

► Ready for Review

- A heart attack occurs when heart muscle tissue dies because the blood supply is severely reduced or stopped.
- The five links in the chain of survival are: recognition and action, CPR, defibrillation, advanced care, and post-arrest care.
- CPR consists of moving blood to the heart and brain by giving chest compressions and breathing oxygen into a victim's lungs.
- The signs of a severe airway obstruction include difficult breathing, weak and ineffective cough, inability to speak or breathe, and signs of cyanosis.

► Vital Vocabulary

airway obstruction A blockage, often the result of a foreign body, in which air flow to the lungs is reduced or completely blocked.

cardiac arrest Stoppage of the heartbeat.

chain of survival A concept involving five critical links to help improve survival from cardiac arrest.

chest compressions Depressing the chest and allowing it to return to its normal position as part of CPR.

cardiopulmonary resuscitation (CPR) The act of providing chest compressions and rescue breaths for a victim in cardiac arrest.

heart attack Death of a part of the heart muscle.

► Assessment in Action

You are having dinner in a very crowded restaurant with your family on New Year's Eve. An elderly man is pushing a piano into the restaurant as part of the entertainment that evening. As he passes your table, he clutches his chest and falls to the floor. He is not moving.

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

- Yes No 1. If he is not breathing or is breathing abnormally, you should next call 9-1-1.
- Yes No 2. The man must be choking since he is in a restaurant.
- Yes No 3. Perform abdominal thrusts.

- Yes No 4. Perform cycles of 30 chest compressions and 2 breaths.
- Yes No 5. Check for breathing before giving any breaths to the victim.
- Yes No 6. Continue CPR until an AED becomes available or EMS personnel arrive.

► Check Your Knowledge

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

- Yes No 1. Gasping is not considered breathing.
- Yes No 2. After you determine that an adult victim is unresponsive, the next step is for someone to call 9-1-1.
- Yes No 3. Tilting the head back and lifting the chin helps move the tongue and open the airway.
- Yes No 4. If you determine that a victim is not breathing, begin chest compressions.
- Yes No 5. Do not start chest compressions until you have checked for a pulse.
- Yes No 6. For all victims (adult, child, infant) needing CPR, give 30 compressions followed by two breaths.
- Yes No 7. Use two fingers when performing CPR on an infant.
- Yes No 8. A sign of choking is that the victim is unable to speak or cough.
- Yes No 9. To give abdominal thrusts to a responsive choking victim, place your fist below the victim's navel.
- Yes No 10. When giving abdominal thrusts to a responsive choking victim, repeat the thrusts until the object is removed or the victim becomes unresponsive.

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Automated External Defibrillation

5

chapter *at a glance*

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- ▶ **How the Heart Works**
- ▶ **Care for Cardiac Arrest**
- ▶ **About AEDs**
- ▶ **Using an AED**
- ▶ **Special Considerations**
- ▶ **AED Manufacturers**

▶ **Public Access Defibrillation**

A victim's chance of survival dramatically improves through early cardiopulmonary resuscitation (CPR) and early **defibrillation** with the use of an **automated external defibrillator (AED)**. To be effective, defibrillation must be used in the first few minutes following cardiac arrest. The implementation of state public access defibrillation (PAD) laws and the Food and Drug Administration's (FDA) approval of "home use" AEDs have made this important care step available to many rescuers in many places, including the following **Figure 1**:

- Airports and airplanes
- Stadiums
- Health clubs
- Golf courses
- Schools
- Government buildings
- Offices
- Homes
- Shopping centers/malls

▶ **How the Heart Works**

The heart is an organ with four hollow chambers. The two chambers on the right side receive blood from the body and send it to the lungs for oxygen. The two chambers on the left side of the heart receive

freshly oxygenated blood from the lungs and send it back out to the body **Figure 2**.

The heart has a unique electrical system that controls the rate at which the heart beats and the amount of work the heart performs. In the right upper chamber of the heart, there is a collection of special pacemaker cells. These cells emit electrical impulses about 60 to

100 times a minute that cause the other heart muscle cells to contract in a coordinated manner.

Because the heart contracts approximately every second, it needs an abundant supply of oxygen, which it gets through the coronary arteries. These arteries run along the outside of the heart muscle and branch into smaller vessels. These arteries sometimes become diseased (atherosclerosis), resulting in a lack of oxygen to the pacemaker cells, which can cause abnormal electrical activity in the heart.

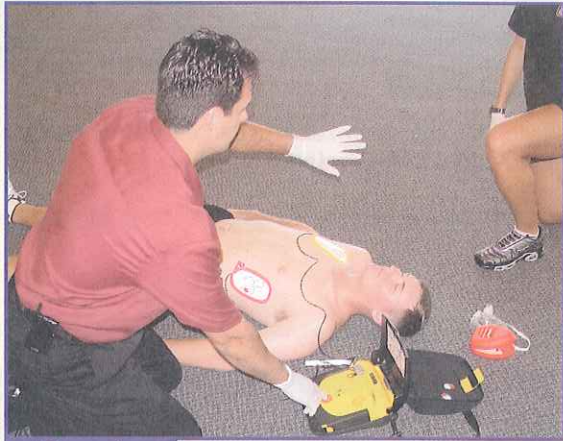


Figure 1

AEDs are available in many places for use by trained rescuers.

When Normal Electrical Activity Is Interrupted

Ventricular fibrillation (also known as V-fib) is the most common abnormal heart rhythm in cases of sudden cardiac arrest in adults **Figure 3**.

The organized wave of electrical impulses that cause the heart muscle to contract and relax in a regular fashion is lost when the heart is in ventricular fibrillation. As a result, the lower chambers of the heart quiver and cannot pump blood, so circulation is lost (no pulse).

A second, potentially life-threatening, electrical problem is ventricular tachycardia (V-tach), in which the heart beats too fast to pump blood effectively

Figure 4

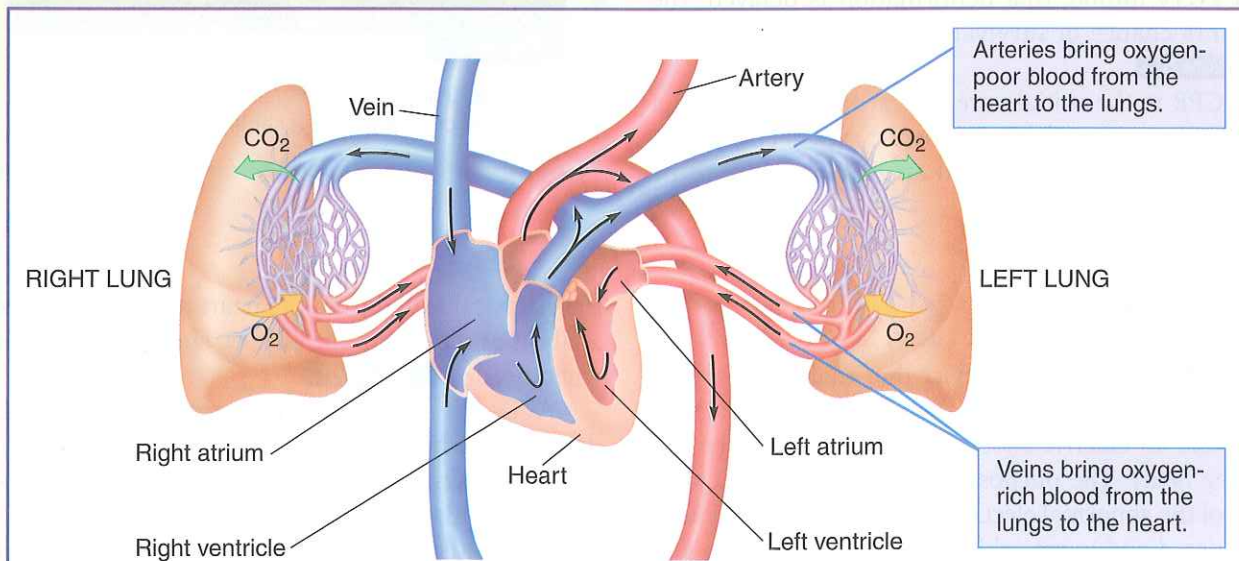


Figure 2

The right side of the heart receives blood from the body and sends it to the lungs. The left side of the heart receives the oxygenated blood and sends it to the body.

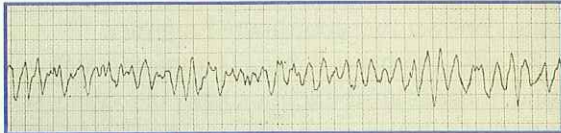


Figure 3

Ventricular fibrillation is disorganized electrical activity.

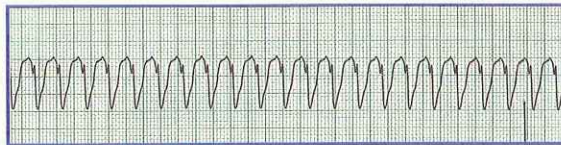


Figure 4

Ventricular tachycardia is very rapid electrical activity.

► Care for Cardiac Arrest

When the heart stops beating, the blood stops circulating, cutting off all oxygen and nourishment to the entire body. In this situation, time is a crucial factor. For every minute that defibrillation is delayed, the victim's chance of survival decreases by 7% to 10%

Figure 5

CPR is the initial care for cardiac arrest until a defibrillator is available. Perform cycles of chest compressions and breaths until an AED is ready to be connected to the victim.

► About AEDs

An AED is an electronic device that analyzes the heart rhythm and if necessary (such as in cardiac arrest) delivers an electric shock, known as defibrillation, to the heart. The purpose of this shock is to correct one of the abnormal electrical disturbances previously discussed and to reestablish a heart rhythm that will result in normal electrical and pumping function.

All AEDs are attached to the victim by a cable connected to two adhesive pads (electrodes) placed on the victim's chest. The pad and cable system sends

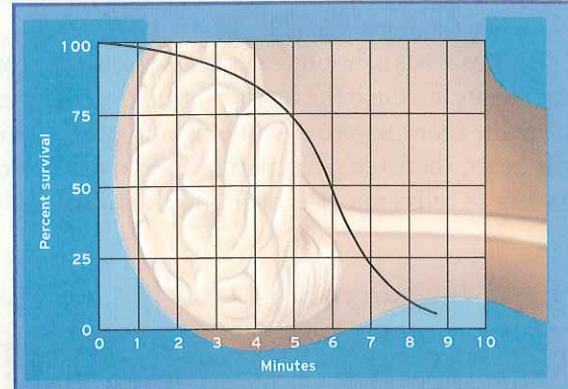


Figure 5

A victim's chance of survival decreases with every minute that passes without proper care.



Figure 6

Two adhesive pads are placed on the victim's chest and connected by a cable to the AED.

the electrical signal from the heart into the device for analysis and delivers the electric shock to the victim when needed **Figure 6**.

AEDs have built-in rhythm analysis systems that determine whether the victim needs a shock. This system enables first aiders and other rescuers to deliver early defibrillation with only minimal training.

AEDs also record the victim's heart rhythm (known as an electrocardiogram, or ECG), shock data, and other information about the device's performance (for example, the date, time, and number of shocks supplied) **Figure 7**.



Figure 7

AEDs store data, including heart rhythms and shocks.

Q&A

How does an AED work?

A microprocessor inside the defibrillator interprets (analyzes) the victim's heart rhythm through adhesive electrodes. The computer analyzes the heart rhythm and advises the rescuer whether a shock is needed. AEDs advise a shock to only ventricular fibrillation and fast ventricular tachycardia.

Common Elements of AEDs

Many different AED models exist. The principles for use are the same for each, but the displays, controls, and options vary slightly. You will need to know how to use your specific AED. All AEDs have the following elements in common:

- Power on/off mechanism
- Cable and pads (electrodes)
- Analysis capability
- Defibrillation capability
- Prompts to guide you
- Battery operation for portability

► Using an AED

Once you have determined the need for the AED (victim unresponsive and not breathing), the basic

operation of all AED models follows the sequence in

Skill Drill 1

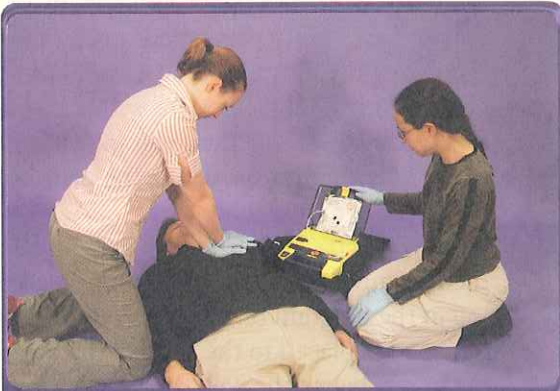
1. Some AEDs power on by pressing an on/off button. Others power on when opening the AED case lid. Once the power is on, the AED will quickly go through some internal checks and will then begin to provide voice and screen prompts (**Step 1**).
2. Expose the victim's chest. The skin must be fairly dry so that the pads will adhere and conduct electricity properly. If necessary, dry the skin with a towel. Because excessive chest hair may also interfere with adhesion and electrical conduction, you may need to shave quickly the area where the pads are to be placed.
3. Remove the backing from the pads and apply them firmly to the victim's bare chest according to the diagram on the pads (**Step 2**). One pad is placed to the right of the breastbone, just below the collarbone and above the right nipple. The second pad is placed on the left side of the chest, left of the nipple and above the lower rib margin.
4. Make sure the cable is attached to the AED, and stand clear for analysis of the heart's electrical activity (**Step 3**). No one should be in contact with the victim at this time, or later if a shock is indicated.
5. Verify that no one is in contact with the victim. The AED will advise of the need to shock and, depending on the device, will either advise the rescuer to push a button to administer the shock, or will deliver the shock automatically. Begin CPR immediately following the shock and follow the prompts that include reanalyzing the rhythm (**Step 4**). If the shock worked, the victim may begin to regain signs of life. Continue providing care until EMS personnel arrive and take over.

► Special Considerations

There are several special situations that you should be aware of when using an AED. These include the following:

- Water
- Children
- Medication patches
- Implanted devices

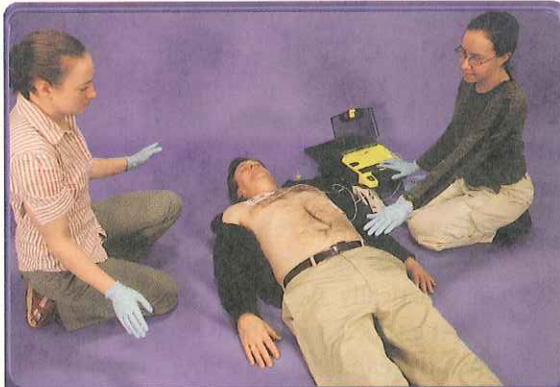
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1**Using an AED****1**

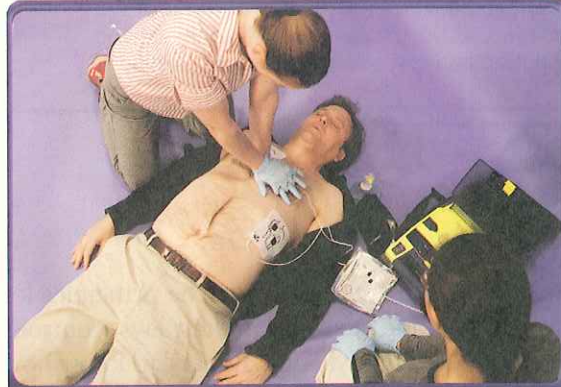
Perform CPR until an AED is available. Once the AED is available, turn the equipment on.

**2**

Apply the electrode pads to the victim's bare skin and make sure the cable is attached to the device.

**3**

Stand clear and allow the device to analyze the heart rhythm. Press the shock button if advised by the device. Fully automatic devices do not have a shock button and will provide the shock if needed.

**4**

Perform CPR and follow the device prompts. Check the victim and repeat the analysis, shock, and CPR steps as needed.

Q&A

Will I get zapped if a victim is shocked in the rain or near water?

It is remotely possible to get shocked or to shock bystanders if there is standing water around and under the victim. Try to move the victim to a dry area and cut off wet clothing. Also be sure that the skin has been dried off so that the electrode pads will stick to the skin. No one should be touching any part of the victim while the device emits an electrical current.

Water

Because water conducts electricity, it may provide an energy pathway between the AED and the rescuer or bystanders. Remove the victim from free-standing water. Quickly dry the chest before applying the pads. The risk to the rescuers and bystanders is very low if the chest is dry and the pads are secured to the chest.

Children

Cardiac arrest in children is usually caused by an airway or breathing problem, rather than a primary heart problem as in adults. AEDs can deliver energy levels appropriate for children aged 1 year or older. If your AED has special pediatric pads and cable, use these for the child **Figure 8**. If the pediatric equipment is not available, use the adult equipment.

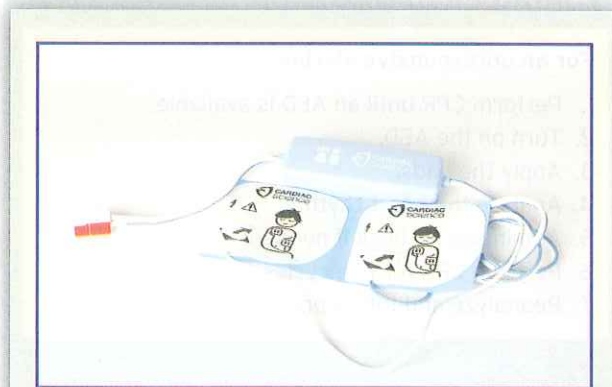


Figure 8

If your AED has pediatric pads, use them according to the manufacturer's instructions.



Figure 9

Remove any medication patches before applying AED pads.

Medication Patches

Some people wear an adhesive patch containing medication (such as nitroglycerin, nicotine, or pain medication) that is absorbed through the skin. Because these patches may block the delivery of energy from the pads to the heart, they need to be removed and the skin wiped dry before attaching the AED pads **Figure 9**.

Implanted Devices

Implanted pacemakers and defibrillators are small devices placed underneath the skin of people with certain types of heart disease **Figure 10**. These devices often can be seen or felt when the chest is exposed. Avoid placing the pads directly over these devices whenever possible. If an implanted defibrillator is discharging, you may see the victim twitching periodically. Allow the implanted unit to stop before using your AED.

AED Maintenance

Periodic inspection of your AED can ensure that the device has the necessary supplies and is in proper

FYI

AED Use on an Infant

For infants (children younger than 1 year), a manual defibrillator can be used. If a manual defibrillator is not available, an AED with a pediatric dose attenuation can be used. If neither is available, an AED without a dose attenuator may be used.

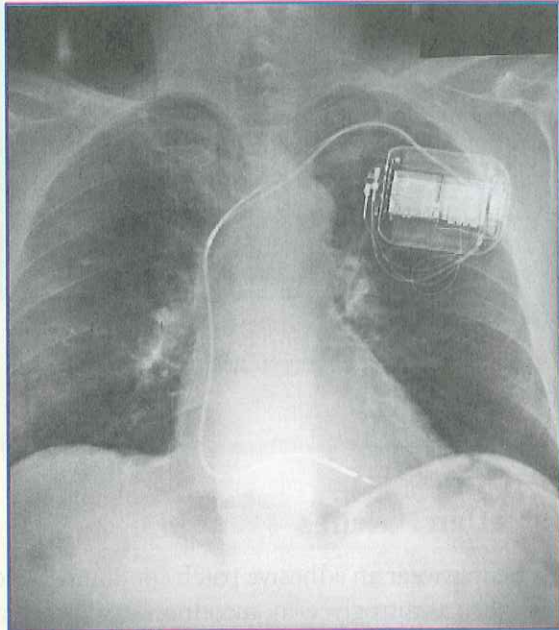


Figure 10

Implanted defibrillator.



Figure 11

Periodic inspection of your AED supplies can ensure that all items are in working condition.

working condition **Figure 11**. AEDs conduct automatic internal checks and provide visual indications that the unit is ready and functioning properly. You do not need to turn the device on daily to check it as part of any inspection. Doing so will only wear down the battery.

AED supplies should include items such as the following:

- Two sets of electrode pads with expiration dates that are not expired
- An extra battery
- Razor
- Hand towel

Other items that should be considered are a breathing device (for example, a mask or shield) and exam gloves.

▶ AED Manufacturers

AED devices and related supplies are available from different manufacturers **Figure 12**.



Figure 12

Various AED devices.

AED Review

For an unresponsive victim:

1. Perform CPR until an AED is available.
2. Turn on the AED.
3. Apply the pads.
4. Analyze the heart rhythm.
5. Administer a shock if needed.
6. Perform CPR for five cycles (2 minutes).
7. Reanalyze and follow prompts.

AED Skill Checklist

Student's Name _____

Date _____

Skills	Satisfactory	Unsatisfactory
Check for Scene Safety	<input type="radio"/>	<input type="radio"/>
Primary check and care: If two rescuers are involved, one assesses and performs CPR while the other applies the AED.		
<ul style="list-style-type: none"> • Establish unresponsiveness and breathing status (not breathing or is gasping). 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Begin 30 chest compressions (regardless of the compression number, interrupt compressions to apply an AED when it arrives). 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Open airway. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Give two breaths (1 second each). 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Continue cycles of 30 compressions and two breaths until an AED becomes available. 	<input type="radio"/>	<input type="radio"/>
Defibrillation:		
<ul style="list-style-type: none"> • Turn AED power on. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Ensure skin surface is dry. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Apply electrode pads correctly. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Ensure electrode cable is plugged in. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • Stand clear while analyzing. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • If shock is indicated: <ul style="list-style-type: none"> a. Remain clear. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> <ul style="list-style-type: none"> b. Deliver shock. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> <ul style="list-style-type: none"> c. Perform 2 minutes of CPR. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> <ul style="list-style-type: none"> d. Reanalyze. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • If shock is indicated, repeat steps a through d. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> • If no shock is indicated: <ul style="list-style-type: none"> a. Check victim for breathing. 	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none"> <ul style="list-style-type: none"> b. If victim is not breathing, perform 5 cycles of CPR and reanalyze. 	<input type="radio"/>	<input type="radio"/>

Pass _____

Fail _____

prep kit

► Ready for Review

- A victim's chances for survival are dramatically improved through early CPR and early defibrillation.
- Because the heart contracts approximately every second, it needs an abundant supply of oxygen.
- CPR is the initial care for cardiac arrest until a defibrillator is available.
- An AED is an electronic device that analyzes the heart rhythm and delivers an electrical shock to the heart of a person in cardiac arrest.
- There are several special situations to be aware of when using an AED, including: water, children, medication patches, and implanted devices.
- Periodic inspection of the AED can ensure that the device has the necessary supplies and is in proper working condition.

► Vital Vocabulary

automated external defibrillator (AED) Device capable of analyzing the heart rhythm and providing a shock.

defibrillation The electrical shock administered by an AED to reestablish a normal heart rhythm.

► Assessment in Action

Your workplace has recently implemented an AED program. You and several other employees have been trained to locate and use an AED. While at work, a coworker collapses. She is around 50 years old and you

know she has a history of heart problems. You tell a coworker to call 9-1-1 and to bring the AED.

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

- | | | |
|-----|----|---|
| Yes | No | 1. You should establish unresponsiveness before starting anything else. |
| Yes | No | 2. Chest compressions should begin as soon as possible and stop only to apply the AED pads to the chest or to give two breaths. |
| Yes | No | 3. AED pads can be applied over the top of the victim's blouse. |
| Yes | No | 4. The AED will alert you about improper pad placement and connection. |
| Yes | No | 5. You should deliver a shock even if the AED has not alerted you to do so. |

► Check Your Knowledge

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

- | | | |
|-----|----|---|
| Yes | No | 1. The earlier defibrillation occurs, the better the victim's chance of survival. |
| Yes | No | 2. An AED is to be applied only to a victim who is unresponsive and not breathing. |
| Yes | No | 3. CPR is not needed if you are sure an AED will be available in 3 to 4 minutes. |
| Yes | No | 4. AEDs require the operator to know how to interpret heart rhythms. |
| Yes | No | 5. Because all AEDs are different, the basic steps of operation are also different. |
| Yes | No | 6. The AED pads (electrodes) need to be attached to a dry chest. |
| Yes | No | 7. Two electrode pads are placed on the left side of the victim's chest. |
| Yes | No | 8. Batteries and pads have expiration dates of which you should be aware. |
| Yes | No | 9. An AED still can be used if an implanted pacemaker is present. |
| Yes | No | 10. You need to turn the AED on daily as part of a routine inspection. |