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**Continuing Education  
Material:**

**Sudden Cardiac Arrest  
and  
Automated External Defibrillators  
(AEDs)**

**ABP, Inc.**

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## ABP CONTINUING EDUCATION MATERIAL

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### SUDDEN CARDIAC ARREST AND AUTOMATED EXTERNAL DEFIBRILLATORS

#### OBJECTIVES

1. Identify the causes of Sudden Cardiac Arrest (SCA).
  2. Discuss treatment options for Sudden Cardiac Arrest (SCA).
  3. Discuss the use of AEDs and how to develop an AED program.
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This continuing education material, **Sudden Cardiac Arrest and AEDs**, will earn the participant 1.0 contact hours. If you have any questions regarding this information or would like further information on other continuing education opportunities, please contact:

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# SUDDEN CARDIAC ARREST AND AUTOMATED EXTERNAL DEFIBRILLATORS

## INTRODUCTION TO SUDDEN CARDIAC ARREST (SCA)

Sudden Cardiac Arrest occurs when a person unexpectedly loses a pulse and blood pressure. This event occurs because of a malfunction of the heart's electrical system. SCA kills almost 1000 people - men, women and children- in the USA every day or approximately 350,000 people annually. With SCA there are no warning signs. People suddenly collapse and lose consciousness. If a normal heartbeat is not restored within a few minutes, the person dies.

## DEFINITIONS

**Arrhythmia** is abnormal electrical activity of the heart that results in an irregular, intermittent or absent pulse.

**Automated external defibrillator (AED)** is a device that automatically analyzes a heart rhythm and deliver electrical currents to the heart in order to treat arrhythmias.

**Cardiomyopathy** is primary heart disease due to an underlying heart muscle abnormality.

**Congestive heart failure** is the inability of the heart to pump out all the blood that returns to it which can result in blood backing up in the veins that lead to the heart.

**Defibrillation** is the treatment of cardiac arrhythmias, especially ventricular fibrillation, by delivering an electrical current to the heart.

**Heart attack** occurs when a clot in a coronary artery shuts off the blood supply to the heart muscle.

**Massive heart attack (SCA)** occurs when the heart goes directly into ventricular fibrillation, resulting in a combination of sudden cardiac arrest and heart attack.

**Sudden cardiac arrest** occurs when there is an abrupt loss of effective pulse and blood pressure.

**Ventricular fibrillation (VF)** is a chaotic arrhythmia that causes the heart to quiver rather than contract in coordination with the atria resulting in now effective pulse or blood pressure. Unconsciousness is immediate and death follows within minutes without intervention.

## CAUSES OF SUDDEN CARDIAC ARREST

In some cases, people who have SCA have had clean bills of health. In some cases there are underlying conditions or diseases. In congestive heart failure the heart is unable to pump out all the blood that has returned. This results in blood backing up in the veins that lead to the heart and sometimes in fluid accumulating in various parts of the body. There is also a heart abnormality called cardiomyopathy that can cause SCA. Cardiomyopathy has caused young athletes to go into SCA. About 30% of SCAs result from a massive heart attack. A heart attack is caused by a clot in a coronary artery that shuts off the blood supply to the heart muscle. A person having a heart attack will have warning symptoms such as pain in the chest or left arm and generally do not lose consciousness. A heart attack is not always life-threatening. With SCA there are no warning signs and it is always life-threatening. Remember with SCA there are usually no warning signs and it is always life-threatening. With SCA the heart's electrical system is in chaos causing the heart's ventricles to stop pumping blood which results in loss of consciousness due to the lack of oxygen. With a massive heart attack one has a combination of a SCA and a heart attack.

## PERSONS AT RISK FOR SCA

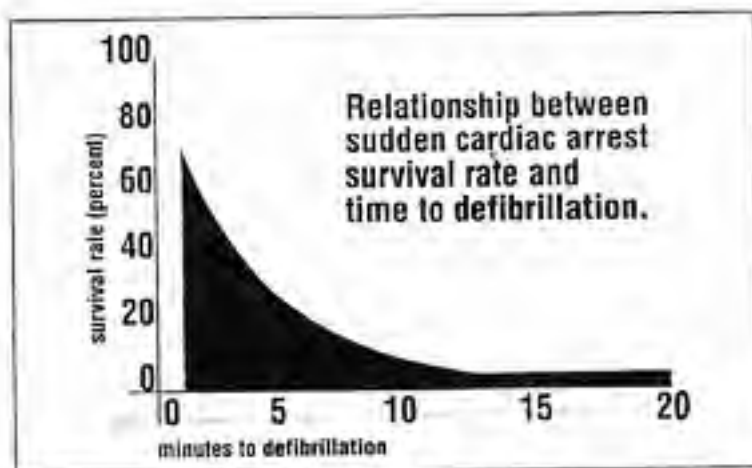
The average age of SCA victims is 65 years, although SCA is unpredictable. Remember that there are many reasons for SCA and it can strike at any age, male or female. It is important to lead a healthy life style and avoid those things that put one at risk for heart disease like excessive fatty foods and smoking. It is important to get regular cardiovascular exercise.

## SCA and SURVIVAL

The nationwide average of survival after a SCA episode is 5%. The key to SCA survival is quick treatment. In areas where victims receive treatment quickly, the survival rate is higher and in some cases up to 45%. In congested areas with lots of traffic where treatment might be slow to arrive, the survival rate is down to 1% (New York City).

## TREATMENT FOR SCA

Unlike a heart attack in which treatment should be given within the first few hours of an attack, in SCA the victim must be treated within minutes of collapse or death will result. The only treatment for SCA is defibrillation. Defibrillation is an electric shock that reverses the chaotic heart activity in the ventricles. A victim should be defibrillated within 4-6 minutes of collapsing. For every minute that passes from collapse to defibrillation there is an estimated 10% decrease in the victim's chance of survival. After about 10 minutes, the chances of survival are extremely slim. The time to defibrillation is the most important factor in saving a SCA victim's life.



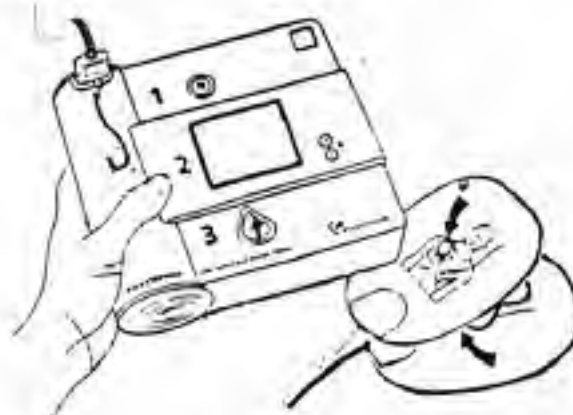
The American Heart Association has developed a concept called the "chain of survival" to help ensure survival from a SCA episode. The four steps that should be present are:

1. Early access to the emergency medical service (EMS) system, i.e. your 9-1-1 system
2. Early CPR
3. Early defibrillation
4. Early advanced cardiac care

Early defibrillation is considered the key link to SCA survival because it is the only treatment to reverse the chaotic heartbeats. Without defibrillation, the chain of survival is broken. About 90% of SCAs occur out of the hospital. Defibrillation is usually performed by an EMT or first responder using a device called an automated external defibrillator (AED).

## WHAT IS AN AUTOMATED EXTERNAL DEFIBRILLATOR?

An automated external defibrillator (AED) is an external device that can be used by minimally trained lay persons in emergency situations to administer an electric shock through the chest wall to the heart. The AED also reads the patient's heart patterns. Built-in computers assess the patient's heart rhythm, judge whether defibrillation is needed, and then says whether or not to administer the shock. Audible and/or visible prompts guide the user through the process. The cost of an AED is under \$3000.



## Automated External Defibrillation is as easy as 1, 2, 3...

1. The operator turns on the AED after confirming cardiac arrest by noting lack of breathing and pulse.
2. The operator connects pads to the AED and then applies them to the victim's bare chest. The machine automatically analyzes the victim's heart rhythm.
3. The AED determines whether shock should be delivered and tells the operator.
4. The operator, after making sure that no one is touching the victim, pushes the shock button.

In general 80% of rhythms occurring at the moment of collapse are treatable, but this is less likely as more time passes. If the victim does not have a "treatable rhythm", the AED will not discharge the electrical shock. A microprocessor inside the defibrillator analyzes the victim's heart rhythm through adhesive electrodes. The computer advises the operator whether a shock is needed. AEDs advise a shock only when it detects ventricular defibrillation or fast ventricular tachycardia. The electric current is delivered through the victim's chest wall through adhesive electrode pads. AEDs are important because they strengthen the Chain of Survival by restoring a normal heart rhythm in victims of sudden cardiac arrest (SCA). The American Heart Association estimates that up to 100,000 lives could be saved each year in the United States if more people were trained to use AEDs and if AEDs were placed where large groups of people gather such as theaters, places of employment, stadiums, and sports arenas.

### USE OF AEDs

An AED is safe to use by anyone who has been trained to operate it. Studies have shown that the devices are 90% sensitive, i.e. able to detect a rhythm that should be defibrillated about 90% of the time and 99% specific, i.e. able to recommend not shocking when defibrillation is not indicated about 99% of the time. There are some potential dangers associated with the use of AEDs which is why training is important. AEDs are so user-friendly that untrained rescuers can generally succeed in attaching the pads, pressing ANALYZE and delivering the shocks. However, an untrained rescuer may not know when to use an AED and they may not use an AED safely, posing some danger of electric shock to themselves and others. An untrained rescuer probably would not know how to respond if the AED prompts "no shock indicated"

An AED should not be used on a child younger than 8 years old or weighing less than about 55 pounds. It is also possible to get shocked or cause a bystander to get shocked if water is standing near or underneath the victim. To prevent shock, make sure the victim is in a dry area and wet clothing has been removed. The victim's skin must be dry so that the electrode pads will stick. When the SHOCK button is pressed, no one must be touching any part of the victim.

An AED will almost never decide to shock an adult victim if the victim is not in ventricular fibrillation. If the operator has attached the AED to an adult victim who is not breathing and in cardiac arrest, the AED will make the correct "shock" decision more than 95 out of 100 times and a correct "no shock indicated" decision more than 98 out of 100 times. This is more accurate than the accuracy of first responders.

For the AED to analyze accurately, the victim must be motionless, which is why CPR must be stopped when the electrode pads are placed on the victim. Some times the victim does not change from ventricular fibrillation to non-ventricular fibrillation at once. These victims require multiple shocks. The shocks are "stacked" in sets of three to increase their effectiveness.

After using an AED on a person in cardiac arrest, there should be a debriefing session on all those involved in the resuscitation attempt. The voice-rhythm-shock record should be collected from the AED's event documentation system. AEDs can record and store (as a minimum) the following information:

- victim rhythm throughout the resuscitation
- response of the AED
- event and interval timing
- audio recording of the voices and actions recorded at the scene of a cardiac arrest



## DEVELOPING AN AED PROGRAM

It is important for any organization that decides to purchase an AED to address certain key issues.

1. Understand local, state and federal laws governing AED use. Information at the state level can be obtained at [www.ncsl.org/programs/health/aed.htm](http://www.ncsl.org/programs/health/aed.htm).
2. Consult your organization's security, legal, and/or risk management departments regarding potential risk and insurance implications of having an AED.
3. Secure a physician's oversight for your program. Physician oversight is legally required to purchase an AED and maintain an AED program.
4. Evaluate current emergency response procedures to determine how to integrate an AED program into existing guidelines.
5. Determine how many AEDs are necessary to provide a three minute response time anywhere in your facility(s) and on its grounds.
6. Define AED response protocols and determine the optimal locations within your facility(s) to place the devices.
7. Identify qualified individuals responsible for maintaining the AED.
8. Select personnel at the facility(s) for training and using the AEDs.
9. Arrange AED training and future recertification programs and/or classes.
10. Educate all employees within your facility about whom to notify and what to do in a cardiac emergency.

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## REFERENCES

1. ***Questions and Answers About AEDs***, American Heart Association.
2. **ELECTROCARDIOLOGY: A TRAINING AND REVIEW MANUAL**, Mullins, C.; ABP, Inc., Granger, IN., 2001.
3. ***Sudden Cardiac Arrest***, Heartstream, Inc., Seattle, WA., 1998.
4. **"Workplace Implementation of AEDs"**, **OCCUPATIONAL HEALTH & SAFETY**, September 2000, pp. 47-77.

## ABP CONTINUING EDUCATION SELF-ASSESSMENT QUIZ

### Sudden Cardiac Arrest and Automated External Defibrillators

Please answer all questions on the Continuing Education Registration Form.

1. What occurs when there is an abrupt loss of effective pulse and blood pressure?
  - a. Arrhythmia
  - b. Congestive Heart Failure
  - c. Massive heart attack
  - d. Sudden Cardiac Arrest
2. What percent of SCAs result from a massive heart attack?
  - a. 10%
  - b. 30%
  - c. 45%
  - d. 50%
3. All of the following are causes of SCA **except**:
  - a. Congestive Heart Failure
  - b. Cardiomyopathy
  - c. Cardiovascular exercise
  - d. Massive heart attack
4. Warning symptoms of a heart attack include all of the following **except**:
  - a. Loss of consciousness
  - b. Chest pain
  - c. Fluid accumulation
  - d. Pain in the left arm
5. The nationwide average survival rate after a SCA episode is:
  - a. 1%
  - b. 5%
  - c. 10%
  - d. 30%
6. The most important factor related to saving the life of a SCA victim is:
  - a. Age of the victim
  - b. Sex of the victim
  - c. Time to defibrillation
  - d. Proximity of a hospital
7. An AED will advise "SHOCK" when the computer detects:
  - a. Atrial tachycardia
  - b. Atrial fibrillation
  - c. Ventricular tachycardia
  - d. Ventricular fibrillation
8. An AED is not safe for use on children under the age of:
  - a. 5 years
  - b. 8 years
  - c. 10 years
  - d. 12 years
9. All of the following statements about AEDs are correct **except**:
  - a. The victim must have any wet clothing removed to prevent possible shock.
  - b. AEDs are 90% sensitive at detecting fibrillation and 99% specific at recommending to not shock.
  - c. It is important to continue to administer CPR during the use of an AED.
  - d. Shocks are stacked in sets of three for increased effectiveness.
10. Which of the following statements about developing an AED program are correct?
  1. Secure physician oversight.
  2. Determine the number of AEDs needed to provide a 4 minute response within your facility.
  3. Identify personnel responsible for AED training of employees.
  4. Educate employees about what to do in a cardiac emergency.
  - a. All are correct
  - b. 1, 3, 4 are correct
  - c. 1 and 4 are correct
  - d. 2, 3, 4 are correct