Be familiar with these situations and know how to respond appropriately. Always use common sense when using an AED and follow the manufacturer’s recommendations.

#### AEDs Around Water

If the victim was removed from the water, be sure there are no puddles of water around rescuers, the victim or the AED. Remove wet clothing for proper pad placement if necessary. Dry the victim’s chest and attach the AED.

If it is raining, ensure that the victim is as dry as possible and sheltered from the rain. Wipe the victim’s chest dry. Minimize delaying defibrillation when taking steps to provide for a dry environment. The electrical current of an AED is directional between the pads. AEDs are very safe, even in rain and snow, when all precautions and manufacturer’s operating instructions are followed.

#### AEDs and Implantable Devices

Sometimes people may have had a pacemaker implanted if they have a weak heart, a heart that skips beats or a heart that beats too slow or fast. These small implantable devices are sometimes located in the area below the right collarbone. There may be a small lump that can be felt under the skin. Sometimes the pacemaker is placed somewhere else. Other people may have an implantable cardioverter defibrillator (ICD), a miniature version of an AED, which acts to automatically recognize and restore abnormal heart rhythms. Sometimes a victim’s heart beats irregularly, even if the victim has a pacemaker or ICD.

If the implanted device is visible or the rescuer knows that the victim has an implanted device, do not place the defibrillation pad directly over the device (**Fig. 8-43**). This may interfere with the delivery of the shock. Adjust pad placement, if necessary, and continue to follow the established protocol. If unsure, use the AED if needed. It will not harm the victim or rescuer.

#### Nitroglycerin Patches

People with a history of cardiac problems may have nitroglycerin patches on their chests. Since nitroglycerin can be absorbed by a rescuer, remove the patch with a gloved

Fig. 8-43



hand before defibrillation. Nicotine patches used to stop smoking look similar to nitroglycerin patches. In order not to waste time trying to identify patches, remove any patch seen on the victim's chest with a gloved hand (Fig. 8-44).

### Hypothermia

Some people who have experienced hypothermia have been resuscitated successfully even after prolonged exposure to the cold. It will take longer to perform a check or an assessment of a victim suffering from hypothermia because looking for movement and checking for breathing and a pulse can take up to 30 to 45 seconds. If no pulse is detected, begin CPR until an AED becomes available. If the victim is wet, dry his or her chest and attach the AED. If a shock is indicated, deliver a shock and follow the instructions of the AED. If there are no obvious signs of life, continue CPR. Follow local protocols as to whether additional shocks should be delivered. Continue CPR and protect the victim from further heat loss. Wet garments should be removed, if possible. The victim should not be defibrillated in water. CPR or defibrillation should not be withheld to rewarm the victim. Rescuers should take care not to shake a hypothermia victim unnecessarily, as this could result in V-fib.

Fig. 8-44



### Trauma

If a victim is in cardiac arrest resulting from traumatic injuries, an AED may still be used. Defibrillation should be administered according to local protocols.

### Chest Hair

Some men have a lot of hair on their chest, which can make getting a good pad-to-skin contact difficult. Since time to first shock is critical, attach the pads and analyze as soon as possible. Press firmly on the pads to attach them to the victim's chest. If a "check pads" message comes from the AED, remove the pads and replace with new ones. The pad adhesive will pull out some of the chest hair, which may solve the problem. If the "check pads" message continues, remove the pads, shave the victim's chest and attach new pads to the victim's chest. A safety surgical razor should be included in the AED kit. Be careful not to cut the victim while shaving.

### AED Maintenance

For defibrillators to perform optimally, they must be maintained like any other machine. AEDs require minimal maintenance. These devices have various self-testing features. However, it is important that operators be familiar with any visual or audible prompts the AED may have to warn of malfunction or a low battery. It is important to read the operator's manual thoroughly and check with the manufacturer to obtain all necessary information regarding maintenance.

In most instances, if the AED detects any malfunction, 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 back-up 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 defibrillation 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.
- If at any time the machine fails to work properly or warning indicators are recognized, discontinue use and contact the manufacturer immediately.

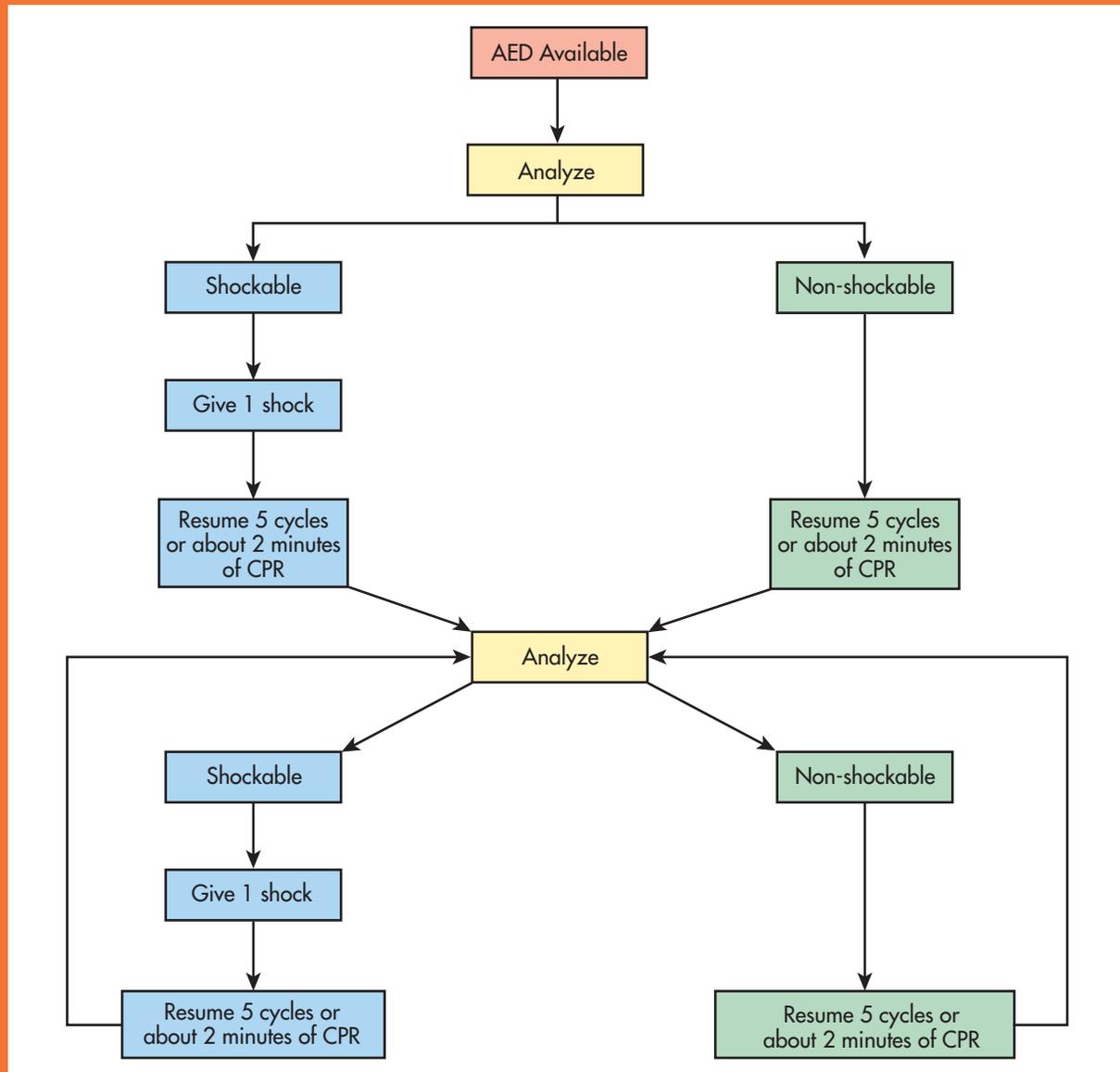
## PUTTING IT ALL TOGETHER

As professional rescuers, lifeguards should be able to recognize and respond to cardiac emergencies. Understand the importance of the four links of the Cardiac

Chain of Survival: early recognition of the emergency and early access to EMS, early CPR, early defibrillation and early advanced medical care. Be able to recognize and care for the signs and symptoms of a heart attack. Know how to recognize and care for a victim of cardiac arrest.

When using an AED, be sure to follow local protocols. AEDs are relatively easy to operate and generally require minimal training and retraining. When using an AED at an aquatic facility, be sure that the victim is placed on a dry surface, such as a backboard, and moved away from the pool's or water's edge.

### AED Algorithm for the Professional Rescuer



**Note:** As long as there is no obvious sign of life and the AED still indicates a need to shock, continue repeating sets of 1 shock to the maximum your local protocols allow, with 5 cycles (about 2 minutes) of CPR between each set. Also, as long as there is no obvious sign of life and the AED indicates that no shock is advised, you should still continue to give 5 cycles (about 2 minutes) of CPR before the AED reanalyzes. Be thoroughly familiar with your local protocols, which may vary from this example.